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International Conference on

Sustainable Multidisciplinary Advances in Research and Technology

Hybrid Mode

In association with

SMART 2023

28th November 2023

Khamgaon Road, Shegaon (MS) INDIA
Pin 444 203

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About the Institute

Mauli Group of Institution's, College of Engineering & Technology, Shegaon, a reputed private institute, occupies a place of pride amongst the premier technical institutes of the central region of India. Established in 2011, financed and run by Late Purushottam Hari (Ganesh) Patil Shikshan Sanstha & is affiliated to Sant Gadge Baba Amravati University. The institute runs six Under Graduate, and two Post Graduate programs. The institute has marched towards the pinnacle of glory through its remarkable achievements & laurels in the field of engineering education in a short span. Institute is awarded with "A" Grade by NAAC, Bangalore and as a Best Emerging Institute Award by ISTE, New Delhi.

The campus boasts of lush green lawns that provide an ambience and a serene atmosphere. It is spread over 45 acres of land, out of which 12 acres is for engineering discipline which includes, academic building area, playgrounds, hostels, staff quarters, office, cafeteria, mess, stores. It has well equipped laboratories having quality instruments and well-furnished classrooms. The college has well qualified and experienced staff.

Objective of the Conference

The objective of SMART-2023 is to bring together experts from Industries, Academia, and R&D Institutions on a common platform to discuss and present ongoing research and advances in the field of Science and Technology

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Principal's Message

I extend my sincere gratitude for your significant contributions to the success of the International Conference on Sustainable Multidisciplinary Advances in Research and Technology (SMART 2023) held on November 28, 2023, in hybrid mode in association with ISTE New Delhi, IETE New Delhi, and The Institution of Engineers, India.

This gathering served as a bridge for intellectual exchange and collaboration, bringing together diverse minds from various fields to explore innovative solutions with a shared commitment to sustainability. The dynamic discussions and presentations showcased the collective strength of multidisciplinary approaches to addressing various challenges.

The richness of ideas and the convergence of expertise emphasised the interconnectedness of our global challenges and highlighted the need for collaborative solutions.

I appreciate the efforts of the organizing committee, the expertise of our keynote speakers, and the active participation of each attendee. As we reflect on the outcomes, let us carry forward the spirit of collaboration and innovation, translating ideas into impactful initiatives that contribute to a more sustainable and technologically advanced future.

Best Regards,

Dr. C. M. Jadhao
Principal,
Mauli College of Engineering and Technology, Shegaon

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DEVELOP IMAGE BASED AMENITY DETECTION MODEL USING DETECTRON2 FASTER RCNN AND SSD MOBILENET V2

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ABSTRACT
Significant progress in object identification has been made in computer vision in recent years, mostly due to deep learning methods. Building an Amenity Detection Model using the robust Detectron 2 framework is the main objective of this research. Improving our awareness of interior surroundings is the goal of this research, which aims to correctly recognize and categorize numerous amenities inside room photographs. Demonstrating the power of computer vision and deep learning, the "Amenity Detection Model using Detectron 2" project automates the process of identifying interior amenities. When it comes to computer vision model construction and training, Detectron2 provides an easy-to-use API. It comes with a ton of documentation and code examples as well. Researchers and developers from all around the world work together on Detectron2 via forums and GitHub, making it an open-source project that receives constant maintenance and updates. A complete system that accurately identifies amenities and provides an easy-to-use interface for interacting with the model's predictions is the outcome of integrating Detectron 2, Streamlit, and Weights and Biases. With the use of this project's technology, which can detect amenities inside photographs rapidly and precisely, space evaluation and interior design might become much easier.

Keywords: Amenity Detection, Machine Learning, Detectron 2, Streamlit, Weights and Biases, deep learning, Computer Vision.

I. INTRODUCTION
Amenities are what? An amenity may be anything that adds practicality to a space, such as a couch in the living room or a shower in the bathroom. The evolution of object detection throughout the years has made it the principal core area of computer vision. One of the most important features of contemporary technology, amenity detection, has become an invaluable asset in the lodging service industry, greatly impacting the quality of life for both hosts and guests on sites like Airbnb. The basic idea behind amenity detection is to automatically find and confirm certain characteristics or amenities in a listing, such whether the property has a pool, Wi-Fi, or if it allows pets. Because it improves the reliability of host listings and increases visitor happiness, this technology development is causing a sea change in the short-term rental market. Airbnb, which links guests with private homes for short stays, has exploded in popularity in the ever-changing sharing economy. Airbnb has made openness one of its guiding principles. To avoid unpleasant shocks for visitors, amenity detection verifies that property listings are correct. When choosing a hotel, guests have varying tastes and requirements. Guests' choices for certain amenities might inform Airbnb's personalized suggestions. Guests appreciate the simplified booking procedure made possible by efficient amenity detection. They may save time and effort by limiting their search results to just those properties that meet their precise needs. If they want to be successful on Airbnb, hosts must be honest about the facilities their house offers. When visitors have a good experience, they are more likely to recommend the host to others, which increases the host's income and goodwill. By precisely documenting amenities, hosts may better prepare their spaces for guests, which in turn leads to easier check-ins, fewer misunderstandings, and less complaints. This helps hosts manage their properties more successfully. Amenity detection provides hosts a leg up in the short-term rental industry, which is becoming more competitive by the day. Listings may stand out and attract a larger group of prospective visitors by highlighting unusual or desired facilities.

II. LITERATURE SURVEY
Detectron2 was a popular computer vision framework developed by Facebook AI Research for building object detection and segmentation models. It is based on PyTorch and has gained significant attention in the research and development community. However, I do not have specific information about an "Amenity Detection using Detectron2" project. Amenity detection typically involves recognizing and localizing various amenities or objects within an environment "Faster R-CNN: Towards Real-Time Object Detection with Region Proposal Networks" by Shaoqing Ren et al. introduced the Faster R-CNN architecture, which was a foundation for many object detection frameworks, including Detectron2. "Detectron: A Robust Object Detection System" by Ross

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Girshick et al. introduced the original Detectron framework. "Detectron2" is an updated version of Detectron, offering a more modular and flexible platform for object detection and image segmentation.

Instance Segmentation:
"Mask R-CNN" by Kaiming He et al. is a widely used framework for instance segmentation. You can adapt this for amenity detection, where the goal is not just object detection but also segmenting instances of amenities.

Transfer Learning and Pretrained Models:
"ImageNet Large Scale Visual Recognition Challenge" by Olga Russakovsky et al. discusses the ImageNet challenge, which is a crucial dataset for pretraining deep learning models for object detection.

Urban Planning and Amenity Detection:
In the context of urban planning and amenity detection, you can explore research on smart cities, land use classification, and urban object recognition. "COCO: Common Objects in Context" is a widely used dataset for object detection, and it contains a variety of object categories that can be relevant to amenity detection.

Geospatial Object Detection:
If your project involves amenity detection in geospatial data, research on geospatial object detection, such as building detection in satellite imagery, can be valuable Conducting a literature survey in an amenity detection with detectron2 entails examining and summarizing pertinent scholarly works that relate to the project's subject or research inquiry. They are as follows:

A review of research on object detection based on deep learning (AINIT 2020)
This paper discusses the significance of target detection in computer vision over the past two decades, highlighting the distinction between single-stage and two-stage detection algorithms. It provides a detailed overview of representative algorithms in both categories and explores widely used datasets. The paper concludes with a discussion of potential challenges and prospects in the field of target detection

Deep Residual Learning for Image Recognition
With an emphasis on learning residual functions relative to layer inputs, this research presents a residual learning framework that may be used to train deeper neural networks. It shows that these residual networks are more amenable to optimization and may attain impressive accuracy improvements as the depth increases. Specifically, the ImageNet dataset proved to be too much for a 152-layer residual network, which ultimately triumphed in the ILSVRC 2015 classification competition. The study also mentions how the depth of representations greatly improved object recognition on the COCO dataset, which led to remarkable outcomes in several contests.

Object Detection with Deep Learning: A Review
In this study, we focus on how deep learning approaches have replaced more conventional object recognition methods that used to depend on manually created characteristics. It takes a look at object identification frameworks that rely on deep learning, with a focus on CNNs. Specific detection tasks such conspicuous object, face, and pedestrian recognition are covered in the study, in addition to generic object detection architectures, modifications, and optimizations. The paper wraps up with experimental results, technique comparisons, and recommendations for where the fields of object identification and learning systems based on neural networks should go from here.

Faster RCNN: Towards Real-Time Object Detection with Region Proposal Networks
This work introduces a Region Proposal Network (RPN) that shares convolutional features with object detection networks, eliminating the computational bottleneck associated with region proposal algorithms. The RPN is trained to generate high-quality region proposals, which are used for object detection. By merging RPN and Fast RCNN, it achieves state-ofthe-art accuracy on various datasets and offers a frame rate of 5fps on a GPU, contributing to winning entries in competitions.

MobileNets: Efficient Convolution al Neural Networks for Mobile Vision Applications
The paper introduces MobileNets, a class of efficient models designed for mobile and embedded vision tasks. These models employ depthwise separable convolutions to create lightweight deep neural networks. MobileNets offer two key hyperparameters for balancing latency and accuracy, enabling model customization based on specific constraints. Extensive experiments demonstrate their strong performance in comparison to other models on ImageNet classification and their effectiveness in various applications, including object detection, fine-grain classification, face attributes, and large-scale geo-localization.

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SSD: Single Shot MultiBox Detector

A technique for object recognition in photos called SSD (Single Shot MultiBox Detector) is introduced in the study. SSD is based on deep neural networks. Based on the position of the feature maps, SSD discretizes the bounding box outputs into default boxes with different aspect ratios. It is much quicker than competing methods, generates proposals automatically, and achieves competitive accuracy on datasets such as PASCAL VOC, COCO, and ILSVRC. Even with reduced input picture sizes, SSD outperforms other single-stage approaches because to its unified architecture for training and inference.

III. IMPLEMENTATION

Computer vision tasks, such as object identification and instance segmentation, are the main applications of Detectron2, an open-source deep learning framework created by Facebook AI Research (FAIR). Thanks to its modular design, Detectron2 may be easily customized and extended. Various computer vision tasks may be readily adapted by researchers and developers by plugging in different components for trials. You may use these models as a solid foundation for your own research and initiatives. It's ideal for high-throughput or real-time applications because to its improved speed and efficiency compared to its predecessor. It uses streamlined code, hardware acceleration, and support for multiple GPUs. Detectron2 offers tools for data preparation and custom datasets, and it supports a variety of dataset types. When it comes to computer vision model construction and training, Detectron2 provides an easy-to-use API. It comes with a ton of documentation and code examples as well. Researchers and developers from all around the world work together on Detectron2 via forums and GitHub, making it an open-source project that receives constant maintenance and updates. As a whole, Detectron2's performance, availability of pre-trained models, and adaptability have made it a favorite among computer vision researchers and practitioners, facilitating the creation and testing of cutting-edge vision-based applications.

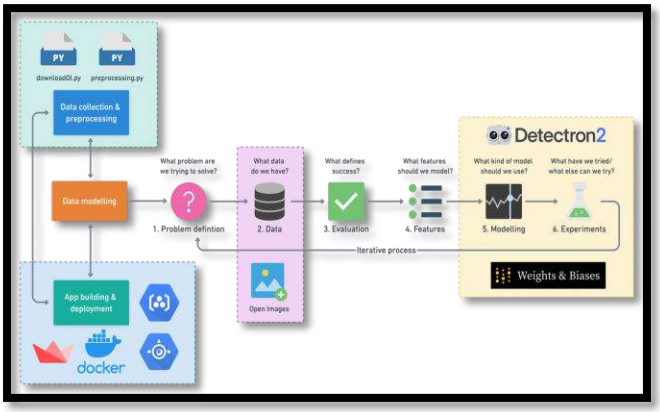

Fig. 1: Flowchart

When you upload an image on any real-estate website, a computer vision machine learning model scans the images, finds the amenities and will add the amenity to the list automatically. An example of how an object detection algorithm works in finding the amenities in a room is shown below.

In the above image, the object detection algorithm detects all the amenities and draws a rectangular wire frame which is to be listed in the website for your occupant to look upon. Even if you have missed to add anything up in your list of amenities, machine learning will be your rescuer thereby increasing the sale value of your house

Fig. 2: Sample output 1

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Fig. 3: Sample output 2

Amenity detection with Detectron2 recipe:

- Collect data with downloadOI.py (a script for downloading certain images from the Open Images).
- Preprocess data with preprocessing.py (a custom script with functions for turning Open Images images and labels into Detectron2 style data inputs).
- Model data with Detectron2.
- Track modelling experiments with Weights & Biases.
- Create a user-facing app with Streamlit.
- Deploy app and model with Docker, GCR (Google Container Registry) and Google App Engine.

A. Data Acquisition

Creating a database of pictures of home amenities is the most crucial step in this strategy. The report notes that Airbnb used its own database for most of the photos, with a small selection from the Open Images collection. The decision on the taxonomy and amenity labels had to be made before the dataset could be built. In this case, the taxonomy ought to serve the unique requirements of the company. Upon evaluation, they arrived at forty amenity classes, categorized as kitchen, bathroom, and bedroom, including appliances such as gas stoves, ovens, refrigerators, bathtubs, showers, towels, beds, pillows, and more. They could compile a massive picture collection from any and all sources since they are a company. This is only a personal hobby project, thus we don't have the resources to hire a professional. Utilizing existing picture databases is, then, the optimal course of action. While reading this, I saw that the Airbnb engineering team began using the Open Image Dataset for their models. "Why not me?" I reasoned. After perusing the Open Images Dataset's classes, I compiled a list of 30 home amenity classes that would be applicable to my model.

names: ['Bathtub', 'Bed', 'Billiard table', 'Ceiling fan', 'Coffeemaker', 'Couch', 'Countertop', 'Dishwasher', 'Fireplace', 'Fountain', 'Gas stove', 'Jacuzzi', 'Kitchen & dining room table', 'Microwave oven', 'Mirror', 'Oven', 'Pillow', 'Porch', 'Refrigerator', 'Shower', 'Sink', 'Sofa bed', 'Stairs', 'Swimming pool', 'Television', 'Toilet', 'Towel', 'Tree house', 'Washing machine', 'Wine rack']

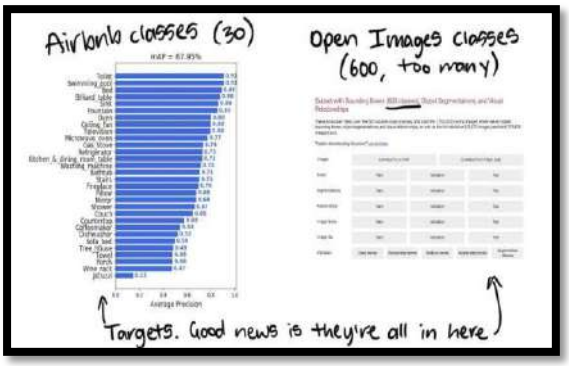

Fig. 4: Target Classes

IV. DATA PREPROCESSING:

To prepare Open Images data and labels for use with Detectron2, a series of preprocessing functions were employed, allowing the data to be converted into the required Detectron2 style inputs. This involved transforming image and annotation data into a format compatible with the object detection framework. Here's a breakdown of the key steps and functions used in this process:

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1. Data Acquisition:
Images were obtained from Open Images, with each image having a unique identifier.

Four label files were collected, which included bounding box annotations and class descriptions.

2. Getting Image IDs:
A function called **get_image_ids()** was created to extract unique image identifiers from a folder containing the downloaded images.

This step was crucial to track and match annotations to specific images.

3. Formatting Annotations:
Annotation files from Open Images contain information about object coordinates (XMin, XMax, YMin, YMax) and image IDs. The unique image IDs obtained from **get_image_ids()** were used to filter and organize relevant annotations. Class labels were mapped to numerical category IDs using a class descriptions file (**class-descriptions-boxable.csv**).

4. Converting Bounding Box Coordinates:
Detectron2 requires bounding box coordinates in absolute pixel values and a specific order (XMin, YMin, XMax, YMax). A function called **rel_to_absolute()** was implemented to convert relative pixel coordinates to absolute values. This function utilized image height, width, and existing bounding box coordinates to make the conversion.

5. Creating Image Dictionaries (Detectron2-style labels):
A critical function named **get_image_dicts()** was developed to merge image data with annotations.

It takes a target image folder, related annotation file, and a list of target classes.

The functions **get_image_ids()**, **format_annotations()**, and **rel_to_absolute()** were used within **get_image_dicts()** to generate Detectron2 style labels (a list of dictionaries).

These dictionaries included information such as annotations, file paths, image dimensions, and image IDs.

The resulting image dictionaries were saved to JSON files for future use.

6. Registering Datasets with Detectron2:
To work with Detectron2, datasets must be registered using **Dataset Catalog.register ()** and **Metadata Catalog.get ()**.

A lambda function was employed for preprocessing as it can only take one parameter.

The JSON files containing image dictionaries were loaded using **load_json_labels()**, ensuring that the **bbox_mode** was correctly formatted as a Detectron2 style **BoxMode**.

7. Dataset Immunity:
Registering datasets with Detectron2 was explained as a way to make datasets semi-immutable, preventing easy changes.

This feature helps maintain consistency and prevents dataset mismatches during model training and evaluation.

In summary, the data preparation process involved collecting images and labels from Open Images, converting annotations into a compatible format for Detectron2 and creating Detectron2 style image dictionaries for each image in the dataset. This meticulous data preprocessing laid the foundation for training and evaluating object detection models on the custom data, making it ready for further modeling and experimentation.

V. MODEL PERFORMANCE IN REAL TIME

Here is the model in action, sufficient examples are given where both the current state-of-art model and our customized generic 3rd party model are seen in action. One important conjecture that needs to be announced is that this research work model only has 30 classes whereas the state-of-art model has many classes. This was done to reduce the amount of training time involved and not because it was not possible. The amount of classes involved with the custom model can very well be scaled up if necessary data sets are available.

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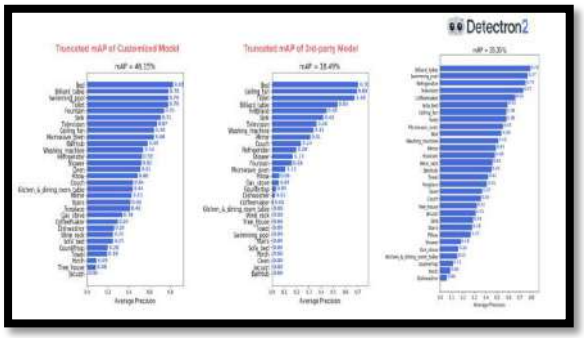

Fig. 5: Mean Average Precision (mAP)

A. System and Software Requirements

Detectron2 can run on a CPU, but for real-time speed, a strong multi-core CPU or, even better, a GPU is suggested. GPU (Graphics Processing Unit): Nvidia's Tesla T4 the average precision for each class and then averages the results across all classes. A higher mAP indicates better performance.

4.1 Hardware Requirements

- Phone
- Windows PC

4.2 Software Requirements

- Google Colab
- Python Language
- StreamLit
- Jupyter Notebook

B. Performance Metrics

Tests were conducted on 70 test data images, and the system was able to detect the use of helmets and safety vests based on the red bounding box for helmets and the pink colour for vests. The detection results are presented in real time on both the front and rear views. Below mentioned is the result of the model training graph with an epoch of 50 on Google Collaboratory. The results of precision with epoch 40 have produced quite high precision, the greater the result of the precision level in object detection, the lower the error rate of each object detection performed.

Accuracy: The accuracy score in machine learning is an evaluation metric that measures the number of correct predictions made by a model in relation to the total number of predictions made.

Accuracy = (TP + TN) / (TP + FP + TN + FN)

Precision: Precision is the number of true positive detections divided by the total number of detections, i.e., it measures the proportion of correctly identified objects among all detected objects.

Precision = TP / (TP + FP)

Recall: Recall is the number of true positive detections divided by the total number of objects in the dataset, i.e., it measures the proportion of correctly identified objects among all actual objects.

Recall = TP / (TP + FN)

F1 score: F1 score is the harmonic mean of precision and recall, which ranges between 0 and 1.

F1 score = 2 ∗ ((Precision ∗ Recall)) / ((Precision + Recall))

Mean Average Precision (mAP): mAP is a common evaluation metric used in object detection. It calculates the average precision for each class and then averages the results across all classes. A higher mAP indicates better performance.

Confusion Matrix: A confusion matrix is a table (refer to table no 2) that summarises the performance of a classification model by showing the number of true and false positives and negatives for each class. It is a useful tool for evaluating the accuracy of a model and identifying areas for improvement.

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True Positives (TP): cases where the model correctly predicted a positive label

False Positives (FP): cases where the model predicted a positive label, but the true label was negative

False Negatives (FN): cases where the model predicted a negative label, but the true label was positive.

True Negatives (TN): cases where the model correctly predicted a negative label.

Table no- 2 Confusion matrix

n = total predictions	Actual: No	Actual: Yes
Predicted: No	True Negative	False Positive
Predicted: Yes	False Negative	True Positive

Fig. 6: Confusion matrix

C. Modeling and Training

In the modeling and experimentation phase of the project, the use of Weights and biases (W&B) played a pivotal role in tracking deep learning experiments, ensuring that the project stayed on track. The experiment aimed to develop a robust object detection model for Airbnb's target classes using Detectron2.

Initial Experimentation: The initial experiment involved training models on a smaller dataset to assess their performance. This step was crucial to determine if the models were learning effectively. W&B was employed to monitor key metrics, notably the average precision, a critical metric for evaluating object detection models. The results were promising, showing improvements in average precision and maintaining consistent performance across different models.

Hypothesis for Model Selection: To select the most suitable model for further development, a hypothesis was formulated. The top two models from the initial experiment, "retinanet_R_50_FPN_1x and "retinanet_R_101_FPN_3x," were chosen for further evaluation. Both models were to be trained on a larger dataset (approximately 10% of the full dataset), with each model undergoing about 1000 training iterations. The results would determine which model performed better and was therefore selected as the "big dog" model for further training.

Data Preparation for the Second Experiment: The entire training, validation, and test datasets from Open Images were downloaded to facilitate the second major experiment. This time, the evaluation involved all 30 target classes, a significant increase from the previous three classes. To ensure the integrity of the experiment, it was crucial that the smaller dataset used for evaluation represented the class distribution of the full dataset accurately. The 10% training data split was carefully created by randomly selecting examples from the full dataset while maintaining a proportional class distribution.

Second Major Experiment: The second experiment was conducted using the two top-performing models from the initial experiment. Both models were trained on the representative 10% dataset, tracking all aspects of the experiment with W&B. Despite the increased complexity due to the larger number of classes, the models demonstrated their ability to learn, as evidenced by improvements in average precision and reductions in loss.

Selection of the Big Dog Model: Based on the results of the second major experiment, "retinanet_R_101_FPN_3x" emerged as the chosen model to be upgraded to "big dog" status. This decision was based on its superior performance in the 10% dataset evaluation.

Training the Final Model: Preparing for the final model training phase, the project involved a substantial amount of data. The entire Open Images dataset, comprising over 38,000 images across all target classes, was utilized. Given the computational limitations (using only one GPU), a critical constraint was imposed on the project's timeline. The training duration for a full run was estimated to be around 15 to 20 hours.

Hyperparameter Tuning: While hyperparameter tuning can be a significant aspect of model optimization, time constraints led to a focus on just a few critical hyperparameters: learning rate and mini-batch size. The learning rate determines the magnitude of updates the model makes to its knowledge, while the mini-batch size affects how many images the model processes at a time. These two settings, along with the model's structure, significantly influence performance.

Linear Learning Rate Scaling Rule: The linear learning rate scaling rule was introduced to adjust the learning rate and mini-batch size based on the number of GPUs used. Since the project utilized a single GPU compared

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to Detectron2's original 8 GPUs, adjustments were made accordingly. Additionally, to preserve the original model patterns during transfer learning, the learning rate was divided by ten as a precaution.

Training the Big Dog Model: With these adjustments in place, the final model was trained on the entire Open Images dataset. After 18.5 hours of training over 34,834 training images and 180,000 training steps, the model achieved a mean average precision (mAP) score of 43.297% on the held-out test set. While the metrics were not directly comparable to Airbnb's results due to dataset differences, this performance demonstrated the model's ability to generalize well to new data.

Real-World Testing: The true test of a computer vision model lies in its real-world performance. The project showcased several test images that the model had never seen before, demonstrating its ability to correctly identify and locate objects in various real-world scenarios.

In conclusion, the modeling and experimentation phase of the project involved meticulous experimentation, model selection, and hyperparameter tuning to develop a reliable object detection model for Airbnb's target classes. The use of Weights & Biases facilitated efficient experiment tracking and ensured that the project stayed on schedule, ultimately leading to a successful outcome with a well-performing "big dog" model ready for further deployment and evaluation.

Fig. 7: Output

VI. CONCLUSION

Computer vision has begun to permeate almost every industry. Having access to high-quality, well specified models becomes even more important in light of this. The generic models are cumbersome and not designed for usage with common devices. However, object-detection models that have been described with precision are still lacking in several areas. Because of this, the potential applications of this discovery are almost boundless.

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A SYSTEMATIC APPROACH ON DESIGN AND IMPLEMENTATION OF ASPECT BASED SENTIMENTAL ANALYSIS SYSTEM

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ABSTRACT
Sentiment or opinion analysis employs natural language processing to extract a significant pattern of knowledge from a large amount of textual data. It examines comments, opinions, emotions, beliefs, views, questions, preferences, attitudes, and requests communicated by the writer in a string of text. It extracts the writer's feelings in the form of subjectivity (objective and subjective), polarity (negative, positive, and neutral), and emotions (angry, happy, surprised, sad, jealous, and mixed). Sentiment analysis is an important task in natural language understanding and has a wide range of real-world applications. The typical sentiment analysis focuses on predicting the positive or negative polarity of the given sentence(s). This task works in the setting that the given text has only one aspect and polarity. A more general and complicated task would be to predict the aspects mentioned in a sentence and the sentiments associated with each one of them. This generalized task is called aspect-based sentiment analysis (ABSA). In the annual Sem Eval competition, an ABSA task has been added since 2014. Among submissions of the past two years, most winning models use support vector machines (SVM). Thus, it covers the theoretical framework and use cases of sentiment analysis in libraries. Proposed system is showing the application of sentiment analysis in libraries using two different tools.

Keywords: sentiment, opinion, analysis, support vector machine, framework

I. INTRODUCTION

As a fine-grained sentiment analysis task, aspect-based sentiment analysis (ABSA) has received continuous attention. Multiple fundamental sentiment elements are involved in ABSA, including the aspect term, opinion term, aspect category, and sentiment polarity. Given a simple example sentence "The surface is smooth.", the corresponding elements are "surface", "smooth", "design" and "positive", respectively.

Meanwhile, the structure of opinion tree is hard to capture, since it consists of rich semantic relations and multiple interactions between sentiment elements. To this end, we design two strategies for effectively forming the opinion tree structure. Firstly, we propose a constrained decoding algorithm, which can guide the generation process using opinion schemas. In this way, the opinion knowledge can be injected and exploited during inference. Secondly, we explore sequence-to-sequence joint learning of several pre-training tasks to integrate syntax and semantic features and optimize for the performance of opinion tree generation.

This system shows the application of sentiment analysis on a data set consisting of paper peer reviews. The domain of scientific paper reviews presents some major challenges, such as:

- Usually classes are unbalanced, because there is a strong bias towards negative opinions.
- Different reviews usually vary in terms of the number of assessments.
- Normally, there is not a clear correlation between the number of positive and negative opinions with the final evaluation made by reviewers

All these issues make this domain a challenge for opinion mining and sentiment analysis purposes. A double blind review scheme was used to prevent biases during the evaluation of the different articles. An international reviewing committee was in charge of the evaluation of each paper. The papers were distributed among the reviewers according to their affinity to the corresponding research area. The reviewers evaluated the submitted papers and provided their comments and evaluations in Spanish and in some cases in English.

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A. Objective

- To predict the aspects and in a sentence and its associated sentiments.
- To extract the sentiments in terms of subjectivity, polarity and emotions.
- To generate the qualitative statement and generate the scaling ratio as per the reviews.
- To analyze the complete briefing of the writer of the sentence.
- To generate the response using CNN

II. LITERATURE SURVEY

Zohre et al. 2019 proposed that most of the early works on ABSA usually apply a set of filters on high-frequency noun phrases to identify aspects. An aspect can be expressed by a noun, adjective, verb or adverb. Usually in reviews, people talk about relevant aspects frequently which give the idea that aspects should be frequent nouns. Therefore their relationship can be used for identifying new aspects (and sentiments). Some researchers created a list of predefined aspect and also uses dependency parser to find aspects. It used GI (General Inquirer) and WordNet lexicons to complete the list of sentiment word. Then it identifies some templates of dependency relation in training data, and identify valid aspect-sentiment pairs in test data that follows one of those templates extracted from the training data. Some reserachers extends classical dependency parsing to phrase level. This parser is used to extract noun and verb phrases as aspect candidates. [1]

Wenxuan et al. 2022 described that discovering and understanding opinions from online user-generated content is crucial for widespread applications. For example, analyzing customer sentiments and opinions from reviews in E-commerce platforms helps improve the product or service, and make better marketing campaigns. Given the massive amount of textual content, it is intractable to manually digest the opinion information. Therefore, designing an automatic computational framework for analyzing opinions hidden behind the unstructured texts is necessary, resulting in the emergence of the research field sentiment analysis and opinion mining. For instance, an entity can be a specific product in the E-commerce domain, and its property or characteristics such as the price and size are the aspects of it. Since an entity can also be regarded as a special “general” aspect, we collectively refer to them as an aspect. ABSA is thus the process of building a comprehensive opinion summary at the aspect level, which provides useful fine-grained sentiment information for downstream applications [2]

Andi et al. 20220 mentioned that review can affect customer decision making because by reading it, people manage to know whether the review is positive, or negative. However, positive, negative, and neutral, without considering the emotion will be not enough because emotion can strengthen the sentiment result. This study explains about the comparison of machine learning and deep learning in sentiment as well as emotion classification with multilabel classification. For service and ambience aspects, ET leads with 92.65% and 87.1% with LP and CC methods, respectively. On the other hand, in deep learning comparison, GRU and BiLSTM obtained similar F1- score for food aspect, 88.16%. On price aspect, GRU leads with 83.01%. However, for service and ambience, BiLSTM achieved higher F1- score, 89.03% and 84.78%. [3]

Guoshuai et al. 2023 proposed a multitask learning model that integrates BERT and RGAT models for APC and ATE tasks. The two tasks are conducted simultaneously in a joint training manner. In the example, “I like the service in the restaurant, but the environment is not very good”, the aspect terms are “service” and “environment”. The output emotional polarity of the two aspects is positive and negative. The sentiments corresponding to these two aspects are quite opposite, so it is not appropriate to conduct a sentiment analysis of the whole sentence but to conduct a more fine-grained analysis. The main research line of ABSA focuses on two subtasks, namely, ATE and APC [4]

Haoyue et al. 2020 stated that sentiment analysis is a process of analyzing, processing, concluding, and inferencing subjective texts with the sentiment. Companies use sentiment analysis for understanding public opinion, performing market research, analyzing brand reputation, recognizing customer experiences, and studying social media influence. According to the different needs for aspect granularity, it can be divided into document, sentence, and aspect-based ones. Finally, existing problems and some future research directions are presented and discussed. Nowadays, reviewing online customer comments and ratings before purchasing a product has become a very common and popular trend practice. Studies have shown that consumers trust online reviews or comments from strangers before purchasing a product or service [5].

III. ANALYSIS OF PROBLEM

The digital age, also referred to as the information society, is characterized by ever growing volumes of information. Driven by the current generation of Web applications, the nearly limitless connectivity, and an

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insatiable desire for sharing information, in particular among younger generations, the volume of user-generated social media content is growing rapidly and likely to increase even more in the near future. People using the Web are constantly invited to share their opinions and preferences with the rest of the world, which has led to an explosion of opinionated blogs, reviews of products and services, and comments on virtually anything.

In addition to this traditional producer/consumer model, sentiment analysis is also important for other economic areas, like for example financial markets For instance, the annotations needed differ for the various approaches since some methods classify sentiment in only positive or negative, while others use a five-star rating. In other cases, the specific focus of an evaluation may not be aspect level sentiment analysis, like in where the task of selecting comprehensive reviews is evaluated. The focus on different tasks also solicits the use of a wide variety of evaluation metrics in aspect level sentiments analysis. The sentiment model is aspect-agnostic and it works fairly well with sentences of uni-sentiment. However, when judging sentences with multiple conflicting sentiments, the output is hard to predict. To solve this problem, we design the following method to connect sentiments with aspects.

IV. PRAPOSED WORK

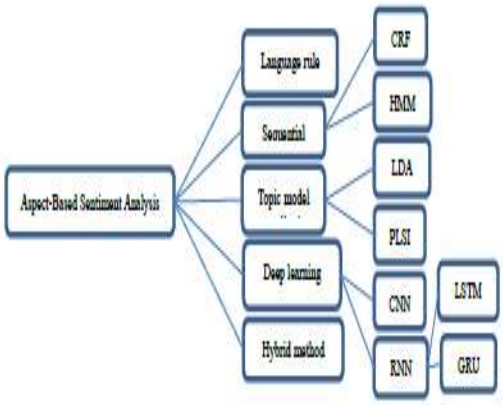

Fig. 1: ABSA method and techniques

Sentiment analysis (also referred to as subjectivity analysis or opinion mining or emotion artificial intelligence) is a natural language processing (NLP) technique that identifies important patterns of information and features from a large text corpus. It analyzes thought, attitude, views, opinions, beliefs, comments, requests, questions, and preferences expressed by an author based on emotion rather than a reason in the form of text towards entities like services, issues, individuals, products, events, topics, organizations, and their attributes. It finds the author's overall emotion for a text where text can be blog posts, product reviews, online forums, speech, database sources, social media data, and documents. One of the most interesting results is improvement obtained by the combination of the scoring algorithm and SVM. Basically, the score gives additional information to the SVM to facilitate the classification. Future work could deal with the extension and generalization of this method, also including the scores obtained for the aspects so as to further improve performance.

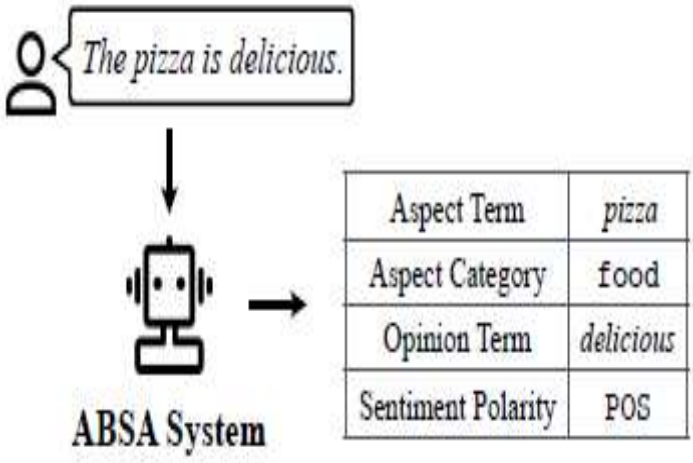

Fig. 2: An example of the four key sentiment elements of ABSA

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For ABSA, the target can be described with either an aspect category c or an aspect term a, while the sentiment involves a detailed opinion expression - the opinion term o, and a general sentiment orientation - the sentiment polarity p. These four sentiment elements constitute the main line of ABSA research:

- Aspect category c defines a unique aspect of an entity and is supposed to fall into a category set C, predefined for each specific domain of interest. For example, food and service can be aspect categories for the restaurant domain.
- Aspect term a is the opinion target which explicitly appears in the given text, e.g., "pizza" in the sentence "The pizza is delicious." When the target is implicitly expressed (e.g., "It is overpriced!"), we denote the aspect term as a special one named "null".
- Opinion term o is the expression given by the opinion holder to express his/her sentiment towards the target. For instance, "delicious" is the opinion term in the running example "The pizza is delicious".
- Sentiment polarity p describes the orientation of the sentiment over an aspect category or an aspect term, which usually includes positive, negative, and neutral.

V. METHODOLOGY

Sentiment analysis models focus on the polarity of the data i.e. positive or negative but are also focuses on feelings and emotions and even on intentions. There are many popular sentiment analysis models. Some of them are:

- Fine grained Sentiment Analysis
- Emotion Detection
- Aspect based Sentiment Analysis
- Multilingual Sentiment Analysis

VI. EXPECTED OUTCOMES

To evaluate the classifier standard machine learning and pattern recognition metrics for classification problems are applied. In particular, we use accuracy, precision, recall and the F1-score. These evaluation metrics have been selected because they are the most commonly applied metrics in the state-of-the-art and related work. Evaluation metrics are provided as an average over each class, along with the corresponding standard deviation considering 10 replications, except in the case of the scoring algorithm, which is evaluated over all the data set and always provides the same result since it is deterministic (results only depend on parameters)

VII. CONCLUSION

Aspect Based Sentiment Analysis (ABSA) is one of the techniques used to perform sentiment analysis and it identifies certain keywords from the texts by dividing the texts into smaller parts in order to efficient identify the sentiment of the text. Various methods can be used to identify the sentiment; it may be clustering, classification etc. Many different algorithms can be used and each has their own accuracy. We used the Vader tool to perform sentiment analysis whereas many algorithms like random forest classifier etc. can be used too. Besides these core elements of aspect-level sentiment analysis, there are additional concerns: robustness, flexibility, and speed. Robustness is needed in order to cope with the informal writing style found in most user-generated content.

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NEUROMORPHIC COMPUTING

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ABSTRACT
Neuromorphic computing is a method of computer engineering in which elements of a computer are modeled after systems in the human brain and nervous system. The term refers to the design of both hardware and software computing elements. Neuromorphic computing is sometimes referred to as neuromorphic engineering. Neuromorphic engineers draw from several disciplines -- including computer science, biology, mathematics, electronic engineering and physics -- to create bio-inspired computer systems and hardware. Of the brain's biological structures, neuromorphic architectures are most often modelled after neurons and synapses. This is because neuroscientists consider neurons the fundamental units of the brain. Neurons use chemical and electronic impulses to send information between different

1. INTRODUCTION
Neuromorphic computing is a method of computer engineering in which elements of a computer are modeled after systems in the human brain and nervous system. Neuromorphic computing is sometimes referred to as neuromorphic engineering. Neuromorphic computing uses hardware based on the structures, processes and capacities of neurons and synapses in biological brains. Neuromorphic computing is an emerging field that has the potential to drastically influence every human's life within the next decades. Neuromorphic computing explores the computing process of the brain and attempts to replicate it onto modern electronics. It offers improvements on current computer architecture, von Neumann architecture, and will lead to more efficient computing, easier development of machine learning, and further integration of electronics and biology. Neuromorphic computing presents a solution to the limitations of von Neumann architecture.

Neuromorphic computing applies these principles to develop computing solid state circuits that store and process data in the same, repeating structures representative of neurons, which communicate through memory-holding connections representative of synapses (Indiveri, 2013). Emulating synapses with memory, however, poses a difficult challenge. Current research in neuromorphic computing explores organic and inorganic materials to replace synapses in neuromorphic circuitry. Simply put, neuromorphic computing is a computing method in which parts of a computer are designed after the **human brain and nervous system**. The most common form of neuromorphic computing is *spiking neural networks.*

The term neuromorphic is generally used to describe analog, digital, mixed-mode analog/digital VLSI, and software systems that implement several models of neural systems. The implementation of neuromorphic computing on the hardware level can be realized by various technologies, including spintronic memories, threshold switches, CMOS transistors, and oxide-based memristors. This chapter introduces the neuromorphic computing systems and explores the fundamental concepts underlying this emerging paradigm. We first discuss biological neurons and the dynamics that are abstracted from them to model artificial neurons. Next, we discuss artificial neurons and how they have evolved in their representation of biological neuronal dynamics. Afterward, we discuss implementing these neural networks in terms of neuron models, storage technologies, inter-neuron communication networks, and learning.

2. METHODOLOGY

1. Modeling Neural Networks:
Neuromorphic computing starts with the development of computational models that mimic the structure and function of biological neural networks. These models include neurons, synapses, and learning rules.

2. Spiking Neural Networks (SNNs):
Many neuromorphic systems focus on Spiking Neural Networks (SNNs), which simulate the behavior of neurons using discrete spikes or pulses to represent information. SNNs offer a more biologically plausible model compared to traditional artificial neural networks (ANNs).

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3. Hardware Implementation:
Neuromorphic hardware is designed to simulate the behavior of neural networks in real-time. This includes the development of specialized neuromorphic chips and memristor-based synapses.

4. Parallel Processing:
Neuromorphic computing architectures emphasize parallel processing, enabling the execution of multiple operations simultaneously, similar to how the brain processes information across a vast network of neurons.

5. Event-Driven Processing:
Event-driven processing is a key feature of many neuromorphic systems. These systems respond to events or changes in input, allowing for efficient processing and lower power consumption.

6. Learning and Adaptation:
Learning algorithms are integrated into neuromorphic systems to replicate synaptic plasticity and enable learning from data. These algorithms often include spike-timing-dependent plasticity (STDP) rules**.**

2.1 WORKING PROCESS

1. Data Input:
The working process begins with the input of data or sensory information. This data can be in various forms, such as images, sounds, or sensor readings.

2. Encoding:
Data is encoded into a format suitable for neural network processing. In SNNs, this often involves converting continuous data into spike trains, where spikes represent events or features.

3. Neural Processing:
The encoded data is processed by the neuromorphic hardware, where simulated neurons receive and transmit spikes according to the model's parameters and connectivity.

4. Learning and Adaptation:
Neuromorphic systems can adapt and learn from the input data through the application of learning rules, which adjust synaptic weights and connections based on the timing and frequency of spikes.

5. Event-Driven Response:

6. Neuromorphic systems respond to events in the input data. For example, in a vision system, a neuromorphic camera may only send spikes when significant changes or objects of interest are detected in the scene.

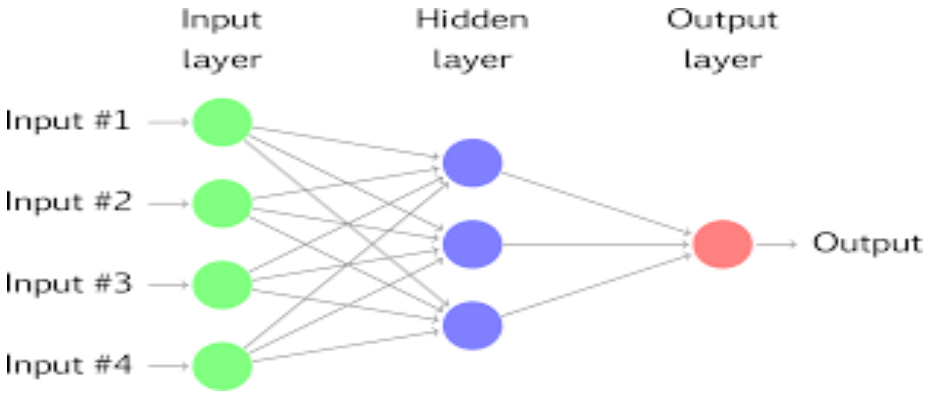

Fig 1: Modeling Neural Network

Hardware Vulnerabilities:
Hardware Exploits: Vulnerabilities in the underlying hardware, such as neuromorphic chips or memristor-based devices, could be exploited to gain unauthorized access or manipulate system behavior.

2.2 PROTOCOLS VULNERABLE of NEUROMORPHIC COMPUTING

Software Vulnerabilities:
Malicious Code: Software used for simulating neural networks in neuromorphic systems may be vulnerable to traditional software vulnerabilities, such as buffer overflows or injection attacks.Insecure Configuration: Incorrectly configured software components may introduce vulnerabilities, potentially leading to unauthorized access or data leakage.

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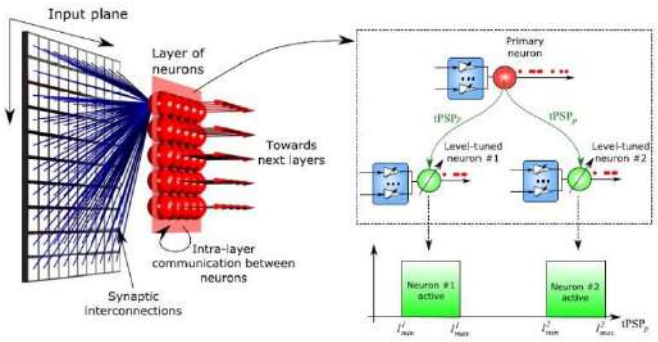

Fig 2: Working Process of Neuromorphic Computing

3. RESULTS

Neuromorphic computing is an emerging field in computer science and neuroscience that aims to design hardware and software inspired by the structure and function of the human brain. While I can't provide real-time updates on specific research developments beyond my last knowledge update in January 2022, I can give you some general insights into the potential results and applications of neuromorphic computing up to that point: Energy-Efficiency: Neuromorphic computing has the potential to be significantly more energy-efficient compared to traditional computing, making it suitable for tasks like artificial intelligence, machine learning, and robotics.

4. CONCLUSION

In conclusion, neuromorphic computing is a promising technology that has the potential to revolutionize the field of artificial intelligence by creating more efficient and powerful computing systems. However, it is important to recognize that there are also several challenges that need to be overcome before neuromorphic computing can reach its full potential. The complexity of replicating the brain, the lack of standardization in the field, the limited applications, and the high cost of developing and implementing neuromorphic systems are all factors that need to be considered.

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DASH FRAMEWORK IN PYTHON"Building Interactive Web Applications with Dash: Python's Dynamic Framework for Data Visualization"

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ABSTRACT
Dash, a Plotly open-source Python tool, quickly builds interactive web apps with a focus on data visualization. Its declarative syntax and component-based structure enable dynamic dashboards to be created without substantial web programming knowledge. Plotly integration, rapid callbacks, scalability, and real-time data support are among the key features. Dash's versatility has made it popular in academia and industry, where it is used by researchers and developers to create user-friendly, data-driven web programs.

Keywords: Plotly, scalability, web apps, data visualization, versatility

1. INTRODUCTION
Sustainable development envisions an inclusive, resilient future for people and the planet. However, assessing the progress of sustainability requires agreed-upon metrics, which are particularly missing in the built environment. For sus- tainable development, the United Nations advocates a" three pillars" structure. The purpose of this research is to improve the integration of physical and intangible factors in housing for socio-culturally focused sustainability. Current sustainability tools emphasize physical features while ignoring socio-cultural factors that are critical for socially and culturally suitable housing in a low-carbon future. Unlike traditional research involving industry specialists, this study stresses citizens' engagement and criticism, which is generally disregarded [1].

2. METHODOLOGY
How Dash applications are typically built

1) **Installation:** Dash is a Python framework, so the first step is to install it using a package manager like pip.

```
pip install dash
```

2) **Importing Libraries:** Import necessary libraries, including dash for creating the application and dash_core_components and

dash_html_components for constructing the layout.

```
import dash
from dash import dcc, html
```

3) **Initialization:** Create an instance of the Dash class to initialize the application.

```
app = dash.Dash( name )
```

4) **Layout Definition:** Define the layout of the application using HTML and Dash components. The layout deter- mines how the app appears.

```
\begin{verbatim} app.layout = html.Div([
html.H1("My Dash App"), dcc.Graph(
id='example-graph', figure={
'data': [
{'x': [1, 2], 'y': [4, 1], 'a', 'b'}
{'x': [1, 3], 'y': [2, 4], 'a', 'b'}
],
'layout': { 'title': 'Dash Data Visualization'} } ) ])
```

5) **Callback Functions:** Use callback functions to make the app interactive. Callbacks define how the app responds to user input.

```
@app.callback( dash.dependencies.Output('A', 'f'), [dash.dependencies.Input('B','V')])
```

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def update_graph(selected_value):

Update the graph based on user input

6) **Running the App:** Finally, run the app.

if name == ' main ': app.run_server(debug=True)

This is only a rough outline; the real process may differ depending on the application's complexity. Dash offers cus- tomization flexibility, allowing you to integrate more advanced features like authentication, database integration, and real-time updates as needed for your individual application.

3. OBSERVATION

Dash is a Python web framework that specializes in the development of interactive web applications and data visual- izations. The heart of your Dash application revolves around creating layouts and defining interactivity via callbacks.The emphasis is on data visualization and real-time updates. Dash uses layouts instead of views to define how your application appears in a web browser. HTML and Dash components are used to create layouts. Dash lacks Django's model and database concepts [2] . It is primarily used to create front- end components and dynamic content is provided by ex- ternal data sources or APIs. Dash applications frequently generate dynamic HTML pages for user interaction and data visualization, which are made possible by Dash components and HTML/CSS. Dash applications are naturally responsive, making them simple to use.

4. FUTURE

Dash's future appears bright, as it continues to play an important role in simplifying the development of interactive, data-driven web applications in Python. Dash's performance, scalability, and additional features are likely to improve with ongoing community support and enhancements. Because of its versatility and ease of use, it is a valuable tool for data scientists, analysts, and developers, and its adoption is expected to grow. expand in areas such as data visualization, analytics, and real-time dashboarding [4]. Dash is likely to adapt and remain a popular choice as web technologies evolve. for those interested in developing web applications in Python.

5. ADVANTAGES & DISADVANTAGES

Advantages of Dash:

1) **Pythonic Development:** Dash allows developers to leverage their Python programming skills for web development. The syntax is Pythonic, making it accessible to those already familiar with the language.
2) **Rapid Prototyping:** Dash enables rapid prototyping of interactive web applications. Developers can quickly build and iterate on their applications, reducing devel- opment time.
3) **Declarative Syntax:** The framework employs a declar- ative syntax for defining the layout and interactions, making the code more readable and easier to understand.
4) **Interactive Data Visualization:** Dash is particularly strong in creating interactive and dynamic data visualizations, thanks to its integration with Plotly.
5) **Community Support:** Dash has a vibrant community, and the framework is well-supported with documentation, tutorials, and forums. This provides valuable resources for developers seeking assistance or looking to expand their knowledge.

Disadvantages of Dash:

1) **Learning Curve:** Dash may have a learning curve for developers who are new to web development or those unfamiliar with React, as it is used under the hood for more advanced features. This can impact the onboarding process.
2) **Performance Concerns:** Dash applications may face performance challenges for very complex or resource-intensive applications. Careful consideration and opti- mization may be needed for large-scale projects.
3) **Limited Front-End Control:** For developers who pre- fer extensive control over the front-end, Dash's high- level abstractions may limit customization options.

6. CONCLUSION

The Dash framework comes as one of the most powerful and flexible frameworks for web application development. It integrates Python, HTML, and CSS, as well as JavaScript. Its ease of use, combined with Plotly's power for data visualiza- tion, makes Dash an attractive option for developers. As the need for dynamic

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and interactive web applications continues to grow, Dash stands out from the crowd as a valuable tool. It offers speed, responsiveness, and community support, making it an essential part of modern Python web development.

7. ACKNOWLEDGEMENT
We would like to express our gratitude to the creators and contributors of the Dash framework in Python, which played a pivotal role in the development of the interactive visualizations presented in this research. Dash provided a robust and flexible platform for building web-based data dashboards, enabling us to communicate our findings in a dynamic and engaging manner. The ease of use and extensive documentation of Dash significantly contributed to the success of our visualization efforts, and we acknowledge the importance of open-source tools like Dash in advancing scientific communication and data exploration.

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DISEASES PREDICTION IN CROPS USING DEEP LEARNING: AN OVERVIEW

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ABSTRACT
Our project leverages advanced deep learning technology to provide farmers with a powerful tool for early identification and prediction of crop diseases. Timely detection is crucial in preventing the rapid spread of diseases that can devastate crops. We have developed a specialized computer program capable of analysing images of crops to determine their health status. the cornerstone of our approach lies in the implementation of a convolutional neural network (CNN), a type of artificial intelligence specifically designed for image analysis. To train our program effectively, we compiled an extensive dataset comprising images of both healthy and diseased crops. This dataset serves as the foundation for teaching our program to recognize various diseases accurately. beyond technological innovation, our project embodies a larger mission - to support farmers in safeguarding their crops and ensuring an ample food supply for all. The system we are developing holds the potential to revolutionize agriculture by significantly reducing crop losses attributable to diseases. in summary, our project integrates cutting-edge deep learning techniques with a comprehensive dataset to create a robust tool for crop disease identification and prediction. By harnessing the power of convolutional neural networks, we empower farmers with an efficient solution for early detection, ultimately contributing to a more resilient and productive agricultural sector.

Keywords: Crop Diseases, Deep Learning, Convolutional Neural Networks, Agriculture.

I. INTRODUCTION
Crop diseases pose a significant threat to global agriculture, affecting food production and livelihoods. Early and accurate disease detection is essential for effective management. This study explores a cutting-edge solution: deep learning for crop disease prediction. deep learning, a subset of artificial intelligence, offers a promising tool to identify diseases in crops. It works like the human brain, learning patterns and features from vast datasets, such as images of healthy and diseased plants. By analysing these images, deep learning models can distinguish between healthy and infected crops with high accuracy. our research focuses on the practical implementation of deep learning for disease prediction in agriculture. We collect and preprocess extensive datasets of crop images to train the deep learning model. The architecture of the model, a neural network, plays a crucial role in its accuracy. We evaluate its performance using specific metrics to ensure its effectiveness. one of the key advantages of this approach is real-time monitoring. This means that farmers and agricultural professionals can receive instant alerts when diseases are detected. Early intervention can prevent further spread, reduce crop loss, and ultimately boost yields. this research doesn't stop at the laboratory. We consider the real-world application of this technology, addressing issues like scalability and user-friendliness. Our goal is to provide a practical and accessible solution for farmers and agricultural communities. in summary, our study delves into the world of deep learning to develop a user-friendly, real-time, and accurate disease prediction system for crops. By doing so, we aim to revolutionize disease management in agriculture, contributing to food security and economic stability.

II. LITERATURE REVIEW

A. *Plant Disease Detection Using Image Processing and Machine Learning Pranesh Kulkarni1, Atharva Karwande1, Tejas Kolhe1, Soham Kamble1, Akshay Joshi1, Medha Wyawahare1*
The intersection of image processing and machine learning in plant disease detection has emerged as a promising avenue for addressing agricultural challenges. Kulkarni et al. (2023) have contributed to this field by exploring innovative approaches to identify and classify plant diseases. Image processing techniques play a pivotal role in preprocessing plant images, extracting relevant features, and enhancing the quality of input data. These techniques, such as image segmentation and colour analysis, contribute to creating a robust foundation for subsequent machine learning algorithms. The integration of machine learning algorithms, including but not limited to support vector machines, decision trees, and deep learning models, allows for automated disease classification based on learned patterns from labelled datasets. Kulkarni et al.'s work likely builds upon existing literature, acknowledging the significance of datasets like Plant Village and leveraging techniques like transfer learning for enhanced model performance. As with many studies in this domain, challenges related to dataset diversity, model generalization to real-world conditions, and interpretability are prevalent. Future research directions may involve refining the synergy between image processing and machine learning, optimizing model

architectures, and addressing the scalability of these approaches for large-scale agricultural applications. The study by Kulkarni et al. contributes to the growing body of literature, emphasizing the potential of image processing and machine learning for effective and automated plant disease detection in agricultural settings.

B. ***Crop Prediction and Plant Leaf Disease Prediction Using Deep Learning Kalpesh Shinde1, Nishant Dhamale2, Sudarshan Dangat3, Prof. Anand Khatri4***

The research by Shinde et al. (2023) delves into the dual realms of crop prediction and plant leaf disease prediction through the lens of deep learning. This interdisciplinary approach recognizes the interconnectedness of predicting crop yield and identifying potential threats to plant health. Leveraging deep learning techniques, the authors likely explore the application of neural networks, possibly Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs), to address these agricultural challenges. Crop prediction involves forecasting yields based on various factors like climate, soil conditions, and historical data, with deep learning offering a robust framework for handling the complexity of these variables. Simultaneously, plant leaf disease prediction is a critical aspect of precision agriculture, where deep learning models can be trained to recognize patterns associated with different diseases, enabling early detection and intervention. The integration of these two predictive tasks showcases a holistic approach to agricultural management. The review may delve into the challenges encountered, such as data quality, model interpretability, and the need for diverse datasets. It is plausible that Shinde et al. build upon existing literature, drawing insights from studies on crop prediction and plant disease prediction individually, while offering a novel contribution by combining these facets through deep learning methodologies. Future directions for research in this domain might involve refining model architectures, addressing data scarcity issues, and exploring real-world implementation challenges. Shinde et al.'s work likely underscores the potential of deep learning in revolutionizing agricultural practices by simultaneously addressing crop yield prediction and plant disease identification.

C. ***CROP DISEASE PREDICTION USING DEEP LEARNING TECHNIQUES - A REVIEW Gargi Sharma and Gourav Shrivastava***

The literature review by Sharma and Shrivastava (2023) focuses on the application of deep learning techniques in crop disease prediction. The use of deep learning in agriculture, specifically for disease prediction, has gained momentum due to its ability to automatically learn intricate patterns from large datasets. The authors likely explore various deep learning models, such as Convolutional Neural Networks (CNNs) and recurrent neural networks (RNNs), and their effectiveness in identifying and classifying crop diseases. Transfer learning, a technique that leverages pre-trained models on extensive datasets for improved performance on specific tasks, may also be a key aspect of their review. the literature may encompass discussions on publicly available datasets commonly used in crop disease prediction, addressing challenges related to imbalanced datasets and the need for more diverse and representative data. The review may highlight the significance of early disease detection in mitigating agricultural losses and emphasize the potential role of deep learning in providing accurate and timely predictions. common challenges in the application of deep learning to crop disease prediction, such as interpretability, model robustness under diverse environmental conditions, and scalability to different crops, may be addressed. The authors may discuss how ongoing research aims to enhance model interpretability and address these challenges for practical deployment in agriculture. the review likely concludes by summarizing the current state of the field, emphasizing successful applications of deep learning in crop disease prediction, and suggesting avenues for future research. This work by Sharma and Shrivastava contributes to the growing body of literature aimed at harnessing advanced technologies to ensure food security and sustainable agricultural practices.

III. DATA COLLECTION AND PREPROCESSING

In developing our crop disease prediction model, we leveraged the PlantVillage dataset, utilizing its rich collection of annotated images and information on various crop diseases. This dataset serves as a crucial resource for training and evaluating our model, enabling it to learn patterns and characteristics associated with different plant ailments. the PlantVillage dataset comprises a diverse set of high-quality images representing crops affected by various diseases, pests, and nutritional deficiencies. Each image is meticulously labelled with corresponding disease types, providing a comprehensive ground truth for the model. The dataset covers a wide range of crops, facilitating the creation of a robust and versatile predictive model capable of identifying and classifying different crop diseases accurately.by incorporating the PlantVillage dataset into our model development process, we ensure that the predictive capabilities of our model are well-informed and accurate, contributing to more effective crop management and disease mitigation strategies in agriculture.

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IV. PROPOSED APPROACH AND METHODOLOGY

A. CNN-BASED DISEASE PREDICTION MODELS

In our study, we leverage Convolutional Neural Networks (CNNs) as a fundamental component for disease prediction in crops. The architecture of our CNN model is rooted in a pre-existing dataset, specifically designed for pre-training purposes. Rather than embarking on the creation of an entirely new CNN architecture, we capitalize on the knowledge embedded within a pre-trained network. This network has been initially trained in a fully supervised manner on a large-scale object recognition task. the rationale behind this approach lies in the concept that features extracted from the activations of a CNN, fine-tuned for object recognition, possess a wealth of information that can be repurposed for a novel task, such as disease prediction in crops. While our training dataset might not boast the same scale as the original dataset used for pre-training, we recognize that the performance of the CNN model is intricately tied to the quantity and diversity of the training set. it is imperative to note that training a deep model, especially in the context of agriculture and disease prediction, demands a unique set of skills and experience. Additionally, the process is inherently time-consuming. Nevertheless, our adoption of a pre-trained CNN model lays a robust foundation for effectively identifying and predicting crop diseases, ensuring a balance between computational efficiency and predictive accuracy. by harnessing the power of transfer learning through a pre-trained CNN, we aim to overcome the challenges posed by limited dataset size, variability, and the resource-intensive nature of training deep models. This strategic utilization of CNNs positions our methodology as a sophisticated and effective approach for disease prediction in crops, bridging the gap between cutting-edge technology and agricultural sustainability.

B. VGG16 AND VGG19:

VGG16 and its extended counterpart, VGG19, both originating from the Visual Geometry Group at the University of Oxford, have revolutionized the field of crop disease prediction. Initially designed for image classification, these models are now fine-tuned for the intricate task of identifying and predicting crop diseases.

VGG16: With its simplicity and uniform architecture comprising 16 weight layers, including 13 convolutional layers and 3 fully connected layers, VGG16 proves instrumental in capturing subtle patterns and features in plant images affected by diseases. Through transfer learning, the model leverages its pre-existing knowledge from object recognition to identify unique visual cues associated with various crop diseases. The ability of VGG16 to discern subtle differences in leaf textures and colours makes it a valuable asset in accurately predicting crop ailments.

VGG19: Building upon VGG16, VGG19 extends its capabilities with a deeper architecture featuring 19 weight layers. The additional layers enhance the model's capacity to capture even more complex features in plant images, proving advantageous in dealing with a diverse range of crop diseases that may manifest in subtle or intricate ways. The fine-tuning process involves adapting the model to recognize disease-specific patterns, enabling VGG19 to excel in identifying and predicting crop diseases with a high degree of accuracy.

C. RESNET:

Developed by Microsoft Research, ResNet introduces a groundbreaking concept called residual learning, addressing challenges associated with training very deep neural networks. In the realm of crop disease prediction, ResNet's unique architecture, featuring shortcut connections, allows the model to focus on learning disease-related features without being hindered by vanishing gradients. ResNet architectures come in various depths, such as ResNet-50, ResNet-101, and ResNet-152, providing flexibility in capturing features at varying levels of complexity. This adaptability proves crucial in identifying subtle deviations in plant structures caused by diseases. ResNet's innovative approach makes it a powerful tool for accurate and reliable crop disease prediction.

In summary, VGG16, VGG19, and ResNet contribute significantly to the field of crop disease prediction by leveraging their image classification prowess, adaptability to diverse datasets, and the ability to capture intricate patterns. The transfer learning process ensures that the knowledge gained from generic object recognition tasks is repurposed effectively for the specific task of identifying and predicting diseases in crops.

V. DISCUSSION

In our discussion, the implementation of CNN-based disease prediction models, specifically VGG16, VGG19, and ResNet, showcases the efficacy of transfer learning from pre-trained networks in the agricultural context. Leveraging a pre-existing dataset for initial training not only enhances computational efficiency but also establishes a robust foundation for disease prediction in crops. The adaptability of VGG16 and VGG19, originally designed for image classification, is evident in their ability to capture subtle patterns and features associated with diverse crop diseases. The transfer learning process, drawing from their pre-existing knowledge

in object recognition, proves particularly effective in discerning nuances in leaf textures and colours. Meanwhile, ResNet's innovative architecture, featuring residual learning and shortcut connections, addresses challenges in training deep neural networks for crop disease prediction. The flexibility of various ResNet depths contributes to its capacity to identify subtle deviations in plant structures caused by diseases. While acknowledging the challenges in training deep models for agriculture, our methodology, grounded in transfer learning and model adaptability, positions itself as a sophisticated and effective approach, bridging the gap between cutting-edge technology and the imperative need for sustainable agricultural practices. Further research and refinement, coupled with domain-specific insights, will continue to enhance the accuracy and resilience of crop disease prediction systems.

VI. CONCLUSION

In conclusion, the research paper on the "Design and Implementation of Disease Prediction in Crops Using Deep Learning" provides a comprehensive overview of a sophisticated and effective methodology for addressing the critical challenge of predicting crop diseases. The adoption of CNN-based models, specifically VGG16, VGG19, and ResNet, underscores the significance of transfer learning in leveraging pre-trained networks for agricultural applications. The strategic choice to capitalize on a pre-existing dataset for initial training demonstrates a commitment to computational efficiency and establishes a robust foundation for disease prediction in crops. the versatility of VGG16 and VGG19, originally designed for image classification, is evident in their capacity to capture subtle patterns and features associated with diverse crop ailments. Transfer learning proves instrumental in repurposing their knowledge from object recognition to the specific task of identifying and predicting diseases in crops. Additionally, ResNet's innovative architecture, featuring residual learning, addresses challenges in training deep neural networks for crop disease prediction, enhancing the model's ability to focus on disease-related features without succumbing to vanishing gradients. as technology intersects with sustainable agricultural practices, this research contributes significantly by bridging the gap between cutting-edge deep learning techniques and the practical needs of the agricultural sector. The methodology outlined in the paper not only addresses challenges related to limited dataset size, variability, and computational efficiency but also emphasizes the importance of domain-specific expertise in training deep models for agriculture. Moving forward, further research and refinement of these models, coupled with ongoing collaboration between technologists and agricultural experts, promise to advance the accuracy and resilience of crop disease prediction systems, contributing to the overall sustainability of agricultural practices.

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EARLY LANDSLIDE DETECTION SYSTEM USING IOT SENSORS A COMPREHENSIVE REVIEW

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ABSTRACT
This paper explores an Early Landslide Detection System using Internet of Things (IoT) technologies. The system uses a network of sensors strategically placed in landslide-prone areas to monitor slope stability indicators. These sensors, equipped with real-time data transmission capabilities, enable continuous monitoring and immediate detection of potential landslide precursors. The paper highlights the use of edge computing for local data processing and machine learning algorithms for analysing sensor data patterns. The system also integrates satellite imagery and remote sensing technologies to enhance accuracy, ensuring a comprehensive and reliable early warning system. Case studies and practical implementations of the system are presented, showcasing its effectiveness in diverse geographical and environmental conditions. The paper concludes by underscoring the transformative impact of IoT sensors in revolutionizing landslide detection, offering a proactive and technologically advanced solution to mitigate the devastating consequences of landslides.

Keywords: Landslide Detection, Early Warning System, Internet of Things (IoT), Sensor Networks, Disaster Mitigation

I. INTRODUCTION
The 12.6% regions of India like Himachal Pradesh and Uttarakhand in the Himalayas are prone to natural hazards such as landslides and land subsidence. These hazards result from a combination of geological, environmental, and human factors. Geological factors encompass weak rock formations, ongoing tectonic movements, and geological structures like faults and joint systems. Environmental factors involve heavy rainfall, river erosion, and improper land use practices that exacerbate the risks. Human activities, including deforestation, mining, and inadequate waste disposal, further contribute to the occurrence of landslides and subsidence. Globally, these geohazards have devastating consequences, impacting communities, infrastructure, and economies.

This study conducts a comprehensive review and integration of Internet of Things (IoT) technologies to both detect and prevent these natural hazards. Insights are drawn from empirical evidence and technical cloud computing and machine learning research and algorithms, shedding light on innovative approaches to enhance early detection. In the context of landslides, a combination of engineering measures and Using IoT sensors," focusing on the synergy between advanced sensor networks, real-time data transmission, and sophisticated data analytics. The research aims to provide a comprehensive understanding of how IoT technologies can enhance the efficiency and reliability of landslide detection systems, and present case studies and practical applications to showcase the real-world impact of this innovative approach in diverse geographical and environmental contexts.

Regarding the effectiveness of different approaches across technical contexts we used different sensors like soil moisture, Vibration sensor, Accelerometer, Pressure sensor, Rain water, Humidity sensor, Temperature Sensor Satellite, Laser Scanner and early detection through ground monitoring systems such as GPS and InSAR (Interferometric Synthetic Aperture Radar) is crucial.

II. LITERATURE REVIEW
Landslides have been observed in Cincinnati, Ohio, since the 1850s, with their detrimental effects escalating due to urban development encroaching on hilly terrain. The City of Cincinnati incurred substantial costs, around $500,000 annually, for emergency street repairs due to landslide damage from 1983 to 1987. Similarly, Hamilton County faced even higher costs, averaging about $5,170,000 annually for damages caused by landslides between 1973 and 1978. Colluvium deposits in the area are particularly susceptible to landslides. Collaborative research by the U.S. Geological Survey and the University of Cincinnati delved into the causes and mechanisms of landslides, utilizing geologic data, historical slide distribution information, and trigger knowledge. This chapter outlines the geological context, various landslide types, the history of investigative efforts, mitigation strategies, and the basis for further research in this field [1].

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The work by Gariano and Guzzetti critically examines the intricate relationship between climate change and its consequences on landslides [2]. This is a pivotal area of study with implications for both scientific understanding and policy development. While the progression of global warming is undeniable, comprehending its nuanced effects on geo-hydrological hazards such as landslides presents a complex challenge. The study acknowledges the role of climate variables, notably precipitation and temperature, in influencing slope stability. However, it also highlights gaps in our knowledge concerning the specific interactions and resulting risks. The research extensively reviews scientific literature, encompassing peer-reviewed articles and conference proceedings, to delve into the historical, contemporary, and projected future impact of climate change on landslides. It explores methods for assessing slope stability through climate projections, examines historical climate records, and analyses evidence of past landslides. Furthermore, the paper presents a preliminary global assessment of potential changes in landslide activity, abundance, and types in response to projected climate shifts. This assessment forms the basis for crucial recommendations related to climate adaptation and strategies for mitigating landslide risks. Ultimately, this comprehensive review contributes substantially to advancing our understanding of the intricate interplay between climate change and landslides, thereby informing decision-making and proactive policy interventions.

[3] Landslide Susceptibility Analysis Using Event-Based Landslide Inventories investigates the intricate relationship between climatic conditions and landslide occurrences, focusing on the mountainous regions of Taiwan that are prone to devastating landslides and debris flows. The research emphasizes the importance of understanding landslide susceptibility to enable sustainable land-use practices and disaster prevention. By evaluating diverse methodologies, including deterministic and statistical approaches, the study aims to predict landslide events through an analysis of geo-environmental variables. Leveraging event-based multi-temporal landslide inventories facilitated by advanced remote sensing technology, the research employs the Bayes' theorem and Weight of Evidence (WOE) method. This unique approach is used to assess susceptibility across different scales of typhoon-induced landslides, with the goal of establishing optimal models through cross-testing and performance evaluation metrics. Ultimately, the research provides valuable insights into the factors driving landslide occurrences and effective strategies for modelling and prediction.

[4] Study of Landslide Hazard Zonation in Mandakini Valley, Rudraprayag District, Uttarakhand Using Remote Sensing and GIS underscores the significant impact of landslides, which pose threats to both infrastructure and human lives, necessitating a focus on landslide susceptibility mapping. Landslides result from complex interactions involving geological, geomorphological, and meteorological factors. These factors can be analysed using spatial data from remote sensing and ground-based sources. Geographic Information System (GIS) techniques play a pivotal role in integrating diverse data types to efficiently delineate hazard zones. The Uttarakhand region, specifically the Mandakini River Valley, experienced substantial devastation in 2013 due to heavy rains, cloudbursts, and flash floods. Historical records also indicate a susceptibility to such disasters. The geological characteristics of the valley, marked by distinct litho-stratigraphical units affected by tectonic movements, contribute to the occurrence of landslides. The study highlights the necessity of comprehensive analysis and mapping to mitigate the impact of landslides in the vulnerable Himalayan region.

[5] The IPCC report strongly alerts to the ramifications of climate change on snow-covered terrains. In the 21st century, there is an anticipated decrease in snow-covered areas and volumes, coupled with elevated snowline elevations. Glacier mass reduction is also predicted due to rising emissions. The report underscores the linkage between increasing global temperatures, rainfall, and the heightened likelihood of glacial lake outburst floods (GLOFs) and landslides involving moraine-dammed lakes.

Several pivotal threats contribute to landslide occurrences in Uttarakhand:

- Rapid proliferation of dams
- Unmonitored construction activities
- Expansion of road networks
- Unplanned deforestation
- Multiple dam projects
- The Char Dham Pariyojana initiative
- The Rishikesh-Karnaprayag Railway Line Project

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Experts highlight the absence of thorough geological assessments regarding the vulnerability of the Uttarakhand Himalayas. Moreover, a lack of specialized expertise within governmental bodies has led to an unscientific approach during project implementation.

The 2015 Landslide Hazard Risk Assessment report by the State Disaster Management Authority conveys substantial information. Remarkably, about 90 percent of the state falls under a high-risk landslide zone. The report discloses that the Char Dham Project alone resulted in the loss of nearly 700 hectares of forests and the felling of over 47,000 trees. Understanding Himachal Pradesh's Scenario Similarly, landslides in Himachal Pradesh stem from several influential factors:

- Extensive deforestation
- Unsustainable slope cutting
- Tunnel construction
- River damming projects
- Excessive tourism impact
- Uncontrolled road widening

Dealing with these challenges demands a holistic strategy encompassing ecological preservation, rational infrastructure growth, and judicious resource management.

The hilly regions and the Himalayan area in India, including the Rudraprayag district, are confronted with significant challenges due to landslides during the rainy seasons. However, these landslide-prone areas suffer from inadequate availability of data and research. This study aims to address this gap by: (1) creating a multi-temporal map of landslides using geospatial tools, considering the limited data environment; (2) evaluating the susceptibility of landslides using the Weight of Evidence (WoE) technique within a Geographic Information System (GIS) at the district level; and (3) providing insights into recent progress, gaps, and future directions for landslide inventory, susceptibility mapping, and risk assessment in the context of India [6].

The region of Kurseong and its environs frequently grapples with landslides, leading to substantial loss of lives and property. Developing landslide susceptibility maps can significantly contribute to both human development and sustainable environmental management in the Darjeeling Himalayan region. This study aims to create robust landslide susceptibility models employing distinct statistical probabilistic methods: the Landslide Nominal Susceptibility Factor (LNSF), Information Value (InfoVal), and Certainty Factor (CF) models.

The research is centred on the Kurseong area, a subset of the Darjeeling Himalaya, and is based on extensive field surveys and satellite imagery from Google Pro. A comprehensive inventory map comprising 273 landslide sites was compiled, with 70% utilized for model training and the remaining 30% for validation. Seventeen factors influencing landslides were considered for the susceptibility models, including aspects like elevation, slope, rainfall, geological structure, and land use/land cover [7].

For this study, a manual digitization process was employed to map 293 landslide polygons from 2011 to 2013 using BHUVAN and Google Earth®. Fourteen factors influencing landslides, such as geology, soil type, and slope angle, were selected based on previous studies. The WoE method was then utilized to assign weights to the different classes of these causative factors, resulting in a landslide susceptibility map that was categorized into five levels. This map's accuracy was validated against randomly selected landslides, achieving a prediction accuracy of 85.7%, indicating the reliability of the model.

The findings reveal that areas with medium to very high susceptibility to landslides is primarily located in non-forest areas, including scrubland, pastureland, and barren land. Regions with high susceptibility are concentrated in the upper catchment areas of the Mandakini River and in proximity to National Highways 107 and 07. Additionally, steep slopes facing southeast, south, and west, as well as areas with high relative relief and shallow soil, exhibit elevated susceptibility. The outcome of this study, the landslide susceptibility map, holds practical significance for local government bodies. It can play a crucial role in mitigating landslide hazards, facilitating land use planning, and safeguarding landscapes.

A map indicating the susceptibility of landslides (LSZ) serves as a valuable tool to grasp the likelihood of slope failures within a particular area. This aids in implementing effective strategies for mitigating the hazards associated with landslides. The creation of such maps can be accomplished through qualitative or quantitative methodologies. This current study aims to apply a statistical technique known as binary logistic regression

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(BLR) analysis to produce an LSZ map for a specific section of the Garhwal Lesser Himalaya in India. This region is in proximity to the Main Boundary Thrust (MBT). The BLR approach permits the incorporation of both categorical and continuous predictor variables within the framework of a regression analysis. To assemble the necessary data on factors contributing to slope instability and past landslide occurrences, a Geographic Information System (GIS) is employed. This GIS is also instrumental in conducting the spatial modelling required for assessing landslide susceptibility.

The regression procedure employs a stepwise progression in combination with the maximum likelihood estimation method. This process retains relevant coefficients and constants of the predictor variables within the regression model. These retained components are then utilized to calculate the probability of slope failure across the entire area under study [8].

III. IOT SENSORS FOR SYSTEM

3.1 Soil Moisture Sensor

The soil moisture sensor consists of two components. Component number 1 is basically a two-legged lead, that goes into the soil, as you can see this component has two male headers which connect to the component number 2 which is an amplifier/ Analog to digital converter circuit.

Fig. 2 Soil moisture sensor

The amplifier circuit is connected with the Arduino using the 4 male headers. These 4 male headers are labelled with Vcc, Ground, D0, and A0. D is for the digital while A is for the analog. So, it means we can get values in both Digital and Analog. The digital output is in the form of 0 or 1which can be controlled using this potentiometer. This module has also two led's, one led is the power ON led, while the other led works with the digital output pin. When the moisture is below a certain value which is set using the potentiometer then led remains off. When there is moisture, this led turns ON. While the analog output can be any number between 0 and 1024. This value will entirely depend on the water content present in the soil. So now we can say that the soil moisture sensor has two modes.

3.2 Vibration Sensor

It is used for detecting soil vibration. This sensor has two contact pins, an external force is acted upon either by movement or vibration, the sensors' two-contact pins are closed and contact is made between the two pins. When the force is removed the sensor terminals return back to open contacts. It is commonly used in electronics toys, alarms, domestic appliances, electronic devices, etc.

Fig. 1 Vibration Sensor

SW-580PT is a suspended spring-type vibration sensor or switch. In the static condition, the switch is open and this is the default state. When the sensor experiences movement or vibration the switch closes shortly. This sensor does not measure the amplitude of the vibration, but can very easily detect the presence of vibration or movement of any kind in any direction.

3.3 Accelerometer

The accelerometer sensor (The ADXL335) is a small, thin, low-power, complete 3- axis accelerometer with signal conditioned voltage outputs. The product measures acceleration with a minimum full-scale range of ±3 g.

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It can measure the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration.

3.4 Pressure Sensor

Pressure sensors are used to measure the groundwater pressure in the soil, which is one of the factors that can affect the stability of slopes. By monitoring the pore pressure, the system can detect any abnormal changes that indicate a potential landslide risk.

Fig 4 Pressure Sensor

Some examples of landslide detection systems that use pressure sensors are:

A real-time landslide warning system that uses pore pressure transducers, geophones, and dielectric sensors to monitor the groundwater pressure, earth vibration, and soil moisture1. The system sends the data to a control centre using wireless sensor networks.

A landslide monitoring system that uses collaborative local data analysis to enable each node to decide locally whether its sensed data corresponds to a potential event of interest. The system uses pore pressure sensors, tilt angle sensors, and slope displacement sensors to monitor the landslide parameters.

3.5 Rain Sensor

Rain sensors play a crucial role in monitoring environmental conditions, particularly in the context of agriculture and weather forecasting. These sensors are equipped to detect the presence and intensity of rainfall, providing valuable data for irrigation systems, flood prediction, and climate studies.

Fig 3 Rain Sensor

Typically, a rain sensor consists of a set of conductive elements that react to the water droplets, allowing it to differentiate between wet and dry conditions. This information is then relayed to a microcontroller or data logger for further analysis. The data collected from rain sensors contributes to a comprehensive understanding of precipitation patterns, enabling more informed decision-making in various sectors.

3.6 Humidity Sensor

Humidity sensors, also known as hygrometers, measure the moisture content in the air. These sensors are essential for a wide range of applications, including climate control in buildings, industrial processes, and meteorological studies. The most common types of humidity sensors include capacitive, resistive, and thermal conductivity sensors. Capacitive humidity sensors, for instance, detect changes in electrical capacitance as humidity levels vary.

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Fig. 5 Humidity Sensor

This information is crucial for understanding the comfort levels of indoor spaces, optimizing manufacturing processes, and predicting weather patterns. Humidity sensors are integral components in creating environments conducive to human comfort and well-being.

3.7 Temperature Sensor

Temperature sensors are fundamental in monitoring thermal conditions, providing valuable data for climate control, industrial processes, and scientific research. These sensors come in various forms, such as thermocouples, thermistors, and infrared sensors. Thermocouples generate a voltage proportional to the temperature difference between two junctions, while thermistors change their resistance with temperature variations. Infrared sensors detect the infrared radiation emitted by an object, allowing for non-contact temperature measurements. Whether it's maintaining optimal working conditions in manufacturing or understanding global temperature trends, temperature sensors are indispensable tools for a wide range of applications.

Fig. 6 Temperature Sensor

3.8 Laser Scanner

Laser scanners, also known as LiDAR (Light Detection and Ranging) systems, have revolutionized the way we perceive and measure the environment. These devices emit laser beams and analyse the reflected light to create detailed 3D maps of landscapes, buildings, and objects. Laser scanners find applications in fields such as urban planning, archaeology, forestry, and autonomous vehicles. The precision and speed of LiDAR technology enable researchers and professionals to capture intricate details, making it an invaluable tool for monitoring topography, assessing structural integrity, and enhancing our understanding of spatial environments.

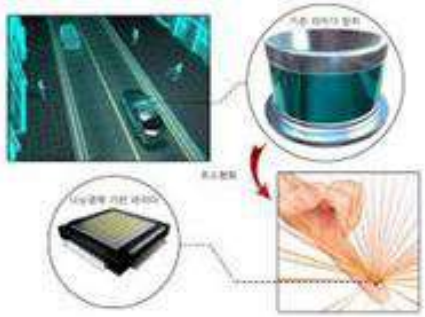

Fig. 7 Laser Scanner

3.9 GPS

Global Positioning System (GPS) technology has become an integral part of modern navigation and location-based services. Consisting of a network of satellites orbiting the Earth, GPS receivers determine precise geographical coordinates by triangulating signals from multiple satellites. Originally developed for military purposes, GPS has evolved into a ubiquitous technology used in smartphones, cars, and a variety of other

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devices. Beyond navigation, GPS plays a crucial role in surveying, agriculture, and disaster management. The ability to accurately pinpoint locations has transformed the way we navigate the world, making GPS a cornerstone of modern positioning and tracking systems.

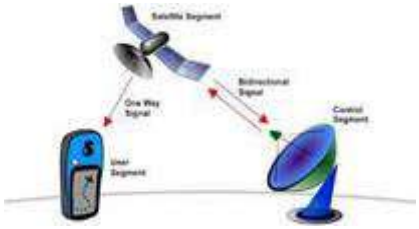

Fig. 8 GPS

3.10 Satellite

Satellites orbiting the Earth serve as essential tools for gathering a vast array of information crucial for scientific research, communication, weather monitoring, and navigation. Equipped with various sensors and instruments, satellites capture images, measure atmospheric conditions, and monitor changes in the Earth's surface. Optical and radar sensors on satellites provide high-resolution imagery, enabling detailed observations of land, oceans, and atmospheric phenomena. Additionally, satellites contribute to global positioning systems (GPS), facilitating accurate navigation and location-based services. Whether aiding in disaster response, environmental monitoring, or telecommunications, satellites play a pivotal role in our interconnected world.

Fig. 9 Satellite Vision

Sensors are managed using nodes to create chipsets at multiple locations, generating automated reviews of activity at specific coordinates. This information is propagated to devices in various forms like graphs and tables through machine learning algorithms. If a specific target is hit, an alert is issued, and satellite scanning is applied for large-scale implementation. This system analyses factors like moisture, environmental conditions, humidity, temperature, and pressure simultaneously on specific coordinates using GPS. A new laser scanner is used to scan the targeted area through the chipset, improving stability and accuracy. Additional sensors can report multiple conditions over a specific period at any scale, and multiple chipsets planted over the region state the problem over the area and state origin. The system generates various graphs, tables, and alerts using sensors, computing tools, and ML algorithms, and propagates it over a wide region like a country using satellite technology for more accuracy and detail.

IV. CONCLUSION

One can design the real time system for landslide detection. This system will develop by using multiple chipsets which is made by sensors. The main component used in this system is combination of Laser scanner, pressure scanner, moisture scanner, GPS with satellite and automated cloud centre. Additionally, we have attached sensors like temperature, accelerometer, rain sensor, flex sensor, humidity and vibration.

Sensors are managed using nodes to create chipsets at multiple locations, generating automated reviews of activity at specific coordinates. This information is propagated to devices through machine learning algorithms, and if a target is hit, an alert is issued. Satellite scanning is applied for large-scale implementation, analysing factors like moisture, environmental conditions, humidity, temperature, and pressure simultaneously on specific coordinates. A new laser scanner improves stability and accuracy. Additional sensors can report multiple conditions over a specific period, and multiple chipsets state the problem over the area and state origin. The system generates graphs, tables, and alerts using sensors, computing tools, and ML algorithms, propagating it over a wide region.

Data collected from sensors send to monitoring centre through monitoring host. If monitoring host detect any value above threshold value, then it sends to all over country and mark alert at systems and surrounding

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residents. Also, Data collected in monitoring host will be analysed through ML algorithms and shows various graphs, tables, and analytics of the region on various conditions. Special attention of the chipset is laser scanner and combination of other sensor and nodes which make it different than other present systems which directly affects resolution, coverage, usability, frequency of overall results which conclude early and accurate landslide detection.

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EFFECTIVE CLASSIFICATION OF CAR REVIEWS DATA USING WEKA CLASSIFIER META REGRESSION AND CLUSTERING

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ABSTRACT
The amount of data in the world and in our lives seems ever-increasing and there's no end to it. We are overwhelmed with data. The WWW overwhelms us with information. The Weka workbench is an organized collection of state-of-the-art machine learning algorithms and data pre-processing tools. The basic way of interacting with these methods is by invoking them from the command line. However, convenient interactive graphical user interfaces are provided for data exploration, for setting up large-scale experiments on distributed computing platforms, and for designing configurations for streamed data processing. Classification is an important data mining technique with broad applications. It classifies data of various kinds. This paper has been carried out to make a performance evaluation of Meta Regression & Clustering classification algorithm. The paper sets out to make comparative evaluation of classifiers Meta Regression & Clustering in the context of dataset of Car Reviews to maximize true positive rate and minimize false positive rate. For processing Weka API were used.

Keywords: Classification, Clustering, Regression, Weka, WWW

I. INTRODUCTION

The amount of data in the world and in our lives seems ever-increasing and there's no end to it. We are overwhelmed with data. Today Computers make it too easy to save things. Inexpensive disks and online storage make it too easy to postpone decisions about what to do with all this stuff, we simply get more memory and keep it all. The World Wide Web (WWW) overwhelms us with information; meanwhile, every choice we make is recorded. As the volume of data increases, inexorably, the proportion of it that people understand decreases alarmingly. Lying hidden in all this data is information. In *data mining*, the data is stored electronically and the search is automated or at least augmented by computer. What is new is the staggering increase in opportunities for finding patterns in data.

Data mining is a topic that involves learning in a practical, non theoretical sense. We are interested in techniques for finding and describing structural patterns in data, as a tool for helping to explain that data and make predictions from it. Experience shows that in many applications of machine learning to data mining, the explicit knowledge structures that are acquired, the structural descriptions, are at least as important as the ability to perform well on new examples. People frequently use data mining to gain knowledge, not just predictions.

II. LITERATURE SURVEY

A. WEKA

Weka was developed at the University of Waikato in New Zealand; the name stands for Waikato Environment for Knowledge Analysis The system is written in Java and distributed under the terms of the GNU General Public License. It runs on almost any platform and has been tested under Linux, Windows, and Macintosh operating systems and even on a personal digital assistant. It provides a uniform interface to many different learning algorithms, along with methods for pre and post processing and for evaluating the result of learning schemes on any given dataset. Weka provides implementations of learning algorithms that can be easily apply to dataset. It also includes a variety of tools for transforming datasets, such as the algorithms.

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Fig. 1: Weka GUI Explorer

Weka provides extensive support for the whole process of experimental data mining, including preparing the input data, evaluating learning schemes statistically, and visualizing the input data and the result of learning. As well as a variety of learning algorithms, it includes a wide range of pre processing tools. This diverse and comprehensive toolkit is accessed through a common interface so that its users can compare different methods and identify those that are most appropriate for the problem at hand. All algorithms take their input in the form of a single relational table in the ARFF format. The easiest way to use Weka is through a graphical user interface called Explorer as shown in Figure 1. This gives access to all of its facilities using menu selection and form filling.

Weka supports several standard data mining tasks, more specifically, data pre-processing, clustering, classification, regression, visualization, and feature selection. All of Weka's techniques are predicated on the assumption that the data is available as a single flat file or relation, where each data point is described by a fixed number of attributes (normally, numeric or nominal attributes, but some other attribute types are also supported). Weka provides access to SQL databases using Java Database Connectivity and can process the result returned by a database query. Weka's main user interface is the Explorer, but essentially the same functionality can be accessed through the component-based Knowledge Flow interface and from the command line. There is also the Experimenter, which allows the systematic comparison of the predictive performance of Weka's machine learning algorithms on a collection of datasets.

III. CLASSIFICATION

Classification may refer to categorization, the process in which ideas and objects are recognized, differentiated, and understood. An algorithm that implements classification, especially in a concrete implementation, is known as a classifier. In the terminology of machine learning, classification is considered an instance of supervised learning, i.e. learning where a training set of correctly identified observations is available. The corresponding unsupervised procedure is known as clustering or cluster analysis, and involves grouping data into categories based on some measure of inherent similarity. [1].

A. Regression

Classification Via Regression performs classification using a regression method by binarizing the class and building a regression model for each value. This is binarized and one regression model is built for each class value. Regression attempts to locate a function which duplicates the data with the smallest amount of error. Regression approaches are applied for classification under this classifier. Single regression model is constructed for every single value of the class. Regression analysis is commonly used for the prediction. Regression is the easiest technique to use, but is also probably the least. This model can be as easy as one input variable and one output variable. Of course, it can get more complex than that, including dozens of input variables. In effect, regression models all fit the same general pattern. There are a number of independent variables, which, when taken together, produce a result into a dependent variable. The regression model is then used to predict the result of an unknown dependent variable, given the values of the independent variables. [1], [3], [4], [5].

B. Clustering

Classification Via Clustering performs classification using a clustering algorithm; the majority class in each cluster is used for making predictions. Clustering belongs to a group of techniques of unsupervised learning. It enables grouping instances into groups. These groups are called clusters. As the result of clustering each instance is being added a new attribute to the cluster to which it belongs. The clustering is said to be successful

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if the final clusters make sense, if they could be given meaningful names. Clustering allows a user to make groups of data to determine patterns from the data. Clustering has its advantages when the data set is defined and a general pattern needs to be determined from the data. It can quickly take entire set of data and turn it into groups, from which one can quickly make some conclusions. Clustering is grouping of objects to find out whether there is some relationship existing between the objects. It is a task through which data should be explored and used for statistical data analysis; this data can be used in various applications like machine learning, pattern recognition, and information retrieval. Clustering is the process of grouping similar elements. This technique may be used as a pre processing step before feeding the data to the classifying model. The attribute values need to be normalized before clustering to avoid high value attributes dominating the low value attributes. Different clustering methods generate various types of clusters on same dataset. The partitioning is not performed by human, but by clustering algorithms.

Clustering is a technique used in data mining which is used to set data elements into their interrelated groups with no advancement of knowledge regarding grouping of definitions. It is not a particular algorithm but a common task is being solved. The relevant algorithm of clustering and the parameters which are used rely on the particular data set and expected results are used. It is not a regular task but a repetitive method of knowledge discovery which is used to share multiple objects involving test and inadequacy. [1], [5], [6], [7], [8], [9].

IV. SYSTEM DESIGN

As an input to the model, various quality car reviews are considered which are available online from Cardekho.com, Carwale.com and other etc. Around 606 car reviews were collected on above repository. The car reviews then manually separated into 5 categories GOOD, BETTER, BEST, BAD, NA (not applicable) In order to extract context from the car reviews, the car reviews was process with stop word removal, stemming and tokenization on the car reviews contents and then converted into the term frequency matrix for further analysis purpose. Flow diagram of the prapose model is shown on Figure 2. Due to classification in above 5 categories we are also able to find the GOOD, BETTER, BEST, BAD, NA count on every data set which help for market analysis, product rating and much more purposes. Based on this data, features (i.e. metadata) were extracted so that contextual assignment of the car reviews to the appropriate content can be done.

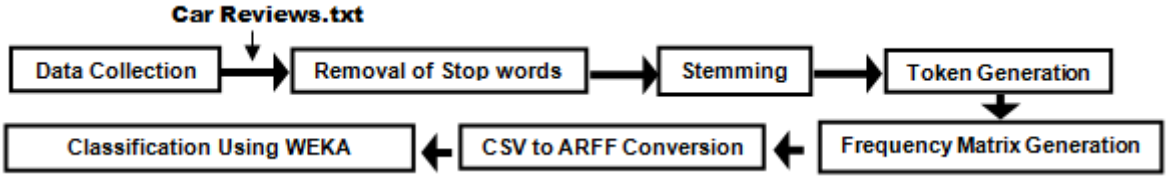

Fig. 2: Flow diagram of the model

V. DATA COLLECTION

Table 1: Car data set Classification.

Sr.No	Car Companies	Numbers of reviews
1	Chevrolet	38
2	Fiat	27
3	Ford	36
4	Honda	47
5	Hyundai	59
6	Mahindra R Mahindra	63
7	Maruti Suzuki	95
8	Renault	53
9	Skoda	23
10	Tata Motors	90
11	Toyota	41
12	Volkswagan	34
	Total	**606**

Hence it was proposed to generate car reviews data. Consequently the national and international resources were used for the research purpose. Data for the purpose of research has been collected from the various online resources .They are downloaded and after reading the car reviews they are manually classified into 12 (Twelve) categories. There were 606 car reviews in total. The details are as shown in the table. The attributes consider for this classification is based on GOOD, BETTER, BEST, BAD, NA count each classification having

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their own data dictionary and based on this they are classified, the review are made by expert and user. Hence, there will be drastic enhancement in e-Contents when we refer to the latest material available in this regards.[10]

VI. PERFORMANCE INVESTIGATION

The car reviews so collected needed a processing. Hence as given in the design phase, all the review were processed for stop word removal, stemming, tokenization and ultimately generated the frequency matrix based on GOOD, BETTER, BEST, BAD, NA count. Stemming is used as many times when review is printed, for a same there can be many variants depending on the tense used or whether it is singular or plural. Such words when processed for stemming, generates a unique word. Stop words needs to be removed as they do not contribute much in the decision making process. Frequency matrix thus generated can be processed for generating a model and the model so generated was used in further decision process. With the model discussed above, two Meta classifier Regression and Clustering were used on the data set of 606 car reviews. For processing WEKA APIs were used. The result after processing is given in following tables shows Confusion Matrixes & figures for true positive rate and false positive rate. The 1.0 represent the best, whereas the worst is 0.0**.**

Table 2: Confusion Matrix for Regression for Test Mode: Use Training Set

Classified as ➡	Good	Better	Best	Bad	NA
Good	70	0	0	2	0
Better	0	39	1	3	0
Best	0	0	63	0	0
Bad	0	0	0	400	0
NA	0	0	0	1	27

Table 3: Tp and FP Rate of Regression for Test Mode: Use Training Set

Class ⬇	TP Rate	FP Rate	Precision	Recall
Good	0.972	0	1	0.972
Better	0.907	0	1	0.907
Best	1	0.002	0.984	1
Bad	1	0.029	0.985	1
NA	0.964	0	1	0.964
Weighted Avg. ➡	0.988	0.019	0.989	0.988

Table 4: Confusion Matrix for Regression for Test Mode: 10-Fold Cross-Validation

Classified as ➡	Good	Better	Best	Bad	NA
Good	70	0	0	2	0
Better	0	37	2	4	0
Best	0	0	62	1	0
Bad	0	1	1	398	0
NA	0	0	0	1	27

Table 5: Tp and FP Rate of Regression for Test Mode: 10-Fold Cross-Validation

Class ⬇	TP Rate	FP Rate	Precision	Recall
Good	0.972	0	1	0.972
Better	0.86	0.002	0.974	0.86
Best	0.984	0.006	0.954	0.984
Bad	0.995	0.039	0.98	0.995
NA	0.964	0	1	0.964
Weighted Avg. ➡	0.98	0.026	0.98	0.98

Table 6: Confusion Matrix for Clustering for Test Mode: Use Training Set

Classified as ➡	Good	Better	Best	Bad	NA
Good	15	0	0	57	0
Better	16	0	0	27	0
Best	21	0	0	42	0
Bad	117	0	0	283	0
NA	0	0	0	28	0

Table 7: TP and FP Rate of Clustering for Test Mode: Use Training Set

Class ⬇	TP Rate	FP Rate	Precision	Recall
Good	0.208	0.288	0.089	0.208
Better	0	0	0	0
Best	0	0	0	0
Bad	0.708	0.748	0.648	0.708
NA	0	0	0	0
Weighted Avg. ➡	0.492	0.528	0.438	0.492

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Table 8: Confusion Matrix for Clustering for Test Mode: 10-Fold Cross-Validation

Classified as ➡	Good	Better	Best	Bad	NA
Good	2	2	10	58	0
Better	0	1	13	29	0
Best	0	5	12	46	0
Bad	11	22	75	292	0
NA	0	0	0	28	0

Table 9: TP and FP Rate of Clustering for Test Mode: 10-Fold Cross-Validation

Class ⬇	TP Rate	FP Rate	Precision	Recall
Good	0.028	0.021	0.154	0.028
Better	0.023	0.052	0.033	0.023
Best	0.19	0.18	0.109	0.19
Bad	0.73	0.782	0.645	0.73
NA	0	0	0	0
Weighted Avg. ➡	0.507	0.541	0.457	0.507

Table 10: Summary of Classification

Classifier	**Regression**		**Clustering**	
Test Mode	Use Training Set	10-fold cross-validation	Use Training Set	10-fold cross-validation
Correctly Classified Instances	599 (99 %)	594 (98%)	298 (49%)	307 (51%)
Incorrectly Classified Instances	7 (1%)	12 (2%)	308 (51%)	299 (49%)

VII. CONCLUSION

In this paper as per the previous performance analysis, Table 10 Summary of Classification shows that the Classifier Regression has the accuracy for test mode evaluate on training data is 99% & for 10-Fold Cross validation is: 98% and the Classifier Clustering has accuracy for test mode evaluate on training data is 49% & for 10-Fold Cross validation is 51%. Hence Regression is good classifier as compare to Clustering classifier for test mode evaluate on training data.

For 10-Fold Cross validation in Regression Classifier the accuracy decreases. The reason for this is that, in 10-fold cross-validation, the original sample is randomly partitioned into 10 subsamples. Of the 10 subsamples, a single subsample is retained as the validation data for testing the model, and the remaining 10 – 1 (i.e. 9) sub samples are used as training data. The cross-validation process is then repeated 10 times (the folds), with each of the 10 subsamples used exactly once as the validation data. The 10 results from the folds then can be averaged (or otherwise combined) to produce a single estimation whereas this not true for Clustering Classifier. **From all the above result in the Table 2 to Table 9, it is observed that performance of Classifier Regression is Excellent as compared to Classifier Clustering.**

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A SURVEY ON CROPS DISEASE PREDICTION USING MACHINE LEARNING AND DEEP LEARNING

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ABSTRACT
The crucial role of plants in climate, agriculture, and economies underscores the importance of their care. Similar to humans, plants are susceptible to diseases caused by bacteria, fungi, and viruses. Timely identification and treatment of these diseases are vital to prevent widespread destruction. This paper proposes a deep learning model for plant disease detection, aiming to accurately identify diseases in crops at an early stage. Early detection is essential for maintaining crop quality and yield by enabling appropriate treatments.However, disease detection requires specialized knowledge in plant pathology. The developed model utilizes neural networks, incorporating augmentation to expand the dataset. A Convolutional Neural Network (CNN) with multiple convolution and pooling layers is employed, trained on the PlantVillage dataset. Subsequently, the model undergoes rigorous testing, using 15% of the PlantVillage data, including images of healthy and diseased plants. The proposed model achieves a testing accuracy of 98.3%.In conclusion, this study focuses on a deep learning model for plant disease detection using leaves' images. Future integration with drones or other systems could enable real-time disease detection, reporting the location of diseased plants for prompt intervention.

Keywords: Deep Learning, Convolutional Neural Network, VGG, Resnet, PlantVillage, Crop disease.

I. INTRODUCTION
Crop identification is a crucial aspect of modern agriculture, optimizing resource allocation and estimating yields. With the global population on the rise, the demand for agricultural products is increasing rapidly. A vast amount of data is generated across various agricultural fields. Analyzing this data aids in predicting crop yield, assessing soil quality, anticipating plant diseases, and understanding how meteorological factors impact productivity. Effective crop protection is essential to sustain agricultural output. Pathogens, pests, weeds, and animals contribute to productivity losses. Crop diseases, stemming from pests, insects, and pathogens, can significantly reduce yields if not promptly addressed. Farmers incur financial losses due to these diseases. This paper presents a survey of diverse machine learning techniques employed for plant disease prediction. Automatic disease detection in plants facilitates early diagnosis and prevention, ultimately enhancing agricultural productivity.

II. LITERATURE REVIEW
A. Ip et al. (2018) conducted a comprehensive review on crop protection through the utilization of big data, emphasizing its role in weed control. The study delved into topics such as invasive species detection, forecasting and modelling herbicide resistance, support systems for crop protection, and robotic weed control. The paper also elucidated the machine learning methodologies employed to address these challenges.

B. Ebrahimi et al. (2017) introduced a method for detecting thrips (Thysanoptera) in crop canopies, specifically targeting identification within strawberry plants using Support Vector Machine (SVM) classification based on canopy images. The approach incorporates various kernel functions in SVM for parasite classification and Thysanoptera detection. Evaluation metrics including MAE, RMSE, MPE, and MSE were employed, revealing an error rate below 2.25% when utilizing color index and region index for classification. The removal of image backgrounds was achieved using MATLAB R2010a as part of the image processing technique.

C. Iqbal et al. (2018) focus on citrus plant diseases and their classification, detailing techniques for segmentation, feature extraction, feature selection, image processing, and classification. The research delves into automated tools for detection and classification, addressing diseases such as canker, black spot, citrus scab, melanose, and greening. In comparison with existing surveys, the K-mean algorithm is employed for disease extraction at different stages of analysis. For color feature computation and classification, Back Propagation Neural Network (BPNN) and Grey Level Co-Occurrences Matrix (GLCM) are utilized. The article covers techniques for preprocessing, including color-based transformation, image enhancement, noise reduction, resizing, and segmentation. Various feature extraction methods based on texture, color, and shape

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are discussed. The study also provides a summary of different classifier techniques and their applications, emphasizing that segmentation accuracy is enhanced through pre-processing techniques.

Algorithms. The integration of machine learning algorithms, including but not limited to support vector machines, decision trees, and deep learning models, allows for automated disease classification based on learned patterns from labelled datasets. Kulkarni et al.'s work likely builds upon existing literature, acknowledging the significance of datasets like Plant Village and leveraging techniques like transfer learning for enhanced model performance. As with many studies in this domain, challenges related to dataset diversity, model generalization to real-world conditions, and interpretability are prevalent. Future research directions may involve refining the synergy between image processing and machine learning, optimizing model architectures, and addressing the scalability of these approaches for large-scale agricultural applications. The study by Kulkarni et al. contributes to the growing body of literature, emphasizing the potential of image processing and machine learning for effective and automated plant disease detection in agricultural settings.

III. Image Analysis for Disease Detection in Plant

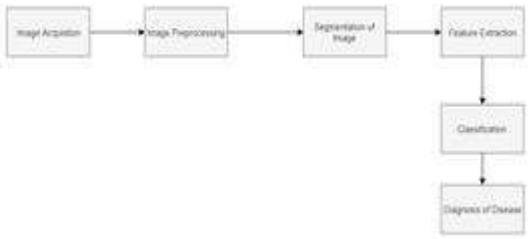

Fig. 1: General workflow of plant disease prediction model

The initial phase in image analysis is the image acquisition process, also referred to as digital image acquisition. This involves representing the visual character of an object through digital encoding, typically achieved by capturing an image using a camera. In contemporary times, digital imaging has extended to mobile phones, enhancing user-friendliness. The media utilized for image acquisition include photographs, printed paper, and photographic film, primarily capturing visual moments.In image preprocessing, two distinct types exist: digital image processing and analog image processing. The primary objective is the removal of unwanted features from the image, a process requiring various algorithms. The key steps in image preprocessing involve Image Acquisition, Image Normalization, Image Enhancement, Segmentation, and Morphology. Image segmentation, as highlighted by Oliver et al. (2018), entails separating an image into pixels and their similar attributes, aiding the image interpretation process. This transformation elevates the image from a low-level to a high-level representation, with the success of image analysis heavily reliant on the reliability of the segmentation process. Both contextual and non-contextual segmentation processes are employed, utilizing several algorithms.

Feature selection involves preserving a copy of the original features. In the subsequent feature extraction process, new feature sets are generated, focusing on eliminating unwanted noise and selecting necessary features for image analysis. This process includes the transformation of attributes, enhancing the speed and effectiveness of the overall procedure.The classification process categorizes data into multiple classes. In cases of new observations, determining their class assignment is crucial. Ferentinos is mentioned in relation to classification, but additional context is needed. Numerous classification algorithms are available, ensuring accurate classification results in this stage of image analysis.

Deficiencies. Each image is meticulously labelled with corresponding disease types, providing a comprehensive ground truth for the model. The dataset covers a wide range of crops, facilitating the creation of a robust and versatile predictive model capable of identifying and classifying different crop diseases accurately.by incorporating the PlantVillage dataset into our model development process, we ensure that the predictive capabilities of our model are well-informed and accurate, contributing to more effective crop management and disease mitigation strategies in agriculture.

IV. METHODOLOGY

A. CNN

The Convolutional Neural Network (CNN) is a specialized deep neural network designed for image recognition and classification. It processes data by scanning crop images from left to right and top to bottom, extracting

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pertinent features. These images, captured via cameras, drones, or other devices, serve as input. The CNN performs various operations through layers such as Convolutional, Pooling, and Fully Connected. The Convolutional layer generates an activation map by filtering the images pixel by pixel. The Pooling layer then reduces data size for more efficient storage. Lastly, the Fully Connected layer flattens the output from preceding layers into a single vector for the next stage.

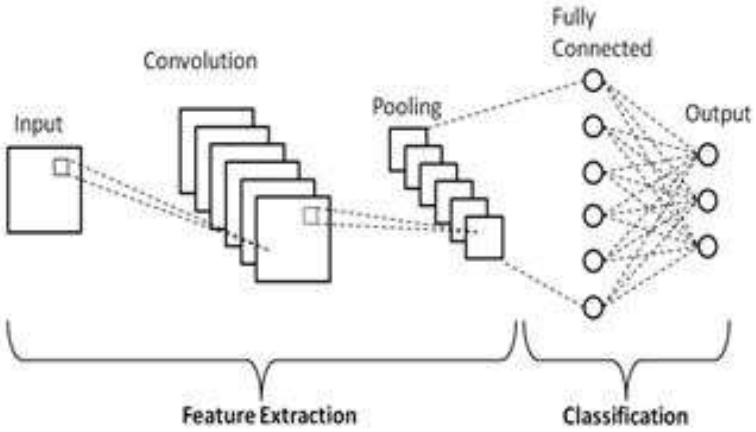

Fig. 2: Convolutional Neural Network

B. VGG

VGG, a deep convolutional neural network architecture, originated from the Visual Geometry Group at the University of Oxford. Recognized for its simplicity and effectiveness in image classification, it includes variants like VGG 16 and VGG 19. Although newer architectures like ResNet and Inception have surpassed VGG in efficiency, it remains a crucial reference in deep learning.

VGG 16 comprises 13 convolutional layers grouped into 5 blocks, each using 3x3 filters, a stride of 1, and padding of 1. Rectified Linear Unit (ReLU) activation functions follow each convolutional layer for non-linearity. After each block, a max-pooling layer with a 2x2 window and a stride of 2 reduces spatial dimensions. Fully connected layers also employ ReLU activation, and the final layer, with neurons equal to task classes, uses softmax to convert scores into class probabilities. The input image for VGG 16 is fixed at 224x224 pixels.

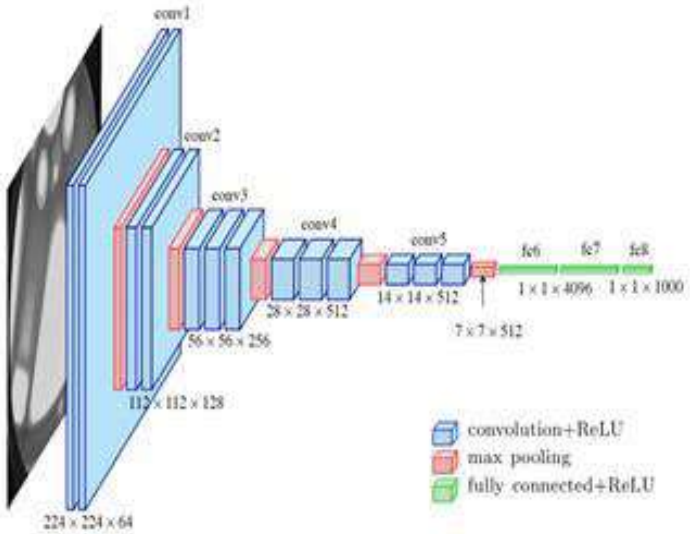

Fig. 3 VGG

C. RESNET

ResNet, short for "Residual Network," revolutionized computer vision and deep CNNs by addressing the challenge of vanishing/exploding gradients. It excels in tasks like image classification, object detection, and image segmentation. The key innovation is the introduction of Residual Blocks, utilizing skip connections in CNNs. Instead of a layer learning the complete mapping, ResNet allows the network to fit the residual mapping. This is expressed as \(H(x) = F(x) + x\), where \(F(x)\) represents the residual. Skip connections mitigate performance issues in individual layers, enabling successful training of very deep neural networks.

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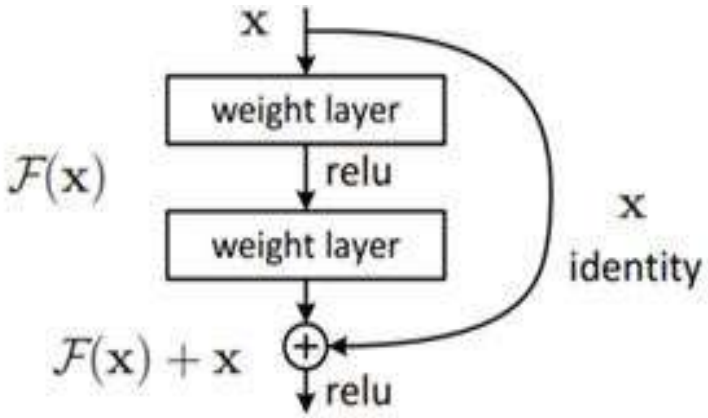

Fig. 4 RESNET

V. Dataset Discription

The investigation utilized plant leaf images sourced from the PlantVillage42 database, encompassing 8121 images of healthy bell pepper, potato, and tomato leaves. For disease detection, 31,061 images of diseased leaves were collected, covering bacterial spot in bell peppers, early blight caused by Alternaria tomatophila and Alternaria solani, late blight caused by Phytophthora infestans in potatoes or tomatoes, as well as bacterial spot and tomato mosaic virus in tomatoes (refer to Supplementary Table S7). In the case of tomatoes, four diseases were specifically chosen from a pool of nine to ensure accurate detection of common diseases across crops and identification of threats to farms.

Algorithm 1. Stepwise Disease Detection Model

Input: Healthy and diseased leaves of bell pepper, potato, and tomato

Output: Classified images as species and disease types of leaf

START:

1. Resize the image to 224 pixels
2. Split the data into 80% training set and 20% test set
3. 18 times data augmentation by rotating 20 degrees of training data

#Step1 : Crop Classification

4. Start training of five pre-trained CNN models using 80% of training set
5. Perform validation and tune hyperparameter
6. Classification kinds of sample through an activation function, Softmax
7. Determine optimal model with high validation accuracy
8. Test with data not used to train the model

9. #Step2 : Disease Detection
10. Start training of five pre-trained CNN models using 80% of each crop's training set
11. Perform validation and tune hyperparameter
12. Determine sample as healthy or diseased through an activation function, Softmax
13. Determine optimal model with high validation accuracy
14. Test with data not used to train the model

#Step3 : Disease Classification

15. Start training of five pre-trained CNN models using 80% of training set of each crop's disease images
16. Perform validation and tune hyperparameter
17. Classification kinds of disease through an activation function, Softmax
18. Determine optimal model with high validation accuracy
19. Test with data not used to train the model

END

Fig. 5 Stepwise disaease detection algorithm

The stepwise evaluation of the plant disease detection model involved using diseased image data from diverse crops to achieve a level of development suitable for smart farming. The evaluation encompassed apple, cherry, corn, grape, peach, and strawberry crops, ensuring a comprehensive assessment of the model's effectiveness across different plant types.

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Table- I (a): Dataset Description

Class	Plant Name	Healthy or Diseased	Disease Name	Images (Number)
C_0	Apple	Diseased	Apple_scab	2016
C_1	Apple	Diseased	Black_rot	1987
C_2	Apple	Diseased	Cedar_apple_rust	1760
C_3	Apple	Healthy	-	2008
C_4	Blueberry	Diseased	-	1808
C_5	Cherry_(including_sour)	Diseased	Powdery_mildew	1683
C_6	Cherry_(including_sour)	Healthy	-	1826
C_7	Corn_(maize)	Diseased	Cercospora_leaf_spotGray_leaf_spot	1642
C_8	Corn_(maize)	Diseased	Common_rust	1907
C_9	Corn_(maize)	Diseased	Northern_Leaf_Blight	1908
C_10	Corn_(maize)	Healthy	-	1859
C_11	Grape	Diseased	Black_rot	1888
C_12	Grape	Diseased	Esca_(Black_Measles)	1920
C_13	Grape	Diseased	Leaf_blight (Isariopsis_Leaf_Spot)	1722
C_14	Grape	Healthy	-	1692
C_15	Orange	Diseased	Haunglongbing (Citrus_greening)	2010
C_16	Peach	Diseased	Bacterial_spot	1838
C_17	Peach	Healthy	-	1728
C_18	Pepper_bell	Diseased	Bacterial_spot	1913
C_19	Pepper_bell	Healthy	-	1988
C_20	Potato	Diseased	Early_blight	1939
C_21	Potato	Diseased	Late_blight	1939
C_22	Potato	Healthy	-	1824
C_23	Raspberry	Healthy	-	1781
C_24	Soybean	Healthy	-	2022
C_25	Squash	Diseased	Powdery_mildew	1736
C_26	Strawberry	Diseased	Leaf_scorch	1774
C_27	Strawberry	Healthy	-	1824
C_28	Tomato	Diseased	Bacterial_spot	1702

Utilizing this table provides insights into the quantity of images within each class, with approximately 2000 images per class. The dataset encompasses fourteen distinct plants, featuring both healthy and diseased leaf images for every plant. Predominantly, the dataset is rich in images of Tomato and Apple plants, while Raspberry,

Table- I (b): Dataset Description

Class	Plant Name	Healthy or Diseased	Disease Name	Images (Number)
C_29	Tomato	Diseased	Early_blight	1920
C_30	Tomato	Diseased	Late_blight	1851
C_31	Tomato	Diseased	Leaf_Mold	1882
C_32	Tomato	Diseased	Septoria_leaf_spot	1745
C_33	Tomato	Diseased	Spider_mites Two-spotted_spider_mite	1741
C_34	Tomato	Diseased	Target_Spot	1827
C_35	Tomato	Diseased	Tomato_Yellow_Leaf_Curl_Virus	1961
C_36	Tomato	Diseased	Tomato_mosaic_virus	1790
C_37	Tomato	Healthy	-	1926
Total				**70295**

Soybean, and Squash classes exhibit fewer images in comparison.

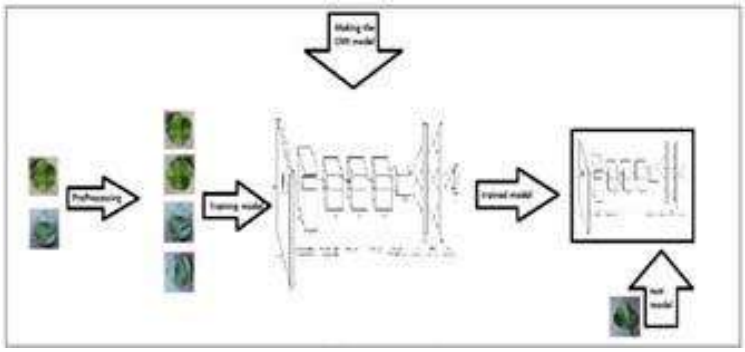

Fig. 6: Applied Methodologies

VI. DISCUSSION

This research underscores the significance of plant disease detection in contemporary times. The Deep Learning model, implemented in Python, underwent testing using 20% (14,059) images from the PlantVillage dataset, spanning 38 distinct classes. The test set comprised a random 20% selection from each class. Additionally, real-time images from the local environment, unrelated to the dataset's classes, were included. Despite challenges such as nighttime captures with flash and images with dirt, the model achieved over 95% accuracy, correctly classifying 96 out of 100 total images.

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VII. CONCLUSION

This research employs deep learning techniques to establish an automated plant disease detection system. The system relies on a straightforward classification mechanism, leveraging CNN's feature extraction capabilities. For predictions, fully connected layers are employed. The study utilized a publicly available dataset comprising 70,295 images, with an additional 100 images from experimental conditions and the actual environment. The system demonstrated an impressive 98% testing accuracy on the publicly accessible dataset and performed well on images of plants from Sukkur IBA University. The conclusion drawn is that CNN is highly suitable for the automatic detection and diagnosis of plant diseases. The envisaged integration of this system into mini-drones for real-time disease detection in cultivated areas holds promise. Despite being trained on the Plant Village dataset with only 38 classes, the system can effectively identify whether a plant is diseased, as symptoms tend to be similar across different plant types. To enhance accuracy on real-condition images, future improvements could involve adding more actual environment images to the dataset, enabling the classification of additional plant and disease types. A proposed three-layer approach for the future involves the first layer detecting the presence of any plant in an image, the second layer determining the plant type, and the third layer identifying and classifying any diseases present.

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FOOD ORDERING SYSTEM,"TASTYGO"-THE APPLICATION

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ABSTRACT
Our proposed approach is an online food ordering system that enables ease for the customers. From the comfort of customers smartphone, you can effortlessly browse through menus, personalize your orders, and seamlessly transact, all while anticipating the feast that awaits you and efficient spectrum stands the administrator, entrusted with the responsibility to curate, manage, and orchestrate the platforms symphony. the system can help Restaurants to increase their revenue by reducing manual errors, optimizing pricing, and maximizing quantity management. Food Ordering System is essential for modern-day Restaurants. They streamline the process of food ordering, improve the customer experience, and increase the efficiency and revenue of the Restaurant operations. we develop food ordering system for the Android as well as web platform capable of ordering, monitoring, and displaying data relevant to a user's order history, cart, and delivery status. The system offers several advantages to customers. In home page customers see discounts as well as offers.

Keywords: Food Ordering System, Dynamic Database Management, Smart Phone.

I. INTRODUCTION

Welcome to a quick journey that combines convenience and flavor in a seamless connectivity. Embark on a pleasing adventure like no other, as we unveil our cutting-edge Food Ordering System - "Tasty Go", meticulously crafted to cater to your cravings with utmost elegance. Whether you're a consumer of exotic tastes or someone seeking comfort in familiar flavors, our Android and web platforms stand ready to redefine your dining experience. With the tap of a finger on your Android device, or a click on your computer's browser, culinary delight is now at your command. Envisioned to cater to both the digital-savvy user and the visionary administrator, our system is ingeniously dual-faceted. From the comfort of your smartphone, you can effortlessly browse through menus, personalize your orders, and seamlessly transact, all while anticipating the feast that awaits you.[1]

On the other end of this efficient spectrum stands the administrator, entrusted with the responsibility to curate, manage, and orchestrate the platforms symphony. For the administrator, our web platform, built upon the robust foundation of React, offers an interface that is not only functional but also aesthetically pleasing. With the might of Node.js at the backend, the administrator's journey becomes one of control, insight, and fine-tuning. To be precise, the user surfs through the precision, sculpted by the admin.

Additionally, the system can help Restaurants to increase their revenue by reducing manual errors, optimizing pricing, and maximizing quantity management. Food Ordering System is essential for modern-day Restaurants. They streamline the process of food ordering, improve the customer experience, and increase the efficiency and revenue of the Restaurant operations.

Come, join us at the crossroads of flavor and functionality. Your next culinary delight is but a click away, as our Android and web platforms unite to redefine the way you order and experience food.

The proposed system will provide the flexibility to the Customers/Users to order from restaurants. It will also provide Recommendations to the customers from the restaurant's owners uploaded on a daily basis. Also, same application can be used as a Startup Business for the developers. It will provide real time customers feedback and ratings along with the comments to the restaurant's owner. It gives appropriate feedbacks to users, so if there is any error happened, then there will be a feedback dialog toward users.[1]

II. LITERATURE REVIEW

Various case studies have highlighted the problems faced while setting up a restaurant. [2 – 6]. Some of the problems found during the survey in the existing system are listed below:

- To place the orders customer visits the restaurant, checks the menu items available in the restaurant, and chooses the items required, then places the order and then do the payment. This method demands manual work and time on the part of the customer.
- When the customer wants to order over the phone, customer is unable to see the physical copy of the menu available in the restaurant, this also lacks the verification that the order was placed for the appropriate menu items.

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- Every restaurant needs someone or the other to take Revised Manuscript Received on July 10, 2019 [2].

III. REQUIREMENT ANALYSIS

Functional Requirements

- The system supports customers orders and ability to modify them
- Customers can search based on Restaurant by name, Dish - type.
- When a customer searches for Restaurants or Dishes wise Restaurant, the search result must contain Restaurants or Dish information (Name, Type, and Price) and also the ability to be one click away from browsing the dishes of the same Restaurant.
- Customers able to change quantity of a dish using buttons or picker.
- Admin able to edit Restaurant information as well as delete a Restaurant.
- The system must be properly integrated on the frontend, backend as well as database side.
- Customers can edit their personal information.
- Customers able to check their cart, delete from the cart as well as order history from their accounts.
- Customers get shown entire order details before payment.

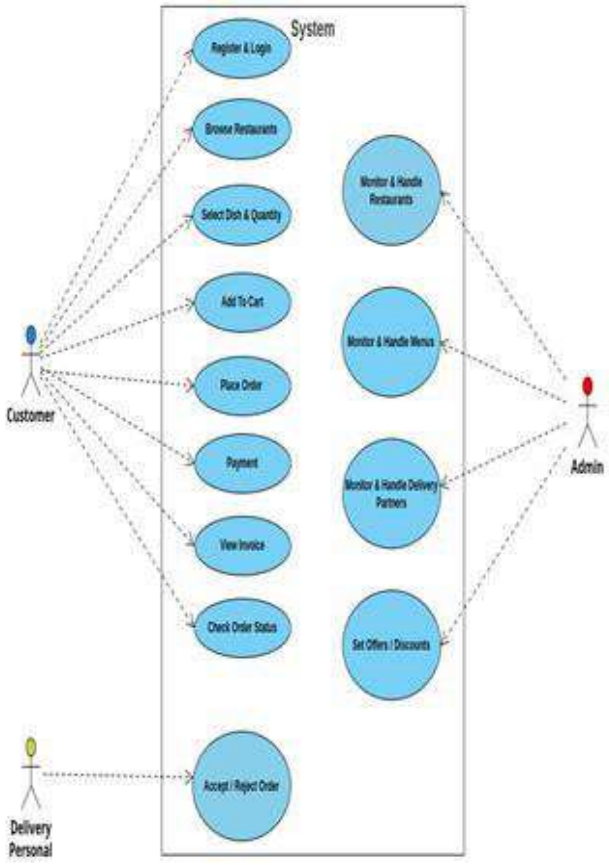
Non-Functional Requirements

The system must provide customers 24*7 hours online ordering service.

IV. IMPLEMENTATION

Use Case Diagram

It is also called behavioural UML diagram. It gives a graphic over-view of the actors involved in a system directly. It shows how different functions needed by the actors how they are interacted. Below is the **"USE CASE DIAGRAM"** of our new proposed system.



System implementation is the most important steps in case of finalizing the approved web system. We need to justify some basic requirement (software & hardware) so that the system will work without having obligation and customers dissatisfactions.

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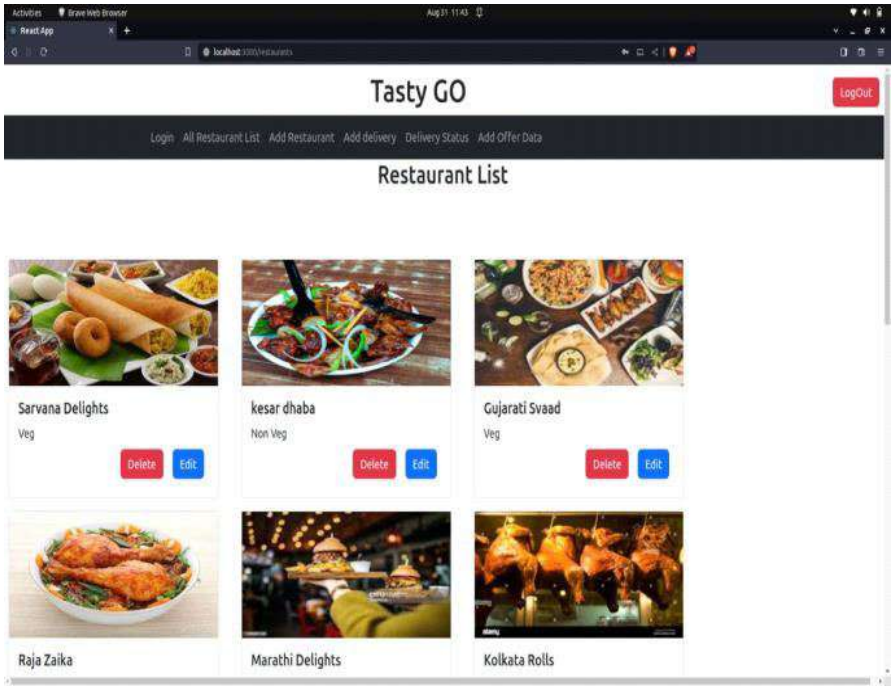
Software Requirement:
Web Browser: Google Chrome, Mozilla Firefox. Database Management System: MySQL, Workbench Backend: NodeJS Web app frontend: ReactJS

Android Application: Android studio.

Web Application Design

Admin Login

Admin can monitor all Restaurants as well as Dishes



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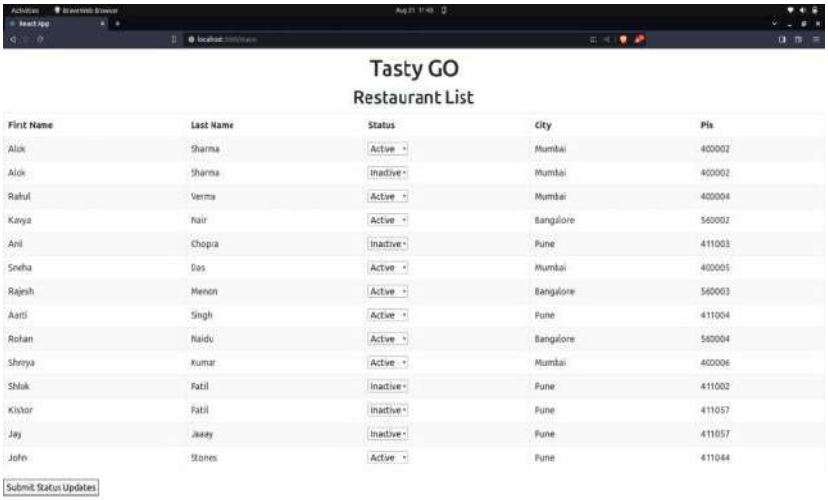
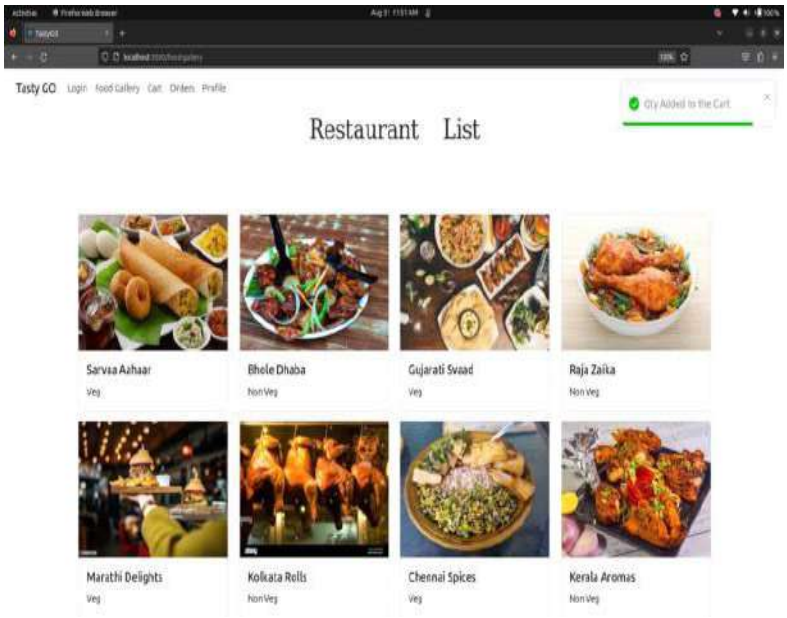
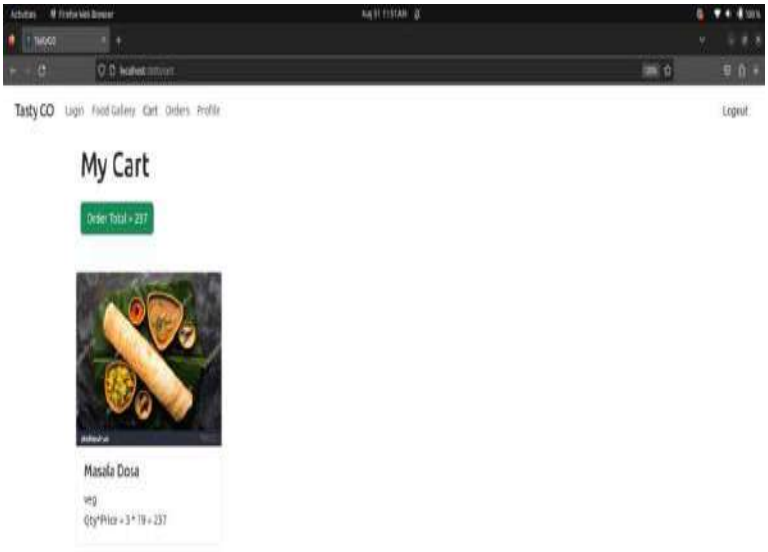
Admin can monitor all Restaurants list



Admin can manage all Delivery personnel



Customer has added a dish to their cart, and is viewing all Restaurants



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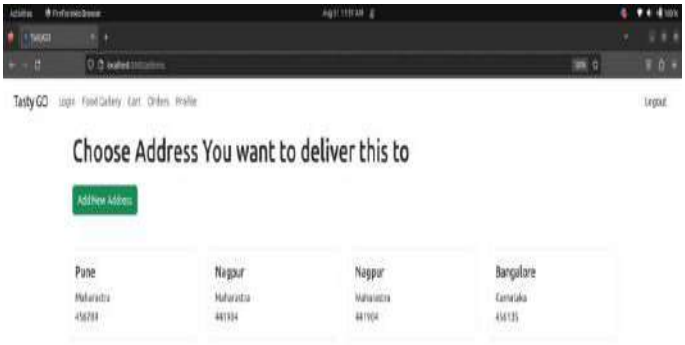
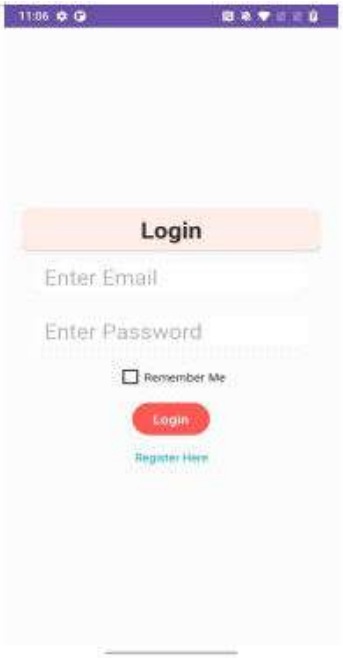
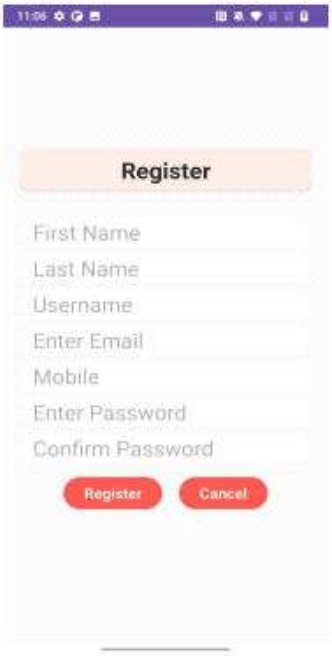
Customer is viewing their cart with estimated total price

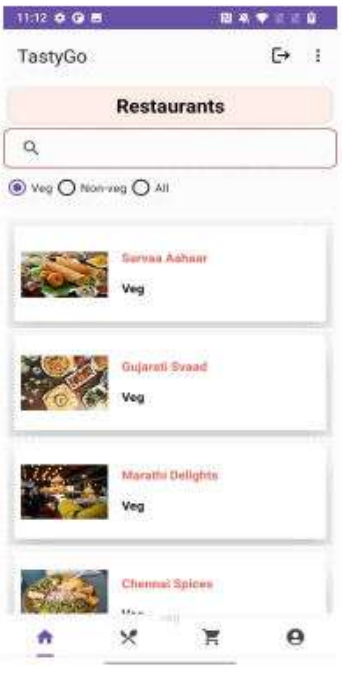


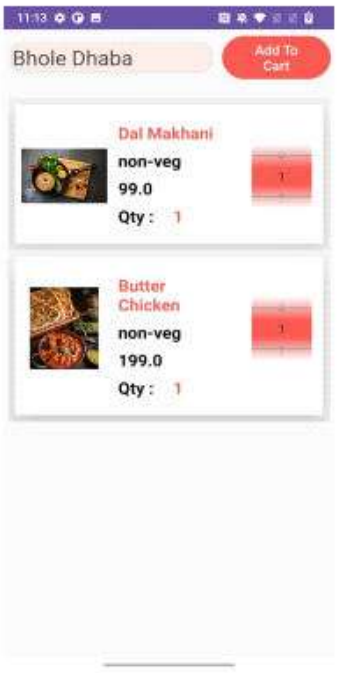
Mobile Application Screenshots

Following are some screenshots of the mobile application made for TastyGo.









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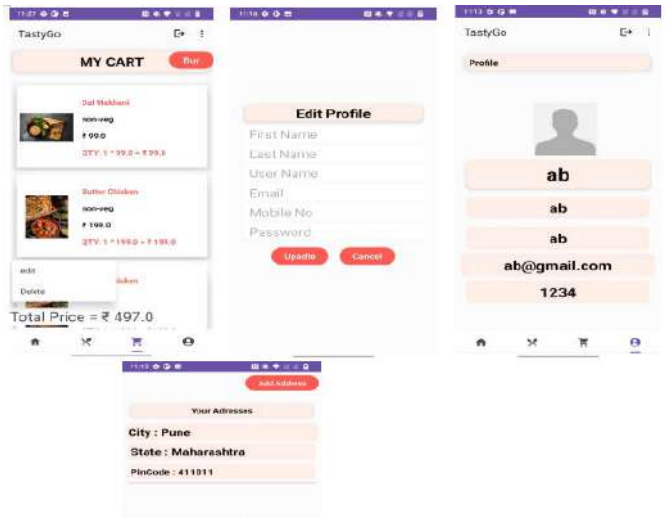

V. CONCLUSION

TastyGo is a comprehensive food ordering system that addresses the needs of both customers and restaurants. Its user-friendly interface, wide range of restaurants, convenient ordering options, real-time order tracking, and secure payment gateway make it an attractive choice for both parties. TastyGo is well-positioned to capture a significant share of the online food ordering market.In home page customers see discounts as well as offers. The application will work for OS Platform (Android) as well as Web. By this customer can order by using this application and admin can monitor. Besides, customers can also browse through filters like veg and non veg. Again, customers no need to worry for payment until they see their order details completely. Food ordering system TastyGo capable of ordering, monitoring, and displaying data relevant to a user's order history, cart, and delivery status.

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USING OF ARTIFICIAL INTELLIGENCE TECHNOLOGY FOR OVERRULING CORRUPTION BY TRUCKS

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ABSTRACT
The people of India and the businesses are connected by roadways and trucks play a major role in this connection. According to road transporter website, there are about 80 lakh registered commercial trucks on road as of 2022 and has about 18% tax on them. While the fines issued to them by RTO are high and mandatory, it is not a rare sight to witness them not being filled. This not only poses a significant threat to road safety but also results in substantial revenue loss for the government when the system is corrupted. Thus, to overrule corruption the implementation of artificial intelligence (AI) technologies is a robust solution. AI technology can be developed for a comprehensive system that monitors and enforces compliance with traffic regulations for heavy transport vehicles and impose taxes without human intervention.

Big Data plays a crucial role in collecting, storing, and processing vast amounts of information generated by the trucking and transport industry. This data can be leveraged to create comprehensive profiles of truck operators, track historical compliance records, and identify patterns of corruption. By harnessing this data, regulatory bodies can take proactive measures to curb illicit activities and enforce penalties effectively without high amount of man force.

By discouraging the illegal practices, this technology can significantly improve the overall efficiency of the industry and enhance the infrastructure of nation's transportation. Furthermore, the adoption of AI-based solutions aligns with the government's commitment to promoting transparency, accountability, and technology-driven governance.

Keywords: Artificial Intelligence, Corruption, Big Data.

1. INTRODUCTION
India's vast and intricate road network serves as the lifeline of the nation's commerce and trade. However, within this expansive network, a concerning trend has emerged as truckers often resort to taking shortcuts between towns to avoid longer and prescribed routes. These shortcuts not only compromise road safety and traffic management but also contribute to excessive wear and tear on highways due to tonnes of load. In a bid to rectify this issue and promote accountability, the integration of artificial intelligence (AI) emerges as a valuable solution [4].

This article delves into the pressing issue of corruption within India's trucking industry, exploring how unscrupulous truck drivers, transport companies, and law enforcement personnel evade fines and compromise the integrity of the system. Additionally, we will examine the potential role of artificial intelligence (AI) and big data in mitigating these challenges and promoting transparency and accountability of the government.

Trucking corruption is a multifaceted problem that has far-reaching consequences. The failure of truck drivers to pay heavy fines for exceeding weight limits or bypassing mandated routes not only puts a severe strain on India's road infrastructure but also compromises road safety. It undermines the very fabric of the nation's transportation system, making it imperative to address this issue effectively [4].

The integration of AI and big data technology into the trucking industry holds significant promise in mitigating corruption and promoting compliance. AI can be employed for real-time monitoring of trucks to ensure that they adhere to weight restrictions and follow prescribed routes without any tolerance. [1, 2]

2. OBJECTIVES
Here are several ways in which AI can be employed for this purpose:

a. **Real-Time GPS Tracking:**
AI-powered GPS tracking systems can provide real-time location data for the vehicle. These systems offer accurate information on the truck's current position, speed, and route. This data can be monitored by relevant

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authorities, shippers, and logistics companies to ensure that trucks are following designated routes and schedules.

b. **Geofencing and Route Alerts:**
AI can create geofences, virtual perimeters around specific areas or routes. When a truck enters or exits these predefined zones, AI can trigger alerts to the appropriate parties. This ensures that truckers stay on their designated routes and don't deviate without proper authorization.

c. **Anomaly Detection:**
AI algorithms can detect anomalies in truck routes. If a truck takes an unauthorized detour or bypasses a prescribed route, the system can immediately flag the deviation and alert authorities. This helps in preventing shortcuts and unapproved diversions.

d. **Predictive Analytics:**
AI can use historical route and traffic data to predict the estimated time of arrival (ETA) for trucks at their destinations. This allows logistics companies to plan better and mitigate delays, reducing the incentive for truckers to take shortcuts.

e. Compliance Monitoring:
AI can monitor various compliance aspects, such as weight limits and toll payments. If a truck is found to be overweight or has not paid tolls, AI can generate alerts for enforcement agencies and toll authorities.

f. **Performance Metrics:**
AI can collect data on a truck's performance, including fuel consumption, engine health, and driving behaviour. This information helps in optimizing routes and schedules and ensuring that trucks are operating efficiently and safely.

g. **Accountability and Transparency:**
By maintaining a digital record of routes, AI technology ensures transparency and accountability. This information can be used for auditing, compliance verification, and dispute resolution.

3. WORKING

The working of the Model is going to be very straight and digitalized. The new and old vehicles (mainly the MHCV's and other lorries) would be registered at the portal which would be integrated with AI Technology. The database of their destination, goods the vehicle possesses would be filled and it would be mandatory. Then the AI model will keep a track of all the happenings and put an alert to all the errors done by the vehicle [5]. The procedure is explained below:

Vehicle Registration Portal: The system begins with a dedicated online portal where vehicle owners, whether they have new or old vehicles, are required to register their vehicles before the deadline. This portal can be accessed by vehicle owners, fleet managers, and government authorities [1,2]

Database Integration: When registering a vehicle, the owner provides essential information about the vehicle, including its make, model, registration number, owner details, and other relevant data. This information is stored in a centralized and confidential database.

Destination and Goods Details: Vehicle owners are mandated to provide information and proper photographs about their planned destinations and the goods their vehicles will be transporting. This data is crucial for route optimization, tracking, and safety measures.

AI Integration: The system integrates AI technology, which is responsible for several critical functions:

a. **Route Optimization:** The AI can help optimize the route for each vehicle based on the destination and current traffic conditions. This ensures that the vehicles take the most efficient and safe routes which is hassle-free.

b. **Real-time Tracking:** Using GPS and other tracking technologies, the AI continuously monitors the location and status of every registered vehicle. This allows for real-time tracking of the vehicles' movements.

c. **Error Detection and Alerts:** The AI is programmed to detect mistakes or anomalies in the operations of the vehicles. These mistakes might include deviations from the suggested route, delays, or any actions that could compromise safety or compliance.

d. **Safety Measures:** The AI can also enforce safety protocols, such as monitoring speed limits and sending alerts or warnings to drivers when they exceed speed limit of the road.

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e. **Data Analytics:** The system can collect and analyse a vast amount of data about vehicle operations, which can be used for numerous purposes, including performance evaluation, maintenance scheduling, and compliance monitoring, etc.

Mistake Logging and Reporting: When the AI detects mistakes or deviations from the expected behaviour, it logs these incidents and generates reports instantly. These reports can be used for compliance audits and performance evaluations.

Government Oversight: Government authorities can access the system to monitor and regulate the operations of commercial vehicles more effectively. They can use the data collected by the AI to ensure compliance with regulations and to address the safety concerns.

4. OUTCOMES

Corruption in the Indian trucking industry has been a long-standing issue, with many truck drivers and owners flouting rules and regulations. Some common corrupt practices include evading heavy fines for overloading, taking shortcuts instead of using designated roads, and underreporting income to avoid taxes [5]. This not only leads to revenue losses for the government but also poses safety hazards on the roads. However, with the integration of AI and Big Data, there are promising strategies to curb these corrupt practices.

Improved Monitoring and Surveillance: AI-powered surveillance cameras and digital sensors can be installed at key checkpoints and toll booths to monitor vehicles' weight and adherence to routes. These systems can instantly flag violations, enabling law enforcement to take appropriate action without delay.

Data Analytics for Anomaly Detection: Big Data analytics can be used to process a massive volume of data generated by the surveillance systems. Advanced algorithms can identify patterns and anomalies in the data and thus helping authorities pinpoint potential instances of corruption.

Real-time Reporting and Alerts: AI can provide real-time alerts to enforcement agencies when a truck is found violating regulations, allowing them to respond instantly. This minimizes the chances of offenders escaping penalties.

Public Reporting and Feedback:
AI-powered platforms can enable the public to report instances of corruption and non-compliance and collecting their feedbacks. This data can be integrated into the larger monitoring and enforcement system. [5]

5. ADVANTAGES

i. By keeping a track on the loads/ goods carried by trucks, there will be transparency on the fines imposed to them and those being paid because of overloading.

ii. By real-time GPS tracking, the route taken by them can be kept under surveillance and hence avoid any shortcuts taken by them.

iii. The installation process of this digital device must be made mandatory as it will help in growth of economy of the government and reduce corruption [3].

6. CONCLUSION

In conclusion, the integration of AI technology into the registration and monitoring of commercial vehicles, particularly MHCVs and lorries, marks a significant advancement in the transportation industry. This digitalized system approaches a streamlined and efficient development that not only enhances the management of vehicle operations but also prioritizes safety, compliance, and environmental considerations.

The Vehicle Registration Portal serves as the gateway to this transformative system, providing vehicle owners and government authorities with a centralized platform for vehicle registration and oversight [5]. The AI integration enables a vast number of essential functions. Lastly, government oversight is empowered through access to this wealth of data, enabling authorities to regulate commercial vehicle operations more effectively and address safety concerns promptly. The AI-driven system aligns the interests of vehicle owners, operators, and regulatory bodies to create a safer, more efficient, and environmentally responsible transportation ecosystem taking both driver and government into consideration.

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SURVEY ON ROLE OF PREDICTIVE DATA ANALYTICS IN RETAILING

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ABSTRACT
Predictive data analytics (PDA) has emerged as a powerful tool for retailers, enabling them to make informed decisions based on data rather than gut instinct. By analysing large amounts of data from various sources, retailers can gain insights into customer behaviour, sales trends, and market conditions. These insights can then be used to improve decision-making in a wide range of areas, including demand forecasting, inventory management, pricing, marketing, and customer service.

Keywords: (PDA) Predictive data analytics, Retailers, Informed decisions, Data, Customer behaviour, Sales trends.

I. INTRODUCTION

The retail industry is undergoing a significant transformation driven by the rise of e-commerce, mobile shopping, and social media. This transformation has created a wealth of data that can be used to improve business decision-making. Predictive data analytics (PDA) is a powerful tool that can help retailers to make better use of this data. PDA uses advanced analytical techniques to identify patterns and trends in data that can be used to predict future outcomes [1].

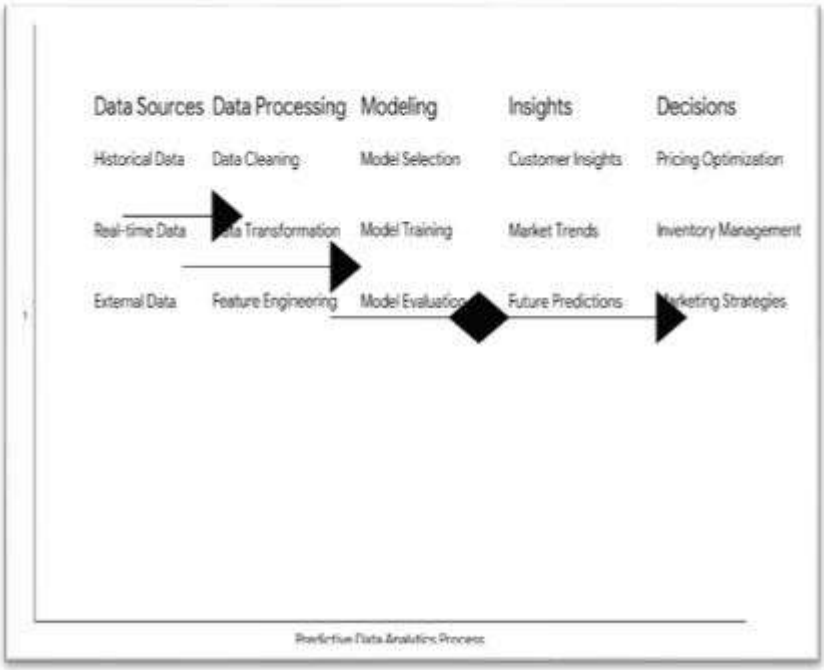

Fig. a Predictive Data Analytics

The Above diagram of the predictive data analytics process in retailing. It consists of four key stages:

1. **Data Sources:** Retailers collect data from a variety of sources, including:

- Historical sales data: This data provides insights into past customer behaviour and demand patterns.
- Real-time transaction data: This data provides insights into current customer behaviour and trends.
- External data: This data includes market trends, weather patterns, and other factors that can impact customer demand and retail operations.

2. **Data Processing:** Once the data has been collected, it needs to be processed to prepare it for analysis. This may involve cleaning the data to remove errors and inconsistencies, transforming the data into a consistent format, and engineering new features to improve the accuracy of the predictive models.
3. **Modelling:** This stage involves developing and training predictive models using a variety of machine learning techniques. The specific modelling techniques used will depend on the specific predictive task at

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hand. For example, retailers may use linear regression models to forecast demand, logistic regression models to predict customer churn, and recommendation systems to personalize marketing campaigns.

4. **Insights and Decisions:** Once the predictive models have been trained, they can be used to generate insights and make informed decisions about various aspects of the retail business. For example, retailers can use demand forecasting insights to optimize inventory levels, customer churn prediction insights to develop retention strategies, and personalized marketing insights to create more targeted and effective marketing campaigns. Overall, the predictive data analytics process in retailing is a cyclical process. Retailers continuously collect new data, use it to update their predictive models, and generate new insights to improve their business operations.

II. Benefits of Predictive Data Analytics

There are many benefits to using PDA in the retail industry. Some of the key benefits include [2]:

- **Improved demand forecasting:** PDA can be used to forecast demand for products and services more accurately than traditional methods. This can help retailers to avoid stockouts and overstocks, which can lead to lost sales and profits.
- **Targeted marketing:** PDA can be used to target marketing campaigns to specific customer segments based on their interests and purchase history. This can help retailers to improve the effectiveness of their marketing spending.
- **Enhanced customer service:** PDA can be used to identify potential customer issues and to provide proactive customer service. This can help retailers to improve customer satisfaction and loyalty.
- **Increased Sales and Revenue:** Accurate demand forecasting, personalized marketing, and optimized pricing can contribute to increased sales and overall revenue growth.
- **Improved Customer Satisfaction:** Personalized customer experiences, reduced churn, and timely promotions can enhance customer satisfaction and loyalty.
- **Enhanced Operational Efficiency:** Optimized inventory management, reduced stockouts, and fraud prevention can improve operational efficiency and reduce costs.
- **Data-Driven Decision Making:** PDA provides actionable insights to support strategic decision-making across various aspects of the retail business.
- **Competitive Advantage:** Gaining a deeper understanding of customer behaviour, market trends, and emerging opportunities can give retailers a competitive edge in the dynamic retail landscape.

III. Examples of PDA in Retail

Here are a few examples of how PDA is being used in the retail industry **[4]**:

- **Walmart**: Walmart uses PDA to forecast demand for products and to optimize inventory levels. The company also uses PDA to identify potential customer issues and to provide proactive customer service **[5]**.
- **Amazon:** Amazon uses PDA to recommend products to customers based on their purchase history and browsing behaviour. The company also uses PDA to personalize prices and to optimize delivery routes.
- **Target:** Target uses PDA to analyse customer data in order to develop personalized marketing campaigns. The company also uses PDA to identify potential cross-selling and upselling opportunities.

IV. Challenges of Implementing PDA

There are a number of challenges associated with implementing PDA in the retail industry. Some of the key challenges include [3]:

- **Data quality:** The quality of the data used for PDA is critical to its success. Retailers need to ensure that their data is accurate, consistent, and complete.
- **Data integration:** Retailers often have data from a variety of sources, such as point-of-sale systems, customer relationship management (CRM) systems, and social media. Integrating this data can be a challenge.
- **Model development:** Developing accurate predictive models can be complex and time-consuming. Retailers may need to hire data scientists or consultants to help them develop models.

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- **Interpretation & Implementation:** Interpreting the results of predictive models and implementing them into business processes can be challenging.
- Retailers need to have a plan for how they will use the insights from PDA to improve their business.

V. CONCLUSION

PDA is a powerful tool that can help retailers to make better decisions and improve their business performance. However, there are a number of challenges associated with implementing PDA. Retailers need to carefully consider their data quality, data integration, and model development strategies before implementing PDA.

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OPTIMIZING STUDENT PLACEMENT - A DATA DRIVEN APPROACH FOR INFORMED DECISION MAKING

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ABSTRACT
This paper presents a data-driven approach aimed at optimizing student placement through informed decision-making. By using comprehensive datasets and research methods, this approach aims to improve the accuracy and efficiency of student placement in educational institutions. The approach described in this study uses data insights to guide informed decisions, ultimately optimizing the allocation of students to programs or courses to improve academic achievement. This paper introduces a policy and data-centric framework designed to revolutionize student recruitment strategies.

Keywords: Optimization, Student placement, Acidamic Success, Data Analytics, Machine Learning

1. INTRODUCTION
Improving student mobility is essential to providing an appropriate learning environment. Skills building ensures that students are matched with appropriate learning challenges, allowing them to succeed and reach their full potential. This process involves consideration of students' skills, aspirations, and learning styles, with the goal of creating a personalized educational experience. By implementing recruitment strategies, educational institutions can increase student engagement, satisfaction and overall success along their learning journey.

2. METHODOLOGY
1. **Assessment Tools:** Use reliable assessments to assess students' academic abilities, learning styles, and strengths.
2. **Data Analysis:** Analyze historical performance data to identify patterns and trends that can inform hiring decisions.
3. **Teacher Recommendations:** Collect information from teachers who have a good understanding of students' abilities and learning needs.
4. **Parental Perspectives:** Consider the insights parents gain about their child's learning preferences, challenges, and interests.
5. **Individualized Education Plans (Ieps):** Follow IEP guidelines to ensure that students with special needs are placed and supported appropriately.
6. **Flexible Grouping:** Use dynamic grouping strategies based on student achievement, and allow for flexibility as needed.
7. **Technology Integration:** Use instructional technology tools for flexible learning, helping to tailor instruction to individual students' needs.
8. **Collaboration:** Foster communication among faculty, administrators, and support staff to share insights and refine hiring strategies.
9. **Professional Development:** Provide training for faculty on effective assessment strategies and differentiated instruction.
10. **Ongoing Assessment:** Regularly monitor and reassess student progress, adjusting programs as necessary to meet evolving need

3. OBSERVATION
Observations for optimizing student placement include assessing individual learning styles, analyzing academic performance data, and considering students' interests and aspirations. Incorporating feedback from teachers, parents, and even students themselves provides valuable insights. Continuous monitoring and adjustment of placement strategies based on the evolving needs of both students and industries contribute to more effective optimization. Moreover, utilizing technology for data-driven decision-making and fostering collaboration between educators and industry stakeholders can enhance the precision of student placements.

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4. FUTURE

The future for optimizing student placement involves leveraging advanced data analytics and artificial intelligence to match students with suitable academic programs based on their skills, preferences, and learning styles. Personalized learning paths, adaptive assessments, and continuous feedback systems will play a key role in tailoring education to individual needs. Additionally, collaborative efforts between educational institutions and industry partners can enhance real-world relevance in student placements, preparing them for the evolving job landscape.

5. ADVANTAGES & DISADVANTAGES

Advantages:

1) **Personalized Learning:** Matching students with suitable learning environments enhances their chances of academic success by catering to their individual learning styles and needs.
2) **Improved Engagement:** Placing students in appropriate classes or programs can increase their engagement, leading to better participation and motivation.
3) **Enhanced Social Integration:** A well-planned placement strategy can facilitate better social integration and collaboration among students, fostering a positive learning community.
4) **Better Resource Allocation:** Optimal placement can help educational institutions allocate resources more effectively, ensuring that support services and teaching resources are utilized where they're most needed.

Disadvantages:

1) **Administrative Complexity:** Implementing an optimized placement system can be administratively complex, involving detailed assessments and coordination among various departments.
2) **Potential Bias:** There might be a risk of bias in the placement process, such as relying solely on standardized tests or overlooking certain student qualities that don't fit into standardized criteria.
3) **Student Adjustment:** Sometimes, optimal placements might disrupt social connections or familiar environments, causing initial adjustment challenges for students.

6. CONCLUSION

The Finally, optimizing student placement is a continuous effort toward creating just learning environments. The benefits of this include personalized education, increased engagement, and efficient resource utilization. However, its effective implementation requires proactive steps to reduce biases, manage administrative burdens and recognize student multifaceted skills beyond standardized tests. We need to strike a balance between well-structured placement strategies and holistic student development in order to create inclusive educational experiences that enable every learner to thrive academically

7. ACKNOWLEDGEMENT

Recognizing the importance of a multi-pronged approach to effective student delivery, recognition goes to the collective efforts of teachers, data scientists, and administrators. Appreciation also extends to students, whose strengths and aspirations determine the basis for effective recruitment strategies. A continued commitment to refining the processes through supervision, feedback, and technological advances is critical to developing customized educational pathways that align with individual abilities and future career opportunities

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OVERVIEW OF FINGERPRINT RECOGNITION SYSTEM

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ABSTRACT
This will be study focuses on Fingerprint recognition remains at the forefront of biometric research and technology, playing a pivotal role in authentication and security applications. On the basis of Fingerprint Recognition System, reference we observed that This paper explores the evolution of fingerprint recognition systems, delving into the intricacies of this field, and addressing the challenges and prospects it presents. As computing capabilities have continued to grow, so too has the sophistication of Automated Fingerprint Authentication Systems (AFIS). Over the last few decades, fingerprint recognition has witnessed significant progress, revolutionizing the way we approach security and identity verification .In a fingerprint recognition system, the primary objective is to verify the identity of an individual based on their unique fingerprint patterns. This is a complex pattern recognition problem, where two competing error rates are critical: the False Accept Rate (FAR) and the False Reject Rate (FRR). Minimizing these error rates while ensuring efficient and reliable recognition is the central challenge in the field.

Keywords: Fingerprint, Pre-processing, Feature extraction, Feature Matching, Databases.

INTRODUCTION
Overview of the fingerprint recognition systems its become integral to various aspects of our technological lives. These systems, subset of image processing and a vital component of security and identity verification, leverage physiological and behavioral characteristics of the human body. Two primary modes govern biometric authentication: Enrolment and Recognition. During Enrolment, biometric data is captured from an individual, often through sensors, and stored in a database alongside the individual's identity for later recognition. The Recognition phase, in turn, encompasses two distinct processes: Identification and Verification. Identification involves matching a person's biometric data, like a fingerprint, against all entries in the database making a invaluable in criminal investigations. And on the other hand, Verification focuses on the one-to-one matching of an individual's biometric data against of specific template in the database, that can commonly used for user authentication. The key element in fingerprint recognition, minutiae points, mark's locations where ridge structures change, such as the bifurcations and endpoints. These minutiae points are pivotal in the matching process. The uniqueness and permanency of biometric characteristics, whether physiological, like fingerprints, palm prints, iris patterns, behavioral, and signature recognition, they can support the reliability and security of biometric systems. In this context, biometric authentication systems continue to emerge and find the applications in numerous domains, ushering in a new era of secure and convenient identity verification.

The human fingertips contains ridges and valleys which together forms distinctive patterns. These patterns are fully develop under pregnancy and are permanent throughout whole lifetime. Prints of such patterns are fingerprints. Injuries like cuts, burns and bruises can temporarily damage quality of fingerprints but when full healed, patterns we can restored. Through various studies it has been observed that no two persons have the same fingerprints, hence they are uniqueness for each person.

Figure 1: A fingerprint image scan by optical sensor

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Fingerprint Recognition: The method that is selected for fingerprint matching was first discovered by Sirm Francis Galton. In 1888, he made a ground breaking observation that fingerprints exhibit intricate details, known as minutiae, which manifest as discontinuities in ridges. Furthermore, he astutely noted that the positions of these minutiae remain constant over time. Therefore, minutiae matching is a good way to establish if two fingerprints are the same person or not.

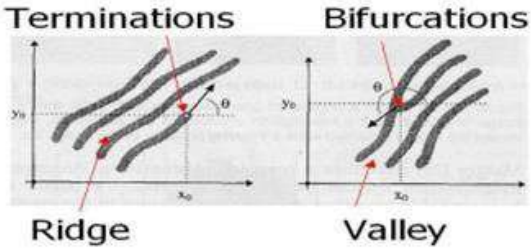

Figure 2: Minutia. (Valley is also referred as Furrow, Termination is also called Ending, and Bifurcation is called as Branch)

Fingerprint features: Fingerprint sensing techniques can be classified into offline scanning, where inked fingerprints on paper are scanned, and live-scanning, which involves electronic fingerprint scanners. Live-scanning is prevalent in applications like Automated Fingerprint Identification Systems (AFIS). Sensors used for fingerprint scanning belong to three main families: optical, solid-state, and ultrasound. Optical sensors, utilizing the frustrated total internal reflection (FTIR) technique, are the most common in forensic and government applications. They offer high accuracy, speed, and reliability in capturing digital fingerprint images for biometric identification.

Figure 3: Fingerprint features

FLOW CHART OF FINGERPRINT RECOGNITION SYSTEM:

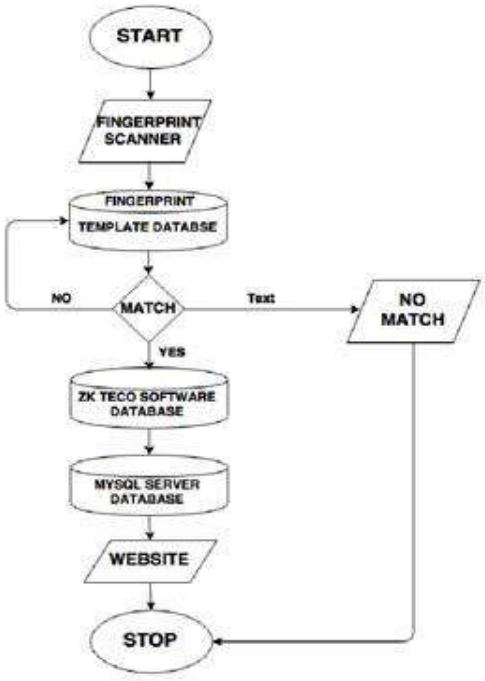

Figure 4: Flow Chart For Fingerprint Recognition System

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Minutia extraction involves Image Enhancement, Image Segmentation, and Final Extraction processes, while Minutiae matching includes Minutiae Alignment and Match processes. In the Image Enhancement step, Histogram Equalization and Fast Fourier Transformation enhance the input image quality, and Image Binarization converts it to a binary image. Image Segmentation is performed using Ridge Flow Estimation and MATLAB's morphological functions to extract the Region of Interest. Minutia points are then extracted in the Final Extraction step through Ridge Thinning, Minutia Marking, and False Minutiae Removal processes. Alternatively, Minutiae detection can occur directly from gray-level fingerprint images, eliminating the need for binarization and thinning. This approach is relevant due to potential information loss during binarization and the time-consuming nature of these processes.

CONCLUSION

Fingerprint Recognition serves as a biometric method for identifying individuals, encompassing stages from minutia extraction to matching, generating a match score. Traditional techniques in intermediate processing stages often result in a relatively low verification rate, indicating susceptibility to scaling and elastic deformations. New techniques and algorithms show promise in addressing these challenges. Additionally, a significant hurdle lies in preprocessing poor quality fingerprint images, contributing to the overall low verification rate.

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OVERVIEW OF NETWORK SECURITY THROUGH CRYPTO- STEGANOGRAPHY WITH REFERENCE TO E-CIPHER METHODS

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ABSTRACT
This paper shows the possibility of exploiting the features of E- cipher method by using both cryptography as well as Steganography methods to send and receive the message in more secured way and shows the different methods are available and a comparative study on Substitution cipher. The methodology shows that successfully using these Poly substitutions methods (Encipher) to evolve a new method for Encrypting and decrypting the messages. In poly-alphabetic substitution ciphers (E-Cipher) the plaintext letters are enciphered differently depending upon their placement in the text. As the name poly-alphabetic suggests this is achieved by using several two, three keys and random keys. A combination instead of just one as is the case in most of the simpler crypto systems. We can use Poly substitution method combining the features of cryptography for text encryption by 2 keys and 3 keys and even more then 3 keys to make the decryption process more complicated. After this process, file is compressed; the compressed file is hidden in image file using LSB method, the same process is applied reversely to retrieve the source message by Genetic keys.

Keywords: Genetic Algorithm, Encryption, Decryption, Genetic Keys, Mono Substitution, Poly Substitution, object.

1. OBJECTIVES OF THE OVERVIEW

The core objective of the research is to protect information leakage what so ever manner it may be, the use of appropriate technology. To provide a high level of confidentiality, integrity, non reputability and authenticity to information that is exchanges over networks.

Confidentiality: The protection of data from unauthorized disclosure.

Integrity: The assurance that data received are exactly as sent by an authorized entity.

Non-reputability: Provide protection against denial by one of the entities involved in communication.

Authentication: it verifies the identity of user in the system and continues to verify their identity in case someone tries to break into the system.

2. SECRET KEY CRYPTOGRAPHY

With ***secret key cryptography***, a single key is used for both encryption and decryption. The sender uses the key to encrypt the plaintext and sends the cipher text to the receiver. The receiver applies the same key to decrypt the cipher text and recover the Plaintext. Because a single key is used for both functions, secret key cryptography is also called *symmetric encryption.*

With this form of cryptography, it is obvious that the key must be known to both the sender as well as the receiver that in fact is the secret. The problem with this approach is the distribution of the key [1].

3. PUBLIC-KEY CRYPTOGRAPHY

Public key cryptography is asymmetric, involving the use of two separate key in contrast to the symmetric encryption which uses only one key.

4. SECURED COMMUNICATION BASIC TERMS

Let's consider two parties that want to communicate secretly, X and Y. If X wants to send something to Y, some information, we call that information a plaintext. After encrypting the plaintext a cipher text is produced. Y knows the encryption method since he is the intended receiver and since he must use the same method together with his secret key to decrypt the cipher text and reveal the plaintext.

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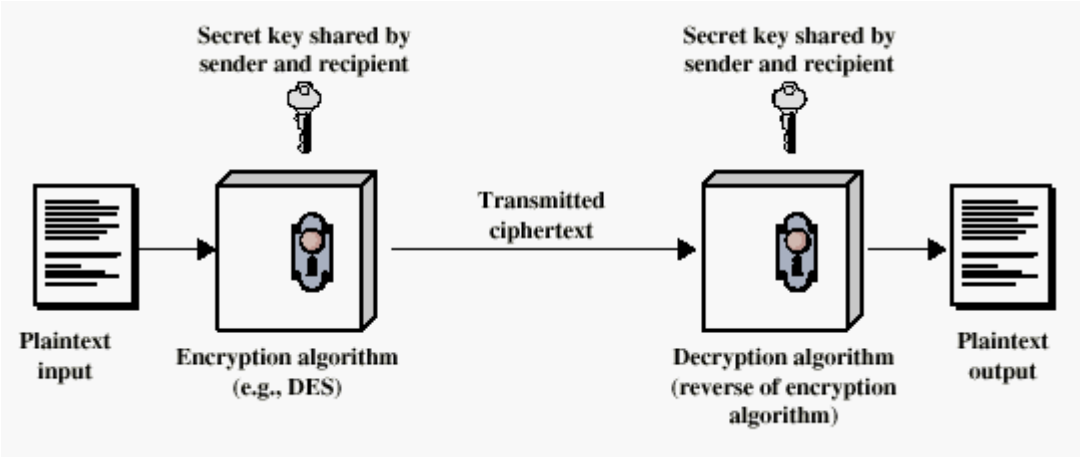
4.1. **Secured Communication System Model**



5. TYPES OF SUBSTITUTIONS CIPHER

There are 4 kinds of substitution cipher Mono-alphabetic, Homophonic, PolyGram Transposition Cipher and Poly - alphabetic methods.

5.1. Caesar cipher

Cipher text alphabets corresponding to the original plain text alphabets may not necessarily be 3 places down the order instead can be any places down the order. Thus, alphabet A in plain text would not necessarily be replaced with D. It. can be replaced by any other alphabet. Once the replacement scheme is decided, it would be constant and will be used for all other alphabets in given message.

In English language there are 26 alphabets. Thus, A can be replaced by any order in the English alphabet set (B through Z). Not make sense to replace A with A. So, each alphabet has 25 possibilities of replacement. The major weakness of Caesar Cipher is its predictability. Rather than using a uniform scheme, use random substitution. This means that in a given plain text message, each A can be replaced by any other alphabet (B through Z), each B can also be replaced by any other random alphabet (A or C through Z) and so on.

The crucial difference, there is no relation between the replacement of B and replacement of A. That is if decided to replace A with D not necessarily replace each B with E can replace B with other character. V To put it mathematically, the cipher can have any permutation or combination of the 26 alphabets which means (26 x 25 x 24 x 23 x ...2) or 4 x 1026 possibilities! This is extremely hard to crack. It might actually take years to try out these many combinations even with the most modern computers [2].

5.2. Homophonic substitution cipher

The difference between the 2 techniques is that replacement alphabet set in simple substitution technique is fixed (A with D) whereas in the case of Homophonic, one plain text alphabet can map to more than one cipher text alphabet.

e.g. A can be replaced by D, H, P, R; B can be replaced by E, I, Q, S....

Difficult to analyze compare with mono-alphabetic because the frequency didn't show the real usage of each alphabet.

5.3. PolyGram Substitution Cipher

Rather replacing one plain text alphabet with one cipher text alphabet at a time, a block of alphabets is replaced with another block. It is done by dividing plain text to a group of alphabet. This group can be 2 alphabets or more than that. Play-fair Cipher and Hill Cipher are examples of cipher that used Polygram Substitution Cipher.

5.4. Poly-alphabetic Substitution Cipher

This cipher has been broken many times, and yet it has been used extensively. The Viennese Cipher and Beaufort Cipher are the examples of it. **Leon Battista** is inventor of Poly Alphabetic Cipher in 1568.The cipher uses multiple one-character keys. Each of the keys encrypts one plain text character.

The first key encrypts the first plain text character the second key encrypts the second plain text character and so on.

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After all the keys are used, they are recycled. Thus if we have 30 one-letter keys, every 30th character in the plain text would be replaced with the same key [3].

6. e-cipher methods

In poly-alphabetic substitution ciphers the plaintext letters are enciphered differently depending upon their placement in the text. As the name poly-alphabetic suggests this is achieved by using several two, three keys and random keys combinations instead of just one, as is the case in most of the simpler crypto systems.

Method 1: **using E-Cipher Method Algorithm**

Take the example text "GOODMORNING".

Take three key k1, k2, k3 and assign a character k1 be 'a' and k2 be 'D' and k3 be 's'. Let ASCII value of e1 be 1 and e2 be 2 and e3 be 3 and take the text, add ASCII value of el to value of first character, and e2 to second character and e3 to third character, alternatively add the value of el, e2, e3 to consecutive characters.

Three layers to be applied to each three consecutive letters and same to be continued thru the remaining text. After adding ASCII value of all values of given text the resultant text is an encrypted message, and it generate a combination of 3* (256 * 256 * 256) letters encrypted coded text with 128-bit manner. Transposition takes place in each character after all the process is over that is moves or change one bit either LSB or MSB, the end result is increasing security. Finally takes the decimal values of each updated character in the given text and print and this process shown in Table 1.

6.1. Methodology

In poly-alphabetic substitution cipher (E-Cipher) the plaintext letters are enciphered differently depending upon their placement in the text. As the name poly alphabetic suggests this is achieved by using several two, three keys and random keys combinations instead of just one, as is the case in most of the simpler crypto systems. Using two keys, we take 2 keys e1,e2 and let the ASCII values of el be 1 and e2 be 2 and take the text, add ASCII values of el to first character and ASCII values of e2 to second character. Alternatively add the value of el and e2 to consecutive characters. Encrypted message is then compressed this file is hidden in Image file using LSB method. The resultant object sends to the receiver. In the receiver side, object is received and then unzipped using the methods then the result is decrypted with substitutions cipher methods.

Poly substitution method(e-cipher) combining the features of genetic keys methods with features of Steganography with cryptography for text encryption by 2 keys and 3 keys and even more then 3 keys to make the decryption process more complicated [4].

6.2. Encryption Result

Keys X, Y, Z and message "GOODMORNING"

Let X-a, Y-b and Z-c

ASCII VALUES for a - 97 b -98 c-99

The Encrypted message is {169,176,179,164,174,179,178,177,173,174,168}

Table 1: Encryption result data - method 1

characters	ASCII value	Add Con. letter	Binary Values	Alter MSB	Final Result
G	71	168	10101000	10101001	169
O	79	177	10110001	10110000	176
O	79	178	10110010	10110011	179
D	68	165	10100101	10100100	164
M	77	175	10101111	10101110	174
O	79	178	10110010	10110011	179
R	82	179	10110011	10110010	178
N	78	176	10110000	10110001	177
I	73	172	10101100	10101101	173
N	78	175	10101111	10101110	174
G	71	169	10101001	10101000	168

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ie. Encrypted Text

6.3. Decryption Result

The Encrypted Text is applied to decrypted formula by applying the reverse process.

Table 2: Decryption result data - method -1

Cyber result	Binary allies	Alter MSB	Subtract Con.Letter	Item. ASCII Value	Plain Text
169	10101001	10101000	168	71	G
176	10110000	10110001	177	79	O
179	10110011	10110010	178	79	O
164	10100100	10100101	165	68	D
174	10101110	10101111	175	77	M
179	10110011	10110010	178	79	O
178	10110010	10110011	179	82	R
177	10110001	10110000	176	78	N
173	10101101	10101100	172	73	I
174	10101110	10101111	175	78	N
168	10101000	10101001	169	71	G

The Plain text is "GOODMORNING"

7. KEYWORDS

Encryption The process of putting text into encoded form.

Genetic Algorithm(GA) Search/optimization algorithm based on the mechanics of natural selection and natural genetics Key A relatively small amount of information that is used by an algorithm to customize the transformation of plaintext into cipher text (during encryption) or vice versa (during Decryption).

Mutation Simulation of transcription errors that occur in nature with a low probability - a child is randomly changed from what its parents produced in mating.

Plaintext A message before encryption or after decryption i.e. in its usual form which anyone can read, as opposed to its Encrypted form.

Poly Alphabetic Using many alphabets - refers to a cipher where each alphabetic character can be mapped to one of many possible alphabetic characters.

Population The possible solutions (chromosomes) currently under investigation, as well as the number of solutions that can be investigated at one time i.e. per generation.

Block A sequence of consecutive characters encoded at one time.

Block length The number of characters in a block.

Chromosome The genetic material of an individual -represents the information about a possible solution to the given problem.

Cipher An algorithm for performing encryption (and the reverse, decryption) - a series of well-defined steps that can be followed as a procedure. Work at the level of individual letters, or small groups of letters.

Ciphertext: A text in the encrypted form produced by some cryptosystem. The convention is for cipher texts to contain no white space or punctuation.

Cryptanalysis: The analysis and deciphering of cryptographic writings or systems.

Cryptography: The process or skill of communicating in or deciphering Secret writings or ciphers

Cryptosystem: The package of all processes formulae and instructions for encoding and decoding messages using cryptography.

Decryption: Any procedure used in cryptography to convert cipher text (encrypted data) into plaintext.

Encryption The process of putting text into encoded form.

Generation The average interval of time between the birth of parents and the birth of their offspring - in the genetic algorithm Case, this is one iteration of the main loop of code [5].

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8. CONCLUSION

The methodology will give the new area of research on cryptography with combined features of Steganography with reference to Substitution ciphers (E-Cipher) Methods. This new methodology for text encrypts and decrypt using E- Cipher Methods with reference to Unicode/ASCII code method is definitely an effective method while compared with other cryptography information security systems.

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HAAR CASCADE CLASSIFIERS: A COMPREHENSIVE OVERVIEW OF FACE DETECTION TECHNIQUES

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ABSTRACT
Face detection plays a pivotal role in computer vision applications, ranging from facial recognition and biometrics to human-computer interaction. This paper explores the application of the Haar Cascade Classifier for face detection, a classic method renowned for its speed and accuracy. The Haar Cascade Classifier, popularized by the Viola-Jones algorithm, is a machine learning technique that leverages integral image representation and adaptive boosting to classify regions of an image as faces or non-faces. The Haar Cascade Classifier is known for its efficiency and accuracy in detecting objects of interest, making it particularly well-suited for real-time applications. This paper will give a brief explanation of the haar cascade classifier; experimental results demonstrate the effectiveness of the proposed approach, showcasing high detection rates while maintaining low false positive rates.

Keywords: Haar Cascade, Face detection, Computer Vision, Adaboost, False Positive Rate.

I. INTRODUCTION
Face detection is a type of application classified under “computer vision” technology. The Haar Cascade Classifiers (HCC) are actually receiving a great deal of attention. The competitively efficient identifiers were given high identification speeds, which indicated the ability to use themselves in a stable real-time HMI structure. It is a simple and effective machine learning-based approach for object detection that can be easily implemented in Python. The versatility and accuracy of the Haar Cascade Classifier make it a go-to technology for businesses and organizations looking to automate tasks and improve safety and security. Haar Cascade training involves creating a classifier to detect specific features by applying filters on image windows and adjusting weights during iterations to minimize errors. Cascade algorithms, like the Haar cascade, provide efficient object detection by sequentially applying multiple stages of classifiers, quickly rejecting non-object regions and saving computation.

A Haar-like feature consists of dark regions and light regions. It produces a single value by taking the difference of the sum of the intensities of the dark regions and the sum of the intensities of light regions. It is done to extract useful elements necessary for identifying an object. This algorithm requires several positive and negative photos to identify faces. Good photographs of a mask and bad images without a face are positive images. It is required that these photos train the classifier. Haar functions at a clear region in windows that fits for neighboring rectangular locales. It identifies each domain's aggregate pixel strength and seeks the truths within these totals [1]. Haar Cascade Classifier is a machine learning-based approach where a cascade function is trained from positive and negative samples to detect the object. It is a popular object detection technique that has been used in wide-ranging computer vision applications, from pedestrian and facial recognition to self-driving cars. Paul Viola and Michael Jones introduced the Viola-Jones algorithm, which is the foundation of the Haar Cascade Classifier. The Viola-Jones algorithm uses a boosting technique, a machine learning ensemble method, to create a strong classifier from multiple weak classifiers. The key innovation of Viola and Jones was the use of Haar-like features, which are simple rectangular filters that can be rapidly computed. These features capture contrast differences between adjacent regions of an image, allowing for efficient feature extraction. The integral image provides a quick way to calculate the sum of pixel values in a rectangular region. An integral image is a new image, introduced to permit the features to be computed. The AdaBoost (Adaptive Boosting), a statistical classification meta-algorithm, picks a certain number of distinguishable features from a set and returns classifiers that efficiently detect those features [2]. Human face recognition is distinguished by a method of identifying facts or confirmation that tests personality. Facial recognition applies to a PC device with a few implementations in which human faces can be identified in pictures Usually, facial identification is achieved by using “right” data from full-frontal facial photographs [3].

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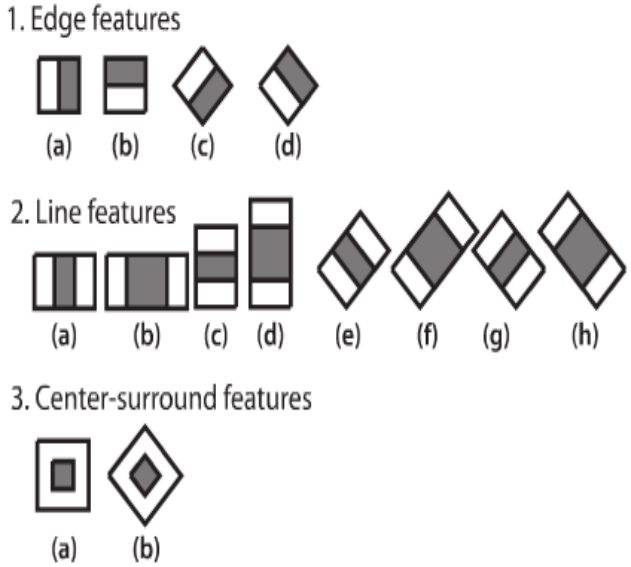

Fig .1 Haar Feature Extraction Kernels

II. METHODOLOGY

The methodology of the Haar Cascade Classifier involves a multi-step process for detecting objects, including faces. It begins with the creation of a robust dataset containing positive samples (images of the object of interest, in this case, faces) and negative samples (images without the object). Training the classifier involves feature extraction, where Haar-like features are computed within sub-windows of these images. These features capture variations in pixel intensities and are used as discriminative characteristics for object detection. The AdaBoost algorithm is employed to select a strong set of weak classifiers from these features, which collectively identify the object. Additionally, integral image representation optimizes feature computation. Once trained, the classifier can be applied to new images for detection. During detection, a sliding window approach scans the image at multiple scales, and the classifier is applied to each window. Objects that meet the classifier's criteria are considered positive detections. The Haar Cascade Classifier is characterized by its speed and accuracy, making it a popular choice for real-time object detection tasks, including face detection.

1. Integral Image: The algorithm starts by calculating an integral image from the input grayscale image. The integral image allows for efficient computation of sums of pixel values in rectangular regions of the image.

2. Haar-like features: Haar-like features are simple rectangular filters that are applied to the integral image. These features are defined by a set of rectangular regions, each with its own weight. The Haar-like features capture variations in pixel values within these regions.

3. Feature Selection: During the training phase, the algorithm selects a subset of the most discriminative Haar-like features from a large pool of possible features. These features should be able to distinguish between positive and negative examples effectively. AdaBoost is often used as the machine learning algorithm for feature selection. It iteratively selects the best features and assigns weights to them, emphasizing the importance of the features that perform well.

4. Weak Classifiers: For each selected Haar-like feature, a weak classifier is trained. A weak classifier is typically a simple decision tree or a decision stump. The weak classifiers make binary decisions based on the Haar-like features, classifying image regions as positive or negative.

5. Cascade Structure: The Haar Cascade classifier is organized into multiple stages, where each stage consists of a set of weak classifiers. The cascade structure is designed to quickly reject negative samples and only proceed to the more computationally expensive stages for positive samples. The output of each stage is a binary decision: either reject the region as negative or continue to the next stage.

6. Cascade Training: During the training process, the algorithm iteratively trains and evaluates the cascade structure. At each stage, it reweights the training samples to give more importance to samples that were misclassified in previous stages. The goal is to create a strong classifier that can achieve high accuracy while minimizing computation time.

7. Object Detection: In the detection phase, the trained Haar Cascade classifier is applied to new images or video frames. The classifier slides over the image at different scales and positions. At each stage of the cascade,

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the Haar-like features are evaluated for the current region of the image. If a region passes all stages of the cascade (i.e., if all weak classifiers in all stages provide positive results), it is considered a positive detection.

8. Post-processing: Detected regions may undergo post-processing steps, such as non-maximum suppression, to eliminate duplicate or overlapping detections and refine the results. Bounding boxes are often drawn around the detected objects to visualize the locations of the detected objects.

A. HAAR CASCADES

The Haar Cascade classifier is based on the Haar Wavelet technique to analyze pixels in the image into squares by function. This uses "integral image" concepts to compute the "features" detected. Haar Cascades use the Ada-boost learning algorithm which selects a small number of important features from a large set to give an efficient result of classifiers then use cascading techniques to detect face in an image. Here are some Haar-Features machine learning techniques in which a function is trained from a lot of positive and negative images. This process in the algorithm is feature extraction.

Each feature results in a single value which is calculated by subtracting the sum of pixels under white rectangle from the sum of pixels under black rectangle. Every haar feature has some sort of resemblance to identify a part of the face.

Value = $\sum$ (pixels in white area) – $\sum$ (pixels in black area).

If we consider all possible parameters of the haar features like position, scale and type we end up calculating about 160,000+ features. So, we need to evaluate huge set of features for every 24*24 PX. So, to avoid this we have an idea to avoid redundant features and pick only those features which are very useful for us. This can be done using AdaBoost.

B. ADABOOST

AdaBoost is a machine learning algorithm that is able to find the best features among 160,000+ features. These features are also called weak classifiers. After these features are found a weighted combination of all these features is used in evaluating and deciding if any given window has a face or not. Each of the selected features (weak classifiers) are considered okay to be included if they can at least perform better than random guessing (detects more than half the cases). Each of the weak classifiers is relevant to detecting a part of the face. Output of the weak classifier is binary if it has identified a part of the face or not. The fundamental idea behind AdaBoost is to iteratively train a sequence of weak classifiers, which are typically simple and perform slightly better than random guessing. At each iteration, AdaBoost assigns higher weights to the misclassified data points from the previous iteration, thus emphasizing the samples that are difficult to classify. This iterative process enables AdaBoost to focus on the challenging instances and build a strong classifier that can effectively handle complex data distributions.

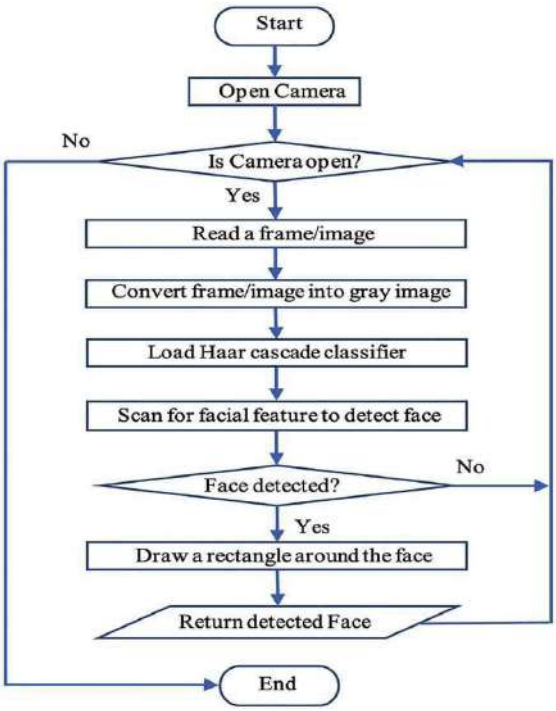

Fig .2 Face Detection Using Haar Cascade Classifier

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III. CONCLUSION

Haar Cascade classifier is a powerful tool in detecting various objects in images and videos, particularly human faces. It has been the subject of much research, and its applications have grown significantly over the years. Its simplicity, accuracy, and real time processing abilities continue to make it a popular algorithm in the field of computer vision technology. The suggested method recognizes individual facial features and verifies a person's identity. Haar-based face detection for real-time applications is a common and powerful face detection algorithm. When applied to a diverse set of test images and real-world scenarios, the classifier consistently achieved high accuracy and robust performance. This is particularly important in applications like security systems and human-computer interaction, where the reliability of face detection is crucial. The Haar Cascade Classifier's speed and efficiency also make it well-suited for real-time applications, as it successfully detected faces in video streams with minimal computational overhead. These findings underscore the practical relevance of the Haar Cascade Classifier in a wide range of computer vision applications, validating its continued use as a fundamental tool for face detection and object recognition tasks.

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PROCESSOR COALLOCATION IN GRID ENVIRONMENT USING WORST FIT POLICY

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ABSTRACT
Grid computing permits virtual organizations to share geographically distributed resources as they pursue common goals, without the need for centralization. This Paper Processor Coallocation with in Grid environment for deals with Processor Coallocation that means accessing multiple idle resources with the help of Worst Fit Policy.

The issue with accessing resources at multiple cluster/sites of a grid simultaneously is to ensure their availability at the initial time, this is the easiest strategy to do so is to reserve processors at each of the selected sites. If the local schedulers do support reservations, this strategy can be implemented by having a grid scheduler obtain a list of available time slots from each local scheduler, reserve a common time slot for all components of an application, and notify the local schedulers of this reservation.

Keywords: Grid Computing, Processor Coallocation

INTRODUCTION
"Grid"" computing has emerged as an important new area that differs from traditional distributed computing in that it focuses on large-scale resource sharing, innovative applications and, in some cases, high performance.

"Grid computing enables virtual organizations (VO) to share geographically distributed resources to pursue common goals without centralized location, control, omniscience, and existing trust relationships" [7,8,10]. Some other definitions for grid computing are

1. The flexible, secure and coordinated sharing of resources through dynamic collections of people, institutions and resources. Transparent, secure, and coordinated resource sharing and collaboration across sites.
2. The ability to form virtual, collaborative organization that share applications and data in an open heterogeneous server environment in order to work on common problems.
3. The ability to aggregate large amounts of computing resources which are geograph- ically dispersed to tackle large problems and workloads as if all the servers and resources are located in a single site.

Coallocation Algorithm
Coallocation algorithm will minimize the total time to execute all jobs (Makespan), minimize the waiting time in the global queue, maximize the resources utilization rate and balance the load among the resources.

Input: : Job Request: JP_L
Input : Resource Provider Speed: *speed*
Input : Advance Reservation List : *ARlist*
Output : Offer : O_c
/* Get resource provider identifier */
1. $c \rightarrow ResourceProviderId$
/* Calculate the execution duration time D of the job JP_L */
2. $D \rightarrow \frac{L}{Speed}$
/* Initialize Offer O_c */
3. $O_c \rightarrow \emptyset$
/* Find all the available free slots in the ARList and put them in the Offer O_c */
4. $i \rightarrow 1$;
5. while *there is an empty slot in the ARList* do
6. $s \rightarrow getAvailableFreeStartTimeIn\ (ARList)$;
7. $n \rightarrow getAvailableFreeProcessorsAtTime(s)$;
8. $S_{(i,c,D)}^{(s,n)} \rightarrow ComposeFreeSlot(s,n,i,c,D)$;
9. $O_c \rightarrow O_c \cup \{ S_{(i,c,D)}^{(s,n)} \}$
10. i→i + 1;
11. end
/* Finaly, return the offer O_c */
12. Return O_c;

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Job Placement Policy

The Worst Fit Policy

The Worst Fit (WF) guideline aims to keep the load on the clusters balanced. It orders the components of a job with an unspecified request type by decreasing size and places them in this order one after the other on the cluster with the largest (remaining) number of unused processors, as long as this cluster has a sufficient number of unused processors. WF leaves as much space as possible in all clusters for later jobs and can therefore lead to coallocation even if all components of the job in question would fit on a single cluster [1].

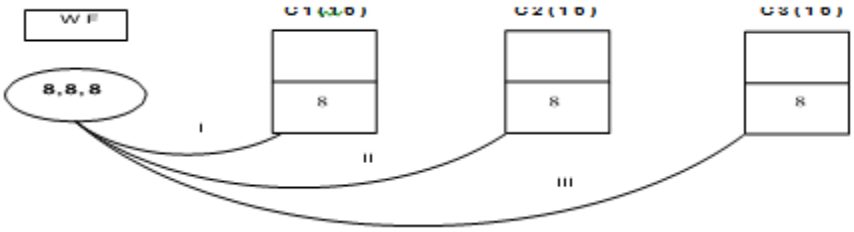

Fig. 1 Worst fit Policy

Proposed System Architecture

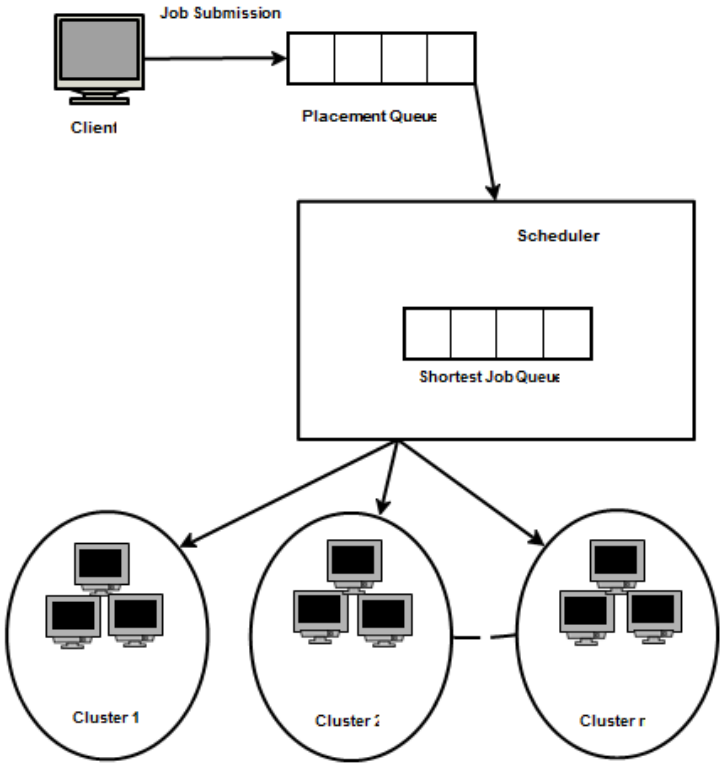

Figure 2: Proposed System Architecture

Algorithm : Worst Fit Policy

Algorithm Worst Fit Policy

1. Start
2. Given a job, order its components in decreasing order of size
3. Order clusters in decreasing order of number of idle processors
4. Parallel job J divide into number of components(j1,j2,. .....jn)
5. Calculate the number of clusters and total number of job component
6. Equal number of job components are given for every cluster
7. Stop

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Experimental Setup

In the simulation, I used the worst fit policy to distribute the workload. I used five clusters named Vrije, Amsterdam, Delft, Multimedia N and Leiden. Each cluster has 85, 41, 68 and 46 32 nodes respectively. I have to send gridlets (50-200) to these clusters using WF policy and measure the average processing time, average utilization rate and acceptance rate.

Simulation Results

Fig. 5 shows Visualizer which shows graphical user interface. By clicking menu "start" we are able to see each resource output graphically. Again, this visualizer has three buttons, their functionalities are given below

- By using Step by Step, we can simulate project stepwise.
- By using Slow Motion, we can simulate project in slow motion which shows gridlets movements slowly.
- By using Run, we can able to see output by making instant execution.

We can give pause condition in seconds. This visualizer shows number of resources available in grid and have their details. Finally, it will display total simulation time.

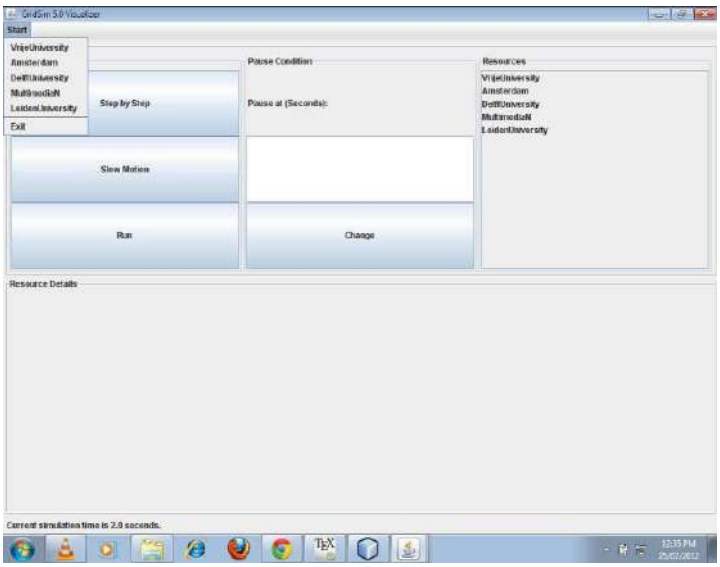

Figure 5: Gridsim Visulizer

Following results shows gridlet movements in each cluster and again it shows gridlet id, user id, Job submission time, start time, total duration, length of gridlet and Number of PE's required for particular gridlet.

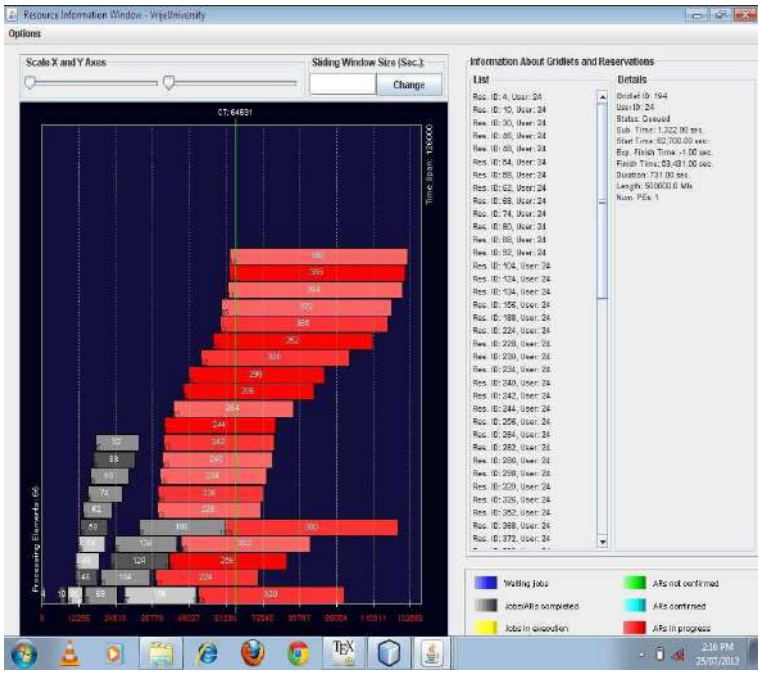

Fig 6: Gridlet Movement in Cluster Vrije

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Performance Metrics

Average Resource Utilization

Resource utilization is defined as the percentage of time a resource is busy executing jobs. In order for the grid resources to be used efficiently, the grid manager should increase their utilization rate to reduce their idle time.

$$u = \sum_{j=1}^{m} u_j / m$$

Where, m = No. of resources, u_j = Individual resource utilization rate.

$$u_j = \sum_{i=1}^{n} (t_{ci} - t_{si}) * r_{ij} / T$$

Where, r_{ij} = 1 if j i is allocated to R_j j, else 0 , t_{ci} = Completion time of job j_i, t_{si} = Start time of job j_i , T = Total simulation time.

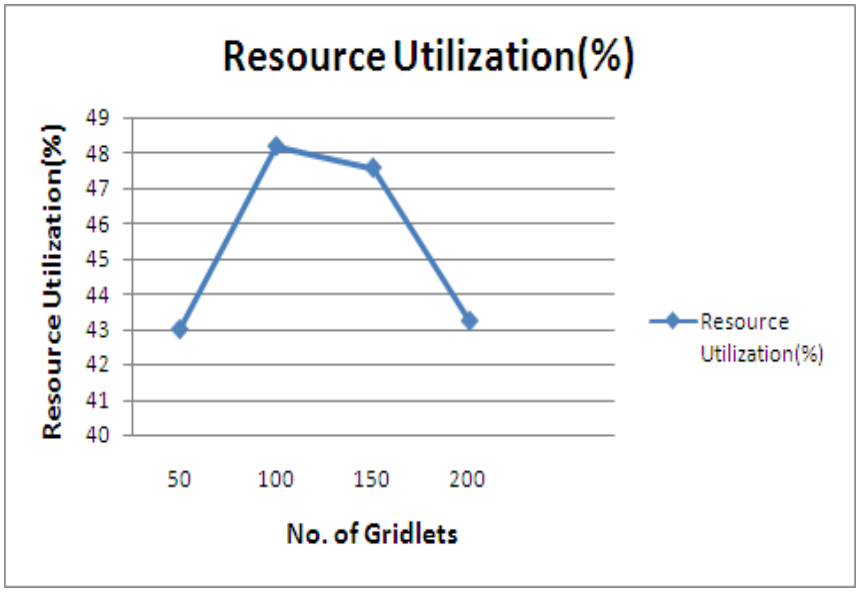

Fig. 7 Resource Utilization in grid

Average Job Response Time

Average Job Response time is a measure of responsiveness for the scheduling mechanism. This is the average job responce time which we can calculate as

$$AWT = \sum (e_j - s_j)/J \text{ for all J jobs}$$

Where, e_j = start time of Job, s_j = Job submission time

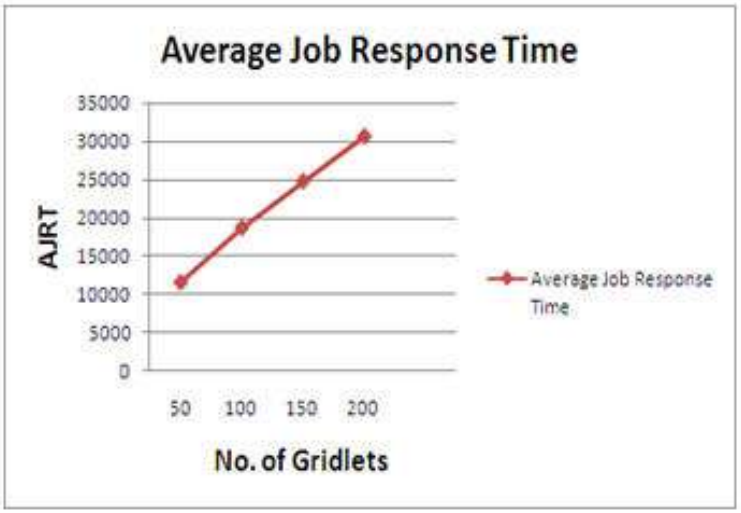

Figure 8: Average Job Response Time

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Figure 7 shows Average Job Response Time which I have calculated from start time and job submission time. I have calculated average job response time in second and from results it is observed that as number of job components increases, the average response time also increases.

CONCLUSION

The average job response time increases when the number of gridlets increases. The average resource utilization rate is better, and when the number of gridlets is increased. The worst fit policy is beneficial when we consider load balancing in grid environment.

FUTURE WORK

Although there is a great opportunity for many scientific parallel applications to benefit from the co-allocation of processors, there are still many problems such as improving the re-source utilization rate, efficient communication libraries and the reliability of the system.

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SURVEY ON AUTOMATIC TEXTUAL SUMMARY GENERATION MECHANISM USING MULTI-MODAL SUMMARIZATION APPROACH

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ABSTRACT
Automatic textual summary generation is a crucial task in the era of information overload, enabling users to quickly grasp the key points of a document without reading the entire text. Multi-modal summarization has emerged as a promising approach to enhance the quality and effectiveness of textual summaries by incorporating information from additional modalities, such as images, videos, and audio. This survey paper provides a comprehensive overview of multi-modal summarization, discussing various approaches, challenges, and opportunities in this field. This paper reviews the existing techniques, challenges, and future directions in the domain of multi-modal summarization for automatic text summary generation.

Keywords: Automatic textual summary generation, Information overload, Key points, Document summarization, Multi-modal summarization

I. INTRODUCTION

The rapid growth of digital information has led to an abundance of text documents, making it increasingly challenging for users to effectively access and process the vast amount of available information. Textual summary generation addresses this challenge by producing concise and informative summaries of text documents, enabling users to quickly grasp the key points without having to read the entire text. [I]Traditional text summarization approaches have primarily focused on extractive summarization, where key sentences are identified and extracted from the input text to form the summary. However, these approaches often fail to capture the full context and nuances of the original text, especially when dealing with complex or lengthy documents. Multi-modal summarization has emerged as a promising approach to overcome the limitations of traditional text summarization methods. By incorporating information from multiple modalities, such as images, videos, and audio, multi-modal summarization can provide a more comprehensive and engaging representation of the content. [II]Automatic Textual Summary Generation has emerged as a pivotal solution to address this challenge, offering a mechanism to distill essential information and present it in a concise and coherent form. As the complexity of the digital landscape increases, there is a growing need for more sophisticated approaches to summarization. In response to this demand, the integration of Multi-Modal Summarization approaches has emerged as a promising frontier, allowing for a more comprehensive and nuanced representation of information.

II. Multi-Modal Summarization Approaches

Multi-modal summarization approaches can be broadly categorized into two main types: extractive and abstractive.

Extractive Multi-Modal Summarization

[III]Extractive multi-modal summarization methods identify and extract key sentences from the input text and relevant information from other modalities, such as images, videos, or audio. These methods typically employ techniques such as sentence salience, image captioning, and speech recognition to extract relevant information from different modalities.

Abstractive Multi-Modal Summarization

Abstractive multi-modal summarization methods generate new sentences that capture the essential information from the input text and other modalities. These methods often employ neural network architectures, such as sequence-to-sequence models, to learn the complex relationships between different modalities and generate coherent and informative summaries.

Challenges and Opportunities

Despite significant progress in multi-modal summarization, several challenges remain. One challenge is effectively integrating information from different modalities, as the relationships between modalities can be complex and may vary depending on the specific task. Another challenge is ensuring that the generated summaries are fluent, informative, and consistent with the original content.

Despite these challenges, multi-modal summarization offers promising opportunities for enhancing the quality and effectiveness of textual summaries. By leveraging additional information sources, multi-modal summarization can provide a more comprehensive and engaging summary experience for users.

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- The following Fig a illustrates the general process of multi-modal summarization:

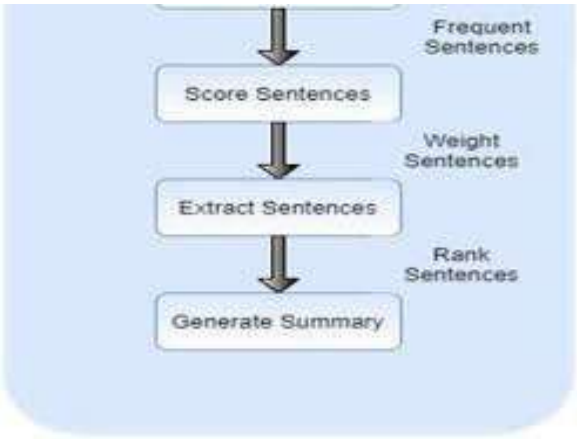

Fig. a multi-modal summarization:

- In this diagram, the input document is first processed by separate modules for each modality, such as a text processing module, an image processing module, and an audio processing module. Each module extracts relevant features from its respective modality. The extracted features are then combined and fed into a fusion module, which learns to integrate information from different modalities. The fusion module outputs a representation of the input document that captures information from all modalities. This representation is then used by a summarization module to generate a summary of the input document.
- This is just a general overview of the multi-modal summarization process. The specific details of each module will vary depending on the specific task and the available data.

Evaluation Metrics for Multimodal Summarization

Evaluating the quality of multimodal summaries is a challenging task due to the inherent complexity of multimodal content. Various metrics have been proposed for evaluating multimodal summaries, including:

1. **Readability:** Measures the fluency and coherence of the generated summary.
2. **Informativeness:** Assesses the summary's ability to convey the essential information from the input modalities.
3. **Fidelity:** Evaluates how well the summary preserves the original meaning of the input modalities.

Applications of Multimodal Summarization

Multimodal summarization has a wide range of applications, including:

1. **News summarization:** Generating summaries of news articles that include text, images, and videos.
2. **Product reviews summarization:** Providing concise summaries of product reviews that incorporate text, images, and ratings.
3. **Educational video summarization:** Creating short summaries of educational videos that highlight key points and concepts.

Challenges and Opportunities

Multimodal summarization faces several challenges, including:

1. **Multimodal representation:** Effectively representing and integrating information from multiple modalities.
2. **Cross-modal understanding:** Understanding the relationships between different modalities.
3. **Summary generation:** Generating fluent, coherent, and informative summaries from multimodal content.

Despite these challenges, multimodal summarization offers promising opportunities for improving the way we summarize and understand complex information. Future research directions include[IV]:

- **Developing more effective multimodal representation techniques.**
- **Improving cross-modal understanding through machine learning and deep learning approaches.**

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- **Designing more sophisticated summary generation models that can capture the nuances of multimodal content.**

III. CONCLUSIONS

Multi-modal summarization has emerged as a powerful tool for generating informative and engaging summaries of complex documents. By incorporating information from multiple modalities, multi-modal summarization can provide a more comprehensive and nuanced understanding of the content. While several challenges remain, multi-modal summarization holds great potential for advancing the field of text summarization and providing users with more effective ways to access and understand information. Multimodal summarization is a rapidly evolving field with the potential to revolutionize the way we interact with information. By combining information from multiple modalities, multimodal summarization can provide more comprehensive, informative, and engaging summaries than traditional text-based summarization methods. As the field continues to develop, we can expect to see multimodal summarization applications in a wide range of domains, including news, education, and entertainment.

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A SURVEY ON TEXT EXTRACTION FROM DOCUMENT USING CONVOLUTIONAL NEURAL NETWORK

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ABSTRACT
In day to day life manually extracting of meaning full text from document is high risk but by using Deep Learning approach such as convolutional neural network (CNN) is a type of artificial neural network used primarily for image recognition and processing due to its ability to recognize patterns in images, demonstrated impressive capabilities in detecting and extracting textual information with high accuracy from diverse document types. By training on labelled samples, CNN can identify and locate specific information, facilitating efficient data extraction, CNN is ability to capture semantic context further enhances its capability to extract meaningful content. CNN is used to recognize and transcribe the word in the region to detect the text. It can reduce the human efforts which are used in to extracting text form document.

Keywords: Deep Learning, Text Extraction, Convolutional Neural network (CNN), Information Extraction.

I. INTRODUCTION
The primary purpose of using CNNs in text Extraction from documents also known as keyword extraction or information extraction, is the process of automatically identifying and extracting relevant words, phrases or entities from unstructured text data. This eliminates the need for manual data entry, saving time and effort. Text extraction is a technique in which we convert scanned page or image which have captions to ASCII code that a machine can recognize or categorize them accordingly in [3].Text information present in pictures and video contain valuable information. Text extraction from image has stages of detection of the text from given image, finding the text location, extraction, and recognition of text from the given image. Text extraction techniques play an important role in multimedia knowledge categorization and retrieval[1].Text detection and recognition is used to get the extracted text in a document using the state of the art algorithms such as Convolutional neural network in [2]. Target text region identification and classification are two separate phases in text extraction. Text detection and recognition works in two steps. The first step is to detect the regions in the image potentially containing text. The second step performs text recognition where for each of the detected regions, a CNN is used to recognise and transcribe the word in the region to detect the text in [2]. The resulting target text regions were sent through many layers of CNN, which initially created a convoluted feature map in [4].Text detection and Recognition of images are based on the analysis and identification of scanned documents and images in [6].A convolutional neural network is a feed forward neural network that is used to analyse images by processing data and used to detect and classify various objects in the image.

Convolutional neural network is the artificial replica of the neural network in which state of neurons are involved. The system is capable of training the model itself just like a brain processes and learns itself.CNN are inspired by the working of brain and how neurons collaborate themselves for the recognition of patterns and analysis of visual information.CNN architecture is composed of convolutional layer and pooling layer which are placed on top of each other can be extended to many layers in [5].Convolutional neural network are used to find patterns in the image. We do that convoluting over an image and looking for patterns. In the first few layers of CNNs the network can identify lines and corners, but we can then pass these patterns down through the neural network and start recognising more complex features as we get deeper in [2].

II. LITERATURE REVIEW
1. "A Survey: Text Extraction from Images and Video" by Vivek Sapate provides a study of the various text extraction techniques and algorithms .The proposed system is capable of detecting and recognising texts of various scales, colors and fonts. A text image analysis is required to modify a text information system to be used for any kind of Image as well as scanned document pictures and real scene pictures through a video camera.

2. "Text Extraction from Images using Convolutional Neural Network" by Bharati V,Sudarshan Rao M,Aditi J,S G Aditya Bharadwaj,S Srividhya uses a text extraction model that is designed to process the images that are uploaded by the user. Images along with the texts have become one of the common ways to exchange information hence understanding these images plays an important role. Today most of the information is available either on paper or in the form of photographs. The current technology is restricted to extracting text

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against clean backgrounds. Thus, there is a need for a system to extract text from general backgrounds. The Current system can extract text from images and perform search action for a particular keyword and also store the extracted text in a document which is in an editable format.

3. "Image Classification and Text extraction using Convolutional Neural Network" by Rabia Zaman, Rafia Bashir and Atif Raza Zaidi uses the technique in this paper that broaden the perception of deep learning methods. It provides dynamic computational models along with nonlinear processing elements arranged in layers. As we know that deep learning serves with multiple neural network techniques, here is popular approach used: CNN for image classification and text extraction.
4. "A Survey on Text Recognition from Natural Scene Images**"** by Revathy A.S,Anitha Abraham and Jyothis Joseph proposed comparative study and evaluated according to two types of classification. Deep learning methods are more accurate and give better results than image processing methods. From the Comparative study; it was found that the deep learning method gives more accuracy. Accuracy, precision, recall and F-measure are the evaluation measurements adopted to determine the performance of methods.
5. "Review paper on CNN Based Computer Vision**"** by Manish Kumar Singh has proposed the review on CNN and it is found that CNN is the most advanced way of extracting features and Classifying the objects .Its unique capacity of extracting the features from any kind of image makes it relevant for wide variety of task .However more model has to be developed so that it can itself define which algorithm will work on a specific type of task and enhance the capacity of a machine to adapt to the requirement automatically.
6. "Text Extraction from an Image using Convolutional NeuralNetwork"byP.Rajeshwari D. Vinay Sekhar Reddy,G.Pranay,Mohd Arbaz Mazharuddin develop effectively a deep learning model that can extract data from a given image in both structured and unstructured environments with the highest possible accuracy In this paper, they eliminate the need for manual text reading in images.

Certain characters may not be recognised correctly in a few circumstances, character may be misidentifying another character. The experiments in this paper show that the majority of the text is effectively recognised and that the recommended methodology is effective.

III. ARCHITECTURE OF CNN

1. Convolutional layer

Convolutional layers are primarily used in Convolutional Neural Networks (CNNs) for image processing tasks, such as image classification, object detection, and image segmentation. These layers are particularly effective for extracting features from images, but they are not typically used for the direct extraction of text from documents.CNN has crucial role in detecting features in input images. Primary function of Convolution layer is to perform Convolutions on input images. The first few layers of a CNN consist of convolutional filters or kernels. These filters slide across the input image and perform convolutions, which involve element-wise multiplication and summation of pixel values within a small receptive field. Convolutional layers are designed to detect local features and patterns, such as edges, corners, and textures. Practice, multiple filters are used in each layer. Each filter is responsible for capturing different types of features from the input. The output feature map is a stack of feature maps, one for each filter. Each feature map represents a different aspect of the input data. Output is then transferred to next layer.

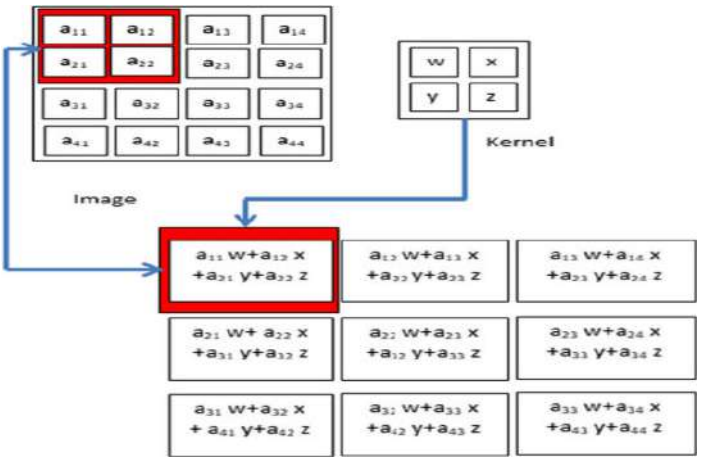

Fig: 1 Convolutional layer

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2. Pooling Layer

Reduces the amount of data created by Convolutional Layer so that it is stored efficiently. It decreases the size of feature map to reduce the computational cost. A pooling layer in a Convolutional Neural Network (CNN) is a fundamental component used for down-sampling or subsampling the spatial resolutions of the feature maps produced by the convolutional layers. Pooling layers reduce the size of the feature maps, which helps in controlling the computational complexity of the network and can also aid in making the network more robust to small variations in the input dataThe two most commonly used pooling operations in CNNs are:1. Max Pooling:- In max pooling, for each region of the input feature map (usually a small grid), the maximum value is retained while the other values are discarded. - It helps to capture the most important information in a local neighbourhood. - Max pooling is often used for tasks like image classification.2. Average Pooling:- In average pooling, for each region of the input feature map, the average (mean) value of the elements in that region is computed- Average pooling is sometimes used in scenarios where smoothing or reducing noise in the data is desired.

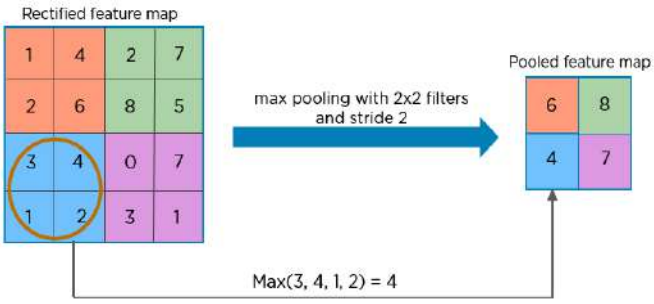

Fig: 2 Pooling Layer

3. Fully Connected Layer

Fully connected layers are traditional artificial neural network layers where each neuron is connected to every neuron in the previous and subsequent layers. These layers learn complex relationships between the extracted features and the classes or labels of the disease types. Consists of Neurons that are fully connected to flattened feature vector. Numbers of neurons are based on number of classes of crops or diseases to be classified. For classifying different kinds of crops, there would a neuron for each class. Fully connected layers, also known as dense layers, are an integral part of Convolutional Neural Networks (CNNs) used for crop disease identification.

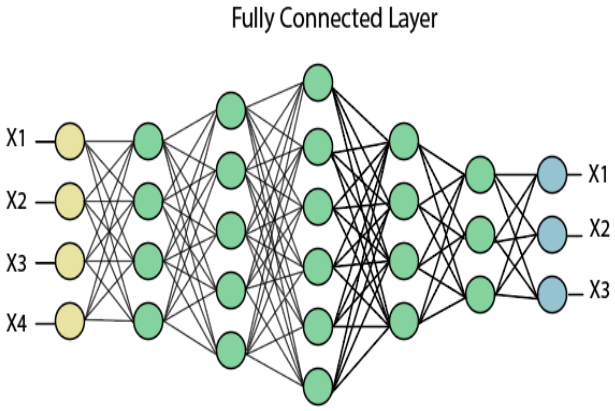

Fig: 3 Fully Connected layer

IV. APPLICATIONS

1. Academic Research:

Researchers can use automated text extraction to extract relevant information from academic papers, scientific articles for literature review and data analysis.CNNs are extensively used for image classification tasks in various domains such as biology, astronomy, and geology. Researchers use CNNs to automatically classify and categorize images, making it easier to analyse and interpret large datasets.

2. Self-driving cars:

CNN has been used within the context of automated vehicles to enable them to detect obstacles or interpret street signs. This is essential for the car to navigate safely and make real-time decisions. Lane Detection and Tracking: CNNs can be employed to detect lane markings on the road and track the vehicle's position within the lanes.

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3. Document Classification:
CNNs can be used to automatically classify document into categories based on their content. The textual content of documents is pre-processed to remove noise, tokenize words, and create numerical representations (e.g., word embeddings or one-hot encodings). CNNs are applied to the encoded text data. Convolutional layers extract local patterns and features from the text, similar to how they extract features from images.

V. CONCLUSION

CNNs have revolutionised the field of text extraction and they are now the de facto standard for this task. CNNs are able to achieve high accuracy and efficiency, and they are able to handle a variety of document types and image formats. Their ability to learn complex patterns and relationships in visual data makes them well suited for identifying text region, recognizing characters, and handling various document formats. As research in this area continues to grow, we can expect to see even more improvements in the accuracy and efficiency of text extraction using CNNs.

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DATA STORAGE SECURITY BY IMPROVED REA ALGORITHM IN CLOUD COMPUTING

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ABSTRACT
This paper discusses the data storage security in cloud computing. It is an investigation into cloud data and security-related issues around it. As everyone knows that cloud computing is a new arena, and data security must be ensured across the network. Many enterprises use cloud computing to store massive amounts of data on the clouds. As a result, there is a need to safeguard data in the form of text, audio, video, and so on. Many techniques have been developed by researchers to secure data in the cloud like Encryption and Decryption algorithms. In this paper a new encryption algorithm is proposed, called as improved Reverse Encryption Algorithm (REA).In existing REA, encryption is performed only once to provide the security but our approach is to improve the security which makes the algorithm more efficient and robust. In improved REA encryption algorithm, the security is more than existing REA because number of iteration increases, complexity of decrypting the text increases.

So, in this way, performance evaluation shows that the proposed method is able to

Provide more security than other cryptographic algorithm as well as the number of iterations is inversely proportional to the size of file.

Keywords: Data Security, Cloud, REA.

I. INTRODUCTION
Cloud computing can be envisioned as the next generation information technology architecture for enterprises, due to its long list of unprecedented advantages in the IT history: on-demand self-service, ubiquitous network access, location independent resource pooling and rapid resource elasticity [1]. As a disruptive era with profound implications, cloud computing is reworking the very nature of ways groups use facts Technology. One fundamental aspect of this paradigm shifting is that data are being centralised and outsourced to the cloud. From users' perspective, consisting of each people and IT enterprises, storing records remotely to the cloud in a bendy on call for way brings attractive benefits: universal data access with location independence and avoidance of capital expenditure on hardware, software and personal maintenances etc. [2].

While cloud computing makes these advantages more appealing than ever, it also brings new and challenging security threats toward user's outsourced data. Since Cloud provider providers (CSP) are separate administrative entities, information outsourcing is truly relinquishing users' remaining manipulate over the destiny in their information. As a result, the correctness of data in the cloud is being put at risk due to the following reasons: First of all, although the infrastructure under the cloud is much more powerful and reliable than personal computing devices, they are still facing the broad range of both internal and external threats for data integrity [3].

In data storage systems [4], users can store their data on external proxy servers to reduce maintenance cost and enhance access and availability. To defend the confidentiality of the outsourced files, the proprietor encrypts them previous to outsourcing them to an untrusted proxy server. The proxy server can perform some functions on the ciphertexts, such that an authorized user can access the desired sensitive files [5]. Although cloud storage provides many appealing benefits for users, it also prompts a number of security issues towards the outsourced data [6].The data stored on the cloud is easily be corrupted, modified or deleted due to hardware failure thus protecting the correctness and integrity of the data in the cloud is highly essential.

II. RELATED WORK
The bucketing approach [3, 5, 6] is dividing the plaintext domain into many partitions (buckets). The encrypted database withinside the bucketing technique is augmented with extra information (the index of attributes), thereby permitting question processing to a point on the server without endangering facts privacy. In the bucketing approach encrypted database contains etuples and equivalent bucket-ids (where many plaintext values are indexed to same bucket-id. In this scheme, query execution over the encrypted database is primarily based at the index of attributes. The end result of this query is a superset of statistics containing fake high-quality tuples. These fake hits ought to be eliminated in a publish filtering system after etuples revert via way of means of the queries are decrypted. Filtering can be complex, because only the bucket-id is used in a join operation,

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especially when random mapping is used to assign bucket-ids rather than order preserving mapping. Because of the row level encryption, the projection operation is not implemented over the encrypted database, in bucketing.

2.1 AES (Rijndael):

The Advanced Encryption Standard (AES) [4] was published by NIST (National Institute of Standards and Technology) in 2001. AES is a block symmetric cipher that is intended to replace DES as the approved standard for a wide range of applications. The AES cipher and other candidates forms the latest generation of block ciphers, and now we see a significant increase in the block size - from the old standard of 64-bits up to 128-bits; and keys size of 128, 192, and 256-bits. NIST selected Rijndael as the proposed AES algorithm. The Evaluation Criteria for selecting AES in the first round are (private key symmetric block cipher, 128-bit data, 128/192/256-bit keys, stronger & faster than Triple-DES, active life of 20-30 years (for long term secrecy).

The final criteria for evaluation were general security, ease of software & hardware implementation, implementation attacks, and flexibility (in encrypt/decrypt, keying, and other factors). After testing and evaluation, NIST announced for selection Rijndael as AES. Rijndael algorithm is flexible in supporting any combination of data and key size of 128,192, and 256 bits. However, AES simply allow 128bit data length that can be divided into four basic operation blocks. These blocks operate on array of bytes and organized as a 4×4 matrix that is called the state. For full encryption, the data is passed through number rounds (10 (key size 128 bits), 12 (key size 192 bits), 14 (key size 256 bits)).

III. PROPOSED METHODOLOGY

REA is a symmetric stream cipher that can be effectively used for encryption and safeguarding of data. It takes a variable-length key, making it ideal for securing data.

Our improved REA encryption algorithm is the modified version of existing REA algorithm. Modification is done by considering the two main parameters like file size and number of iteration that the user wants for encrypting the file. In the existing REA the intruder may attempt to recognize the key by brute force attack or can even guess the key, this hampers the security. Thus, we proposed an improved REA, which provides more security due to the iterative approach used. The main advantage of implementing this iterative approach is that the intruder is not able to recognize the key as well as the no. of iterations used by the user to keep the data secure. The combination of key and no. of iteration makes our approach more secure. Even though the intruder attempts to recognize the key and no. of iteration that is not fruitful as it may take him years together to find the exact combination. In proposed methodology, encipherment and decipherment consists of the same operations, only the two operations are different:

1) Added the keys to the text in the encipherment and removed the keys from the text in the decipherment.
2) Executed divide operation on the text by 4 in the encipherment and executed multiple operation on the text by 4 in the decipherment. Divide operation by 4 is executed on the text to narrow the range domain of the ASCII code table at converting the text.

The details and working of the proposed improved REA with some modifications are given in fig 3.1 and 3.2. Fig 3.1 describes the steps for encryption whereas fig 3.2 shows the steps for improved REA decryption.

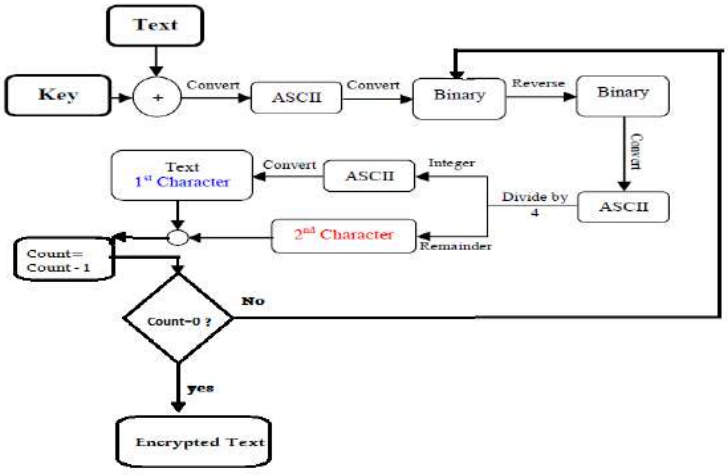

Fig 3.1 Steps for Improved REA Encryption Algorithm

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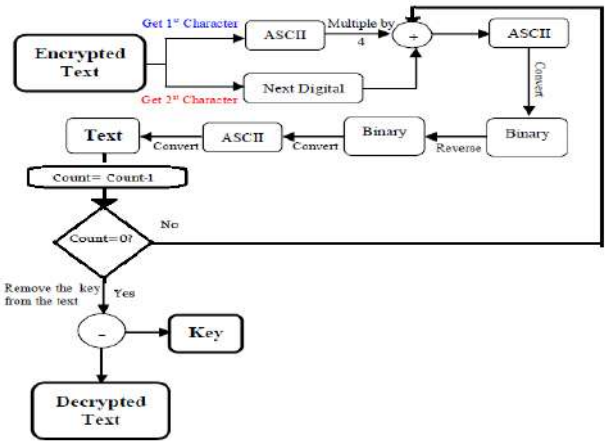

Fig 3.2: Steps for Improved REA Decryption Algorithm

IV. Implementation

Implementation is the stage of the project when the theoretical design is turned out into a working system. Thus, it can be considered to be the most critical stage in achieving a successful new system and in giving the user, confidence that the new system will work and be effective. The implementation stage involves careful planning, investigation of the existing system and its constraints on implementation, designing of methods to achieve changeover and evaluation of changeover methods.

Fig4.1 and 4.2 Shows the snapshot for read and encrypt the file. In this form, there are lots of fields like read the file, enter the key, enter the normal text and encrypt the file. User can upload the file in the encrypted form by providing all the information regarding the file whatever he/she wants to encrypt.

Snapshots to Read and Encrypt the file

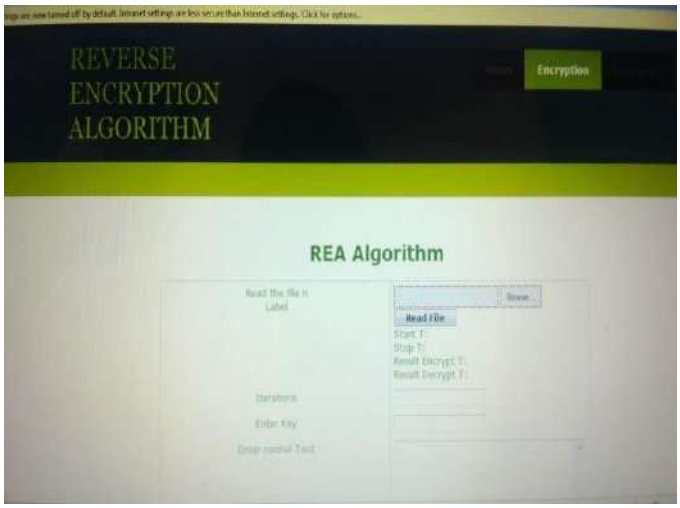

Fig 4.1: Read the File using REA

Fig 4.2: Encryption of file using REA

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Fig 4.1 and 4.2 shows the Reading and Encrypting the file by using REA. After clicking on encrypt file button user can encrypt the file that he/she want to encrypt.

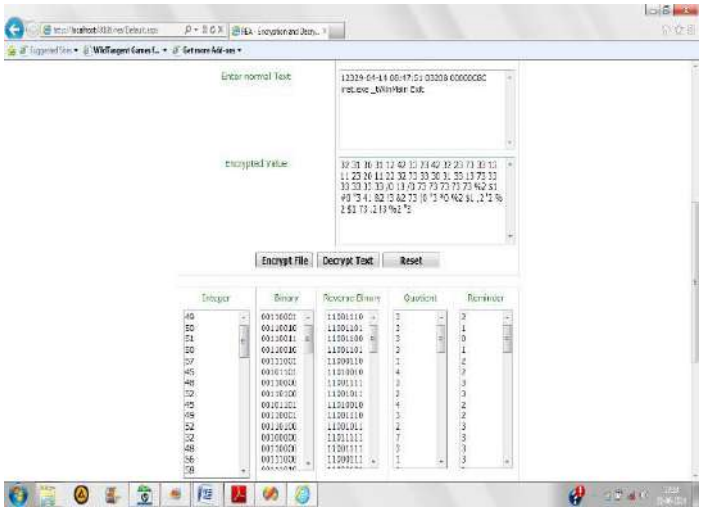

Fig4.3: Snapshot to convert ASCII to Binary

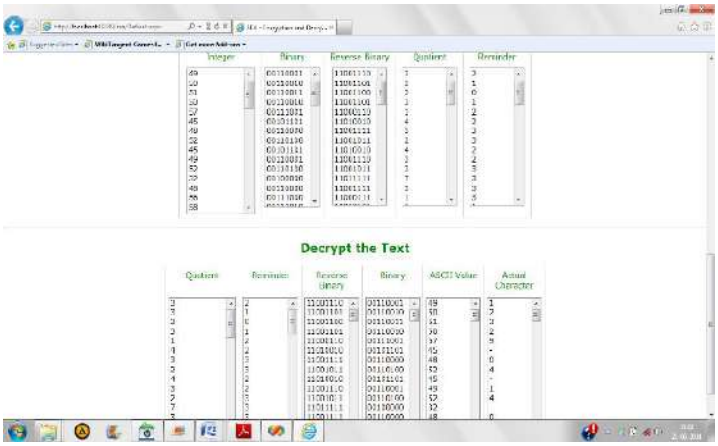

Fig 4.4: snapshot to decrypt the encrypted file

V. RESULT ANALYSIS

Experiment is performed to verify the effectiveness of proposed system.Testing of Proposed system is performed on laptop IV 2.0 GHz Intel processor with 1 MB cache memory,1 GB of memory, and one Disk drive 120 GB. The Operating System which was used is Microsoft Windows 7 professional. ASP.NETis used as programming language, software use is VMware. The values are noted down. Later comparison is done between the numbers of iterations given by user and file size in bytes.

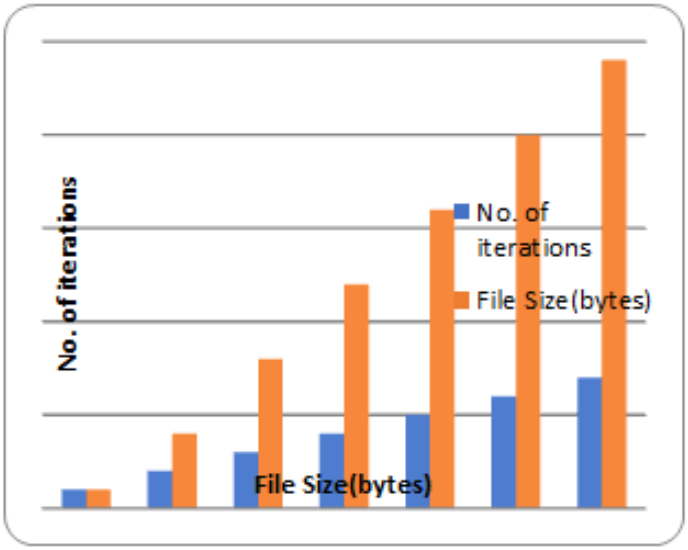

Fig 5.1: Comparison between No. of iterations and file size (in bytes)

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The results for the comparison are shown in Table: 5.1.The results show the superiority of REA algorithm over DES and AES algorithms in terms of the encryption time.

VI. CONCLUSION

Important data in the cloud is stored, which need to be protected from attack as the use of cloud is increasing exponentially in the world. With increase in the use of cloud to store sensitive data, data is stored in encrypted form so the cryptographic support is an important mechanism of securing them. Encrypting sensitive data in the database becomes more and more crucial for protecting from being misused by intruders who bypass conventional access control mechanism and have direct access to the database. People, however, must trade-off performance to ensure the security because the operation of encryption and decryption greatly degrade the performance. For query types that requires extra query processing over encrypted database, the cost differentials of query processing between non-encrypted and encrypted database increase linearly in the size of relations. To solve such a problem REA can implement over encrypted database. Our improved REA encryption algorithm is built on the REA which is more efficient and robust for providing security to the data storage in the cloud.

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REVIEW ON USE OF MACHINE LEARNING TECHNIQUES FOR DEEP MINING

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ABSTRACT
Data mining, also known as knowledge discovery in data (KDD), is the process of uncovering patterns and other valuable information from large data sets. Data mining has improved organizational decision-making through insightful data analyses. Data mining (DM) is a most popular knowledge acquisition method for knowledge discovery. Classification is one of the data mining technique that maps the data into the predefined class and groups. The field of Data Mining is concerned with finding new patterns in large amounts of data. Widely used in Business, medical, marketing, telecommunications, and stock, health care and so on. This paper presents the various classification techniques including decision tree, Support vector Machine, Nearest Neighbor etc. This study provides a comparative Analysis of various classification algorithms.

Keywords: Data Mining, Data Classification, Decision Tree, Bayesian network, Nearest Neighbour, Support Vector Machine (SVM).

I. INTRODUCTION

Data mining is used to extract the required data from large database. Data mining in the database is a new interdisciplinary field of computer science. It is the process of performing automated extraction and generating the predictive information from large database. It is actually the process of finding the hidden information patterns from the repositories. The data mining process used a variety of analysis tool to determine the relationship between data in large database. Data mining consists of the various technical approaches including machine learning, statistic, and database system. The goal of the data mining process is to extract information from large database and transform into a human understandable format. The DM and knowledge discovery are essential components due to its decision-making strategy. In data mining, classification, regression and clustering are three approaches in which instances are grouped into identified classes. Classification is a popular task in data mining especially in knowledge discovery and future plan, it provides the intelligent decision making, classification is not only used to study and examine the existing sample data but also predicts the future behavior to that sample data. The classification includes two phases, first is learning process phase in which the training data is analyzed, then the rules and patterns are created. The second phase tests the data and archives the accuracy of classification patterns. Clustering approach is based on unsupervised learning because there are no predefined classes. In this approach data may be grouped together as a cluster. Regression is used to map data item into a really valuable prediction variable. In Classification technique various algorithms such as decision tree, nearest neighbor, genetic algorithm support vector machine (SVM) etc. In this paper, we examine the various classification algorithms and compare them. In the rest of this paper, we first give Decision Tree Concepts in Section II, Bayesian Network in Section III, K-Nearest Neighbor in section IV, Support Vector Machine in Section V. Introduce some related work in section VI.

II. DECISION TREE

The Decision tree is one of the classification techniques in which classification is done by the splitting criteria. The decision tree is a flow chart like a tree structure that classifies instances by sorting them based on the attribute (feature) values. Each and every node in a decision tree represents an attribute in an instance to be classified. All branches represent an outcome of the test, each leaf node holds the class label. The instance is classified based on their feature value.

There are numerous methods for finding the feature that best divide the training data such as information gain, gain ratio, Gini index etc. The most common way to build decision trees by using top down greedy method partitioning, starting with the training set and recursively finding a split feature that maximizes some local criterion. Decision tree generates the rule for the classification of the data set. The three basic algorithms are widely used that are ID3, C4.5, CART.

A. ID3

ID3 stands for Iterative Dichotomiser 3 and is named such because the algorithm iteratively (repeatedly) dichotomizes (divides) features into two or more groups at each step. It is an iterative Dichotomer . It is an older decision tree algorithm introduced by Quinlan Ross in 1986, ID3 uses a **top-down greedy** approach to build a decision tree. In simple words, the **top-down** approach means that we start building the tree from the top and

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the **greedy** approach means that at each iteration we select the best feature at the present moment to create a node.

Entropy (s): - Σ [P (I) log (2) P (I)]

Where – P (I) refers to proportion of S belong to Class I, S are all the records (instance), C refer as Class, Σ is over C i.e. Summation of all the classifier.

Information Gain(S, A)

= Entropy(S)

- Σ ((|S v|/|S|) Entropy(S v))

-

Where A is feature for which gain will be calculated, V is all the Possible of the feature, S v is the no of element for each V.

B. **C4.5**

The C4.5 is the decision tree algorithm generated Quinlan [15].It is an extension of ID3 algorithm. The C4.5 can be Refer as the statistic Classifier. This algorithm uses gain radio for feature selection and to construct the decision tree. It handles both continuous and discrete features.C4.5 algorithm is widely used because of its quick classification and high precision.

The gain radio "Normalized" the information gain as follows (Quinlan 1993).

$$\text{Gain Radio } (A.S) = \frac{\text{information Gain } (S, A)}{\text{Entropy } (S, A)}$$

C. **CART**

It is stand for Classification Regression Tree. Classification trees are used to predict categorical data, such as whether an email is spam or not, while regression trees are used to predict numerical data, such as the price of a stock. Classification and regression trees are powerful tools for analysing data. Regression trees and classification trees are two different types of tree models used in machine learning. The term 'classification and regression tree' (CART) is often used to refer to either type - but they both use the same algorithm, a decision tree-like structure diagram. A regression tree uses data from a set to predict an outcome or target value. It starts with a single root node which breaks down into smaller nodes until it reaches its maximum depth.

Table I: Comparison of Decision Tree Algorithm

Algorithms	ID3	C4.5	CART
Measure	Entropy info gain	Entropy info gain	Gini diversity index
Procedure	Top-down decision tree construction	Top-down decision tree construction	Constructs binary Decision tree
Advantages	1.Easy to understand. 2) In final decision whole training example is taken.	1. It handles training data with missing feature values. 2. It handles both continuous and discrete features	1. CART doesn't Require Variables to be Selected advance. 2. It easily Handles outliers.

III. BAYESIAN NETWORK

A Bayesian Network (BN) is a graphical model for relationships among a set of various variable features. This graphical model structure S is a directed acyclic graph (DAG) and all the nodes in S are in one-to-one correspondence with the features of a data set. The arcs represent influences among the features while the lack of possible arcs in S encodes conditional independence.

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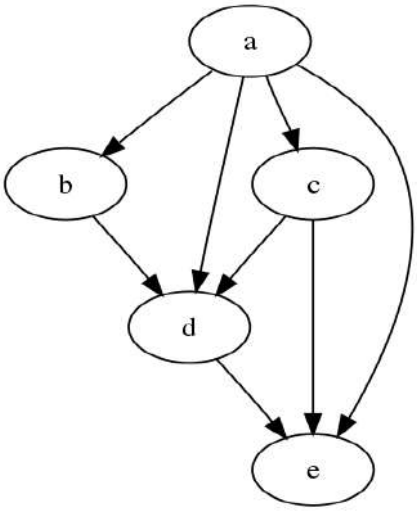

Fig.1: Example of a directed acyclic graph

Bayesian classifier has exhibited high accuracy and speed when applied to large databases.

Bayesian networks are used for modelling knowledge Bioinformatics, engineering, medicine, Bio- monitoring, Semantic search image processing. The Naïve Bayes Classifier is based on Bayes Theorem.

Theorem is P (H|X) = P (X|H) P (H) P (X)

H- Some hypothesis, such that data tuples X belongs to specified class C

X – Some evidence, describe by measure on a set of attributes

P (*H*|*X*) – posterior probability that the hypothesis

H holds given the avid

X *P (H)* – prior probability of H, independent of X

P (*X*|*H*) – posterior probability that of X conditioned on H.

IV. K-NEAREST NEIGHBOUR

The K-Nearest Neighbor (NN) is the simplest method of machine learning. In which object classifies based on the closest training example in the feature space. Its role implicitly computes the decision boundary and it is also possible to compute the decision explicitly. So the computational complexity of NN is the function of the boundary complexity. The neighbors are selected from a set of objects for which the correct classification is known. No explicit training step is required this can be thought of as the training set to the algorithm. The k-NN algorithm is sensitive to the local structure of the data set. This is the special case when k = 1 is called the nearest neighbor algorithm. The best choice of k depends upon the data set; higher values of k diminish the effect of noise on the classification but make boundaries between classes less distinct. The various heuristic techniques are used to select the good K. KNN has some strong consistency results. As the infinity approaches to data, the algorithm is guaranteed to yield an error rate less than the Bayes error rate. If the value of k is small then noisy samples may win the majority votes, which results in misclassification error. That can be solved with larger value of k.

A. Advantages

1. Easy to understand and implement classification technique.

B. Disadvantages

1. Computational costs are expensive, when sample is large.

2. The local structure of the data is very sensitive and require large storage

V. SUPPORT VECTOR MACHINE

The support vector machine [SVM] is a training algorithm. It trains the classifier to predict the class of the new sample. SVM is based on the concept of decision planes that defined decision boundary and point that form the decision boundary between the classes called support vector treat as parameter. SVM is based on the machine learning algorithm invented by vapnik in 1960‘s. It is also based on the structure risk minimization principle to prevent over fitting.

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There are 2 key implementations of SVM technique that are mathematical programming and kernel function. It finds an Optimal separates hyper plane between data point of different classes in a high dimensional space. Let's assume two classes for classification. The classes being P and N for Yn= 1,-1, and by which we can extend to K class classification by using K two class classifiers. Support vector classifier (SVC) searching hyper plane. But SVC is outlined so kernel functions are introduced in order to non-line on decision surface.

VI. RELATED WORK

Imas Sukaesih Sitanggang et al [1] Propose a new spatial decision tree algorithm which is based on the ID3 algorithm for discrete features represented in polygons, points and lines. The proposed algorithm employs the spatial information gain for choosing a best splitting layer from a set of explanatory layers. They Used spatial datasets that are composed by a set of layer.

The proposed algorithm divides the layer into two groups: explanatory and one reference layer and spatial Relationship are applied for construction tuples. Each of the layer has own attribute. In this approach two layers are associated and produce a new layer of spatial relationship. Author shows that this proposed algorithm is 74.72% in real spatial data set.

Khatwani, S. et al [2] proposed Id3 algorithm to create multiple decision tree each of predicts the performance based on the feature. They use the genetic algorithm for fitness function and apply on the Id3 tree to improve on id3 performance.

Nishant Mathur et al [3] precede an ID3 tree based on the Havrda and Charvat Entropy. They analyze that traditional ID 3 algorithm is based on Shannon entropy and proposed entropy and show that traditional id3 contain large no of leaf node.

Sathyadevi, G. et al. [4] propose CART derived model along with the extended definition to identify Diagnosing hepatitis disease provided an efficient classification accuracy based model.

Biao Qin et al [5] proposed novel Bayesian classification technique that is based on the uncertain data. They take 20 data sets from UCI repository and apply uncertain Bayesian classification and prediction technique. Their Implementation proposed algorithm in Weka and show that the result of the proposed approach is better than the Bayesian Classification.

David Tania [6] presents absolute taxonomy of Nearest Neighbor Queries in spatial databases, the taxonomy comprises four perspectives: space, the result, query-point, and relationship.

Xiubo Geng et al [7] proposed a machine learning K nearest neighbor method for query dependent ranking. They first consider the online method and next consider two offline methods which create a ranking model to enhance the efficiency of ranking in advance and approximation are accurate in terms of difference in loss of prediction .

A. Moosavian et at [8] proposed a technique that produces the fault detection of engine journal bearing.

The proposed technique is based on the feature selection and machine learning technique. They use SVM and KNN algorithm for classifying the journal bearing fault condition in the system. They show that the proposed algorithm has possibilities and abilities in the fault diagnosis.

Xuemei Zhang et al [9] propose a structure Risk minimization technique in SVM for minimizing the misclassification; they employ a risk decision rule of empirical risk Minimization (ERM) for a non-separable sample in MATLAB. Shows computational result is better than the SVM.

VII. CONCLUSION

This paper specifies various classification techniques used in many fields, such as Decision Tree, Bayesian network, Nearest Neighbour, Support Vector Machine (SVM). Generally Decision trees and Support vector machines have different operational profiles, where one is very accurate the other is not and vice versa. On the other hand, decision trees and rule classifiers have a similar operational profile. Various algorithms will be combined for classifying the data set. This paper provides compressive overview of various classification techniques used in different fields of data mining. In any field one classification technique is more useful than another. This paper presents various classification techniques. One of the above techniques can be selected based on the required application conditions.

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REAL TIME MONITORING AND UNVEILING OF CYBER THREATS USING SIEM FRAMEWORK

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ABSTRACT
The real-time monitoring and unveiling of cyber threats using a Security Information and Event Management (SIEM) framework is a vital component of modern cybersecurity. SIEM systems play a pivotal role in safeguarding organizations by collecting, aggregating, and analyzing data from various sources in real-time. Through sophisticated event correlation algorithms, they identify and alert security teams to potential security incidents. SIEM solutions help organizations proactively detect threats by correlating events and anomalies across networks, servers, and endpoints. This allows for immediate response and mitigation efforts. They incorporate predefined rules, heuristics, and threat intelligence to enhance threat detection accuracy. By providing detailed information and historical data, SIEM systems assist security analysts in Investigating and understanding the nature and scope of incidents. This proactive approach aids in the prevention of data breaches and cyber attacks. Furthermore, SIEM frameworks facilitate incident response by enabling organizations to orchestrate effective, organized actions in response to confirmed security breaches. These frameworks also support compliance efforts by generating reports that assist in demonstrating adherence to regulatory requirements.

Keywords: SIEM, SIM, SEM, Log Management, Cyber Threats.

I. INTRODUCTION
Security information and event management (SIEM) is a field within the field of computer security, where software products and services combine security information management (SIM) and security event management (SEM). SEM analyzes logs and events data and helps in providing threat monitoring, incident response, and event correlation. SIM, on the other hand, reports, collects, and analyzes log data. SIEM is a software solution that helps monitor, detect, and alert security events. It presents a centralized view of the IT infrastructure of a company. It also helps cyber security professionals to gain insights into the ongoing activities in their IT environments. Depending on the in-built organizational rules, SIEM not only detects an incident but resolves it for better compliance. The process becomes automatic creating alerts for potential intrusions [2].

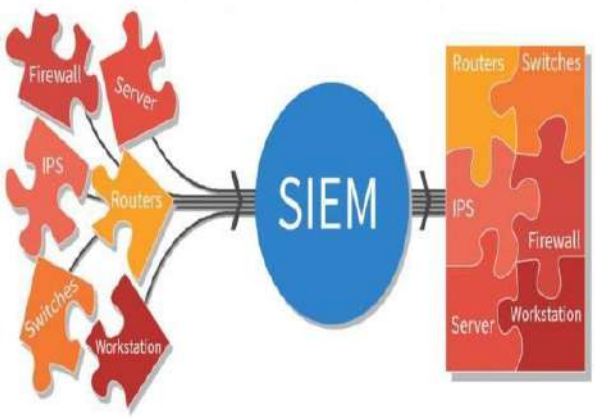

Figure 1: SIEM Framework

SIEM software works by collecting log and event data produced from applications, devices, networks, infrastructure, and systems to draw analysis and provide a holistic view of an organization's information technology (IT). SIEM solutions can reside either in on premises or cloud environments. Analyzing all of the data in real-time, SIEM solutions use rules and statistical correlations to drive actional insight during forensic investigations. SIEM technology examines all data, sorting threat activity according to its risk level to help security teams identify malicious actors and mitigate cyberattacks quickly. This cyber security solution detects abnormalities across all network applications, from multiple vendors of hardware and software. It also allows businesses to monitor their virtual environments and software-as-a-service (SaaS) solutions using one security tool. By covering all of these attack surfaces and endpoints, SIEM allows businesses to stay ahead of both external and internal security threats, and to respond quicker to security incidents through automation and intelligent alerts. Effective forensic and reporting capabilities make SIEM the perfect solution for compliance obligations.

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Several companies have developed SIEM software products in order to detect network attacks and anomalies in an IT system infrastructure. Among them, we can find classical IT companies like HP, IBM, Intel, McAfee and others with more visionary options and promising tools to be taken into consideration in a SIEM context (e.g., Splunk, LogRhythm, QRadar) [3]. initially companies invested a major chunk of their resources on intrusion detection and prevention system that were useful in identifying external security threats.

However, as these systems relied on engines that are signature based, there were high chances of false-positives. This gave rise to first generation SIEM that aimed at reducing signal to noise ratio, thus helped in capturing the most significant security threat. Any event that was in violation of security policy was detected using rule-based correlation method. By tradition, SIEM has exacted quite a lot of monetary and time investment but it has also done away with the issue of false alerts thereby efficiently carrying out the security task. The system was running all well till new and complex threats emerged. The large amount of data generated throughout the IT thread, like various applications, routers, switches, OS, firewalls, IDS or IPS is a little too much for SIEM to handle. Hence, with the objective of monitoring the activities of user instead of managing external threat, a separate log management system came out.

II. HISTORY

SIEM, Security Information and Event Management, was introduced in early 21st century to assist organizations detect probable data breach or cyber-attack as early as possible [1]. The term and the initialism SIEM were coined by Mark Nicolett and Amrit Williams of Gartner in 2005. The concept of log management and analysis began in the early 1990s with the advent of firewalls and intrusion detection systems. This was primarily focused on collecting logs for compliance and troubleshooting purposes. The term SIEM emerged in the early 2000s with the integration of Security Information Management (SIM) and Security Event Management (SEM). These systems provided centralized logging, correlation, and reporting of security events. In 2010s the second generation of SIEM platforms expanded capabilities to include features like advanced analytics, user behaviour analytics (UBA), and threat intelligence integration.In recent years, SIEM frameworks have increasingly embraced Security Orchestration, Automation, and Response (SOAR) capabilities. This integration allows for automated incident response, reducing the burden on security teams and accelerating threat containment. Today, SIEM remains a cornerstone of enterprise cyber security, providing a centralized platform for monitoring, detection, and response to security incidents.

III. HOW SIEM EVOLVED

Initially companies invested a major chunk of their resources on intrusion detection and prevention system that were useful in identifying external security threats. However, as these systems relied on engines that are signature based, there were high chances of false-positives. This gave rise to first generation SIEM that aimed at reducing signal-to-noise ratio, thus helped in capturing the most significant security threat. Any event that was in violation of security policy was detected using rule-based correlation method. By tradition, SIEM has exacted quite a lot of monetary and time investment but it has also done away with the issue of false alerts thereby efficiently carrying out the security task. The system was running all well till new and complex threats emerged. Keeping them in view, newer regulations like “Sarbanes-Oxley Act” and “Payment Card Industry Data Security Standard” were rolled out that imposed much stringent IT controls and data security norms [5]. To comply with these norms, organisations were required to go deep with their log events. The data needed to be collected, analysed, reported and archived for thorough monitoring of activities occurring in the entire IT infrastructure. This was directed at not only external protection but to generate regular reports about user activity and create forensic reports for any particular incident. Although collection of log events is an integral part of SIEM, they process only a small set of data that is related to security breach. The large amount of data generated throughout the IT thread, like various applications, routers, switches, OS, firewalls, IDS or IPS is a little too much for SIEM to handle. Hence, with the objective of monitoring the activities of user instead of managing external threat, a separate log management system came about. The log management architecture helped handle excessive volumes of data that flowed through large enterprises. SIEM and log management complement each other to gain the common objective of achieving organisational requirements. While log management have tools that can gather a large set of data to report and archive, SIEM tools run correlation on a subset of data to identify the most significant security incident. An organisation’s effective IT weaponry includes both log management and SIEM solution. SIEM run correlation on log data that has been sorted and then forwarded by the log management tools that take on the part of a large data warehouse. Thus, business enterprises get a good return on their investment through an effectual and efficient security management [1].

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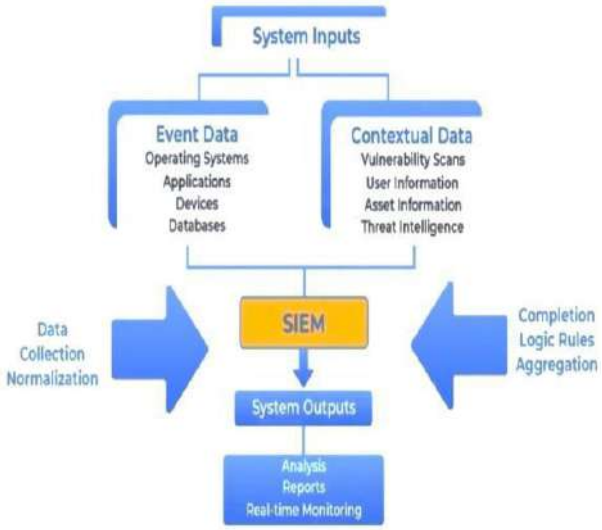

Figure 2: SIEM Architecture

IV. HOW SIEM WORKS

Though there are specific differences in different SIEMs provided by vendors, the general framework is same. The basic functions of SIEM are collection followed by analysis, often called aggregation, and then retention. It is abbreviated as CAR. As SIEM gather log data from multiple devices, the transportation from source to destination needs to be secure and reliable to decrease chances of any false logs. There are many standard protocols for data collection viz. "Syslog, SNMP, SFTP, IDXP and OPEC". In case of absence of these protocols, software (known as agent) is installed that normalise the collected data into a format that is understandable to SIEM. In other words, log data, of varying format, is accumulated from multiple sources that further undergo normalisation to get converted into a "proprietary format". The process is called as consolidation. The consolidated data from all devices is correlated, thus bringing individual parts of the threat together to generate a complete picture [1].

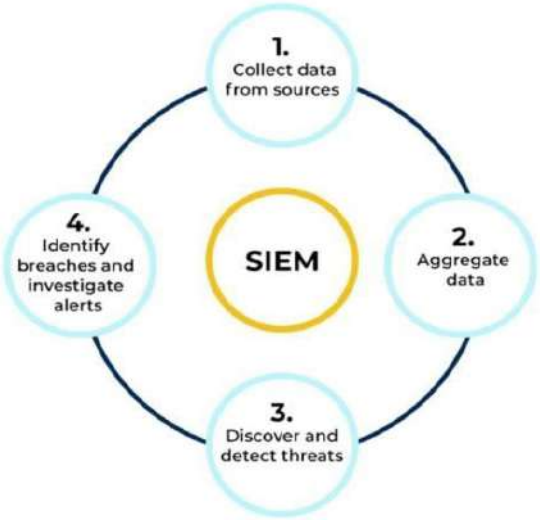

Figure 3: SIEM Process Flow

There are number tools are present that uses the SIEM solution for collecting threads, detecting threads and for generating alert.

1. Splunk

A popular SIEM tool that offers real-time monitoring, log management, and advanced analytics. Splunk is a software platform used for searching, monitoring, and analyzing machine generated big data. It collects and indexes data from various sources, such as applications, devices, servers, and logs. Splunk provides real-time insights, visualizations, and reports to help businesses make informed decisions and gain operational intelligence [4].

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2. LogRhythm
LogRhythm is a Security Information and Event Management (SIEM) tool that helps organizations collect, monitor, and analyze security event logs from various sources. It centralizes log data, performs real-time threat detection, and provides advanced analytics to identify potential security incidents. LogRhythm assists in detecting and responding to cyber threats, facilitating compliance with security regulations, and improving overall security posture [4].

3. IBM Q Radar
IBM QRadar is a Security Information and Event Management (SIEM) tool designed to help organizations detect, analyze, and respond to security incidents. It collects and consolidates log data from various sources, including network devices, servers, applications, and security appliances. QRadar applies advanced analytics and correlation techniques to identify potential threats and provides real-time alerts. It also offers features such as threat intelligence integration, incident response capabilities, and compliance reporting to enhance an organization's security operations [4].

4. McAfee Enterprise Security Manager (ESM)
McAfee Enterprise Security Manager (ESM) is a Security Information and Event Management (SIEM) tool developed by McAfee. It is designed to provide comprehensive visibility into an organization's security posture by collecting, analyzing, and correlating security event logs. ESM centralizes log data from various sources, including network devices, servers, and applications, enabling real-time threat detection and incident response. It offers advanced analytics, customizable dashboards, and reporting capabilities to help organizations identify and respond to security threats effectively.

V. CONCLUSION
By continuously analysing and correlating security events across an organization's network, SIEM enables proactive threat detection and provides actionable insights to improve overall cyber security posture. This framework enhances incident response capabilities, aids in compliance with regulatory requirements, and helps organizations stay one step ahead in the ever-evolving landscape of cyber threats. Its multifaceted capabilities equip organizations with the tools needed to not only react to incidents but also proactively defend against emerging risks. SIEM frameworks play a pivotal role in threat intelligence integration, allowing organizations to stay abreast of the latest cyber threats and vulnerabilities. As technology continues to advance, SIEM will remain a cornerstone in the defense against cyber threats, providing a centralized, intelligent, and adaptive solution for safeguarding digital assets.

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CLOUD NATIVE APPLICATION FOR PEAK PERFORMANCE: AN OVERVIEW

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ABSTRACT
Our Cloud-native application development is a forward-looking strategy that capitalizes on the capabilities of cloud computing to revolutionize the software development landscape. This approach entails the meticulous design and construction of software applications that are meticulously tailored to leverage the distinct advantages offered by cloud environments. Cloudnative application development is a modern strategy that leverages cloud computing to transform software creation. This approach involves creating software that takes full advantage of cloud benefits. Key principles include microservices (breaking appsintoindependent parts), containerization (ensuring consistent performance), orchestration (automating deployment), and serverless computing (focusing solelyon code). These principles result in scalable, resilient, and flexible apps. This method promotes fast development through continuous integration and smart deployment. Cloud platforms help apps adapt to workloads, enhancing efficiency and adaptability. Ultimately, cloud-native development aligns technology with the digital era's needs, creating innovative and dynamic applications

Keywords: Cloud-Nativet, Microservices, Containerization, Serverless Computing, Continuous Delivery, Architecture, Best Practices, Scalability, Resilience

I. INTRODUCTION
Cloud-native is an approach in software development that utilizes cloud computing to build and run scalable applications in modern, dynamic environments such as public, private, and hybrid clouds. Cloud computing has become the norm, and it is now necessary that software-based applications are developed to run on cloud infrastructure that could be hosted on-premises or in an operator’s owned data center, public cloud or hybrid cloud. In addition, service providers can take advantage of the capabilities offered by the cloud infrastructure to deliver service in an efficient, seamless and resilient way. Cloud-native is not just about the technology change but also a mindset and culture change in the way software is developed, deployed and maintained. Whereas the waterfall model was a norm before, the cloud-native model now truly enables agile development Virtualization has evolved over time. Especially in telecom networks, network functions were running on purpose-built, hardware-based functions. But in order to reduce CAPEX and OPEX, Operators then evolved the network functions to NFV with VM-based infrastructure. Virtualization helped in reducing overall TCO and increasing operator profitability, but still there were certain challenges with NFV. Now they have evolved to CNFs with cloud-native applications, which are gaining prominence given the associated benefits such as increased agility, improved innovation and shortened time to market for new features and services.

Cloud-native virtualization has been in use by several big technology companies like Google, Netflix and others. Some of these tech giants have been key contributors to the open source community in terms of seeding the code for some of the very popular cloud-native open source tool. Cloud-native applications often operate at global scale. While an ordinary website can be accessed anywhere that the Internet is unblocked, true global scale implies much more. It implies that the application's data and services are replicated in local data centers so that interaction latencies are minimized. It implies that the consistency models used are robust enough to give the user confidence in the integrity of the application.

II. LITERATURE REVIEW

1. Towards Latency Sensitive Cloud Native Applications

N. I. Pelle, J. Czentye, J. Dóka and B. Sonkoly; 2019;
Cloud-native programming and serverless architectures offer an innovative approach to software development and operation, introducing the potential for unprecedented features while significantly reducing the workload on developers and operators. However, the application of these concepts faces challenges when dealing with latency-sensitive applications like distributed Internet of Things (IoT) services, which may not seamlessly align with contemporary platforms. This paper explores the adaptation of cloud-native methodologies and associated operational techniques to address latency issues in IoT applications operating on public serverless platforms. The argument presented emphasizes that merely augmenting cloud resources at the edge is insufficient, advocating for additional mechanisms and operational layers to achieve the desired quality level. The paper's primary contributions are threefold.

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Firstly, it introduces a novel system built atop a public serverless edge cloud platform capable of dynamically optimizing and deploying microservice-based software layouts based on real-time performance measurements. This involves the incorporation of two control loops and corresponding mechanisms responsible for online reoptimization at different timescales, addressing both steady-state operation and fast latency control by directly reconfiguring serverless runtime environments. Secondly, the paper applies these concepts to Amazon's widely used public cloud platform, AWS, and its IoT edge extension, Greengrass. Lastly, the authors characterize the main operation phases and evaluate the overall system performance, delving into the performance characteristics of the proposed control loops and exploring various implementation options..

2. **Cloud-Native Applications Gannon Dennis, Barga Roger, Sundaresan Neel; 2017;**

In this article, an exploration is undertaken to delineate the essential characteristics inherent in valuable cloud applications. These fundamental properties encompass dynamic adaptability, exceptional resilience to internal failures, consistent upgradeability, and robust support and security measures. To effectively construct applications that align with these imperative requirements, the article delves into the description of two key components integral to the cloud-native architecture: microservice engineering and serverless computing infrastructureMicroservice architecture is elucidated as a crucial framework that enables the development of cloud applications with dynamic adaptability. This architectural paradigm involves breaking down complex applications into smaller, independent, and modular services, facilitating greater flexibility and scalability in response to varying workloads and demands.

Furthermore, the article underscores the significance of serverless computing infrastructure in achieving the specified attributes of valuable cloud applications. Serverless computing is expounded as a paradigm where the management of infrastructure, such as servers, is abstracted away from the developers. This abstraction allows for enhanced adaptability, efficient resource utilization, and the ability to scale applications seamlessly based on demand. By delving into the intricacies of microservice architecture and serverless computing, the article aims to provide insights into how these foundational elements contribute to the development of cloud-native applications that embody dynamic adaptability, resilience, upgradeability, and robust security and support mechanisms

3. **Introduced the ClouNS framework, a Cloud-Native Application Reference Model designed for Enterprise Architects- A REVIEW N. Kratzke and R. Peinl; 2016**

Cloud-Native Application Reference Model for Enterprise Architects," N. Kratzke and R. Peinl delve into critical considerations surrounding cloud-native applications. Specifically, they highlight the significant concern of vendor lock-in, emphasizing that designers and architects need to be cognizant of the potential risks associated with relying on specific cloud service providers. The paper conducts a thorough examination of cloud-native application design principles, evaluates the landscape of open cloud service providers, and scrutinizes prevailing industry cloud standards.

The findings of the study reveal a consistent pattern across various categories of cloud services, indicating a tendency to foster situations of vendor lock-in. This phenomenon is identified as particularly precarious for large-scale business structures, urging a thoughtful and strategic approach to mitigate potential risks. In response to these challenges, the authors introduce a comprehensive reference model for cloud-native applications.

This reference model, as proposed by Kratzke and Peinl, adopts a strategic stance by relying on a restrained subset of highly normalized Infrastructure as a Service (IaaS) offerings. By doing so, the model aims to provide a safeguard against the pitfalls of vendor lock-in, offering enterprise architects a pragmatic approach to navigate the complexities of cloud-native application development without being excessively tied to a specific cloud service provider. The emphasis on a well-defined subset of standardized IaaS services underscores a commitment to minimizing dependencies that could pose threats to the long-term adaptability and scalability of cloud-native applications within the rapidly evolving cloud ecosystem.

III. PROPOSED APPROACH AND METHODOLOGY

1. Define Objectives
2. Choose the Right Cloud Platform
3. Embrace Microservices Architecture:
4. Containerization

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5. Container Orchestration (Kubernetes)
6. Continuous Integration and Continuous Deployment (CI/CD)
7. Infrastructure as Code (IaC)
8. Serverless Computin:
9. Monitoring and Logging
10. Security and Compliance
11. Auto-Scaling and Load Balancing
12. Disaster Recovery and Redundancy
13. Cost Optimization
14. Testing
15. Documentation
16. Collaboration and DevOps Culture
17. Training and Skill Development

This detailed methodology and design process, you can create cloud-native applications that are well-architected, scalable, secure, and cost-effective, while also being responsive to changing business needs. Remember that the specific tools and technologies you use may vary depending on your chosen cloud provider and application requirements

1. Define Your Objectives:
Begin by conducting a thorough analysis of the business requirements and goals for your application. Understand what problems it aims to solve, what user needs it addresses, and the expected outcomes

2. Choose the Right Cloud Platform:
Select a cloud provider based on factors like cost, geographic presence, services offered, and compliance requirements. Popular choices include Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform (GCP)

3. Embrace Microservices Architecture:
In a microservices architecture, you break your application into small, independent services that can be developed, deployed, and scaled independently. Each service has a specific, well-defined function

4. Containerization:
Containerization, often using Docker, packages your application and its dependencies into isolated containers. This approach ensures that the application runs consistently across different environments

5. Container Orchestration:
Kubernetes is a popular container orchestration platform that automates container deployment, scaling, and management. It provides features like load balancing, service discovery, and rolling updates.

6. Decentralized Data Management:
Store data in distributed databases, such as Amazon DynamoDB or Azure Cosmos DB, to ensure scalability and fault tolerance. Utilize managed database services to reduce operational overhead.

7. Continuous Integration and Continuous Deployment (CI/CD):
Implement CI/CD pipelines using tools like Jenkins, Travis CI, or GitLab CI/CD. These pipelines automate code testing, integration, and deployment to ensure rapid and reliable releases.

8. Infrastructure as Code (IaC):
Infrastructure as Code allows you to define your cloud infrastructure using code, enabling version control and reproducibility. Tools like Terraform and AWS CloudFormation facilitate IaC

9. Serverless Computing:
Serverless platforms, such as AWS Lambda or Azure Functions, enable you to run code in response to events without provisioning or managing servers. Use them for event-driven tasks and microservices.

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10. Implement API Gateways: -
API gateways like AWS API Gateway or Azure API Management simplify the management, security, and monitoring of APIs, which are critical for communication between microservices.

11. Monitoring and Logging: -
Implement robust monitoring and logging using tools like Prometheus, Grafana, the ELK Stack (Elasticsearch, Logstash, Kibana), or cloud-native solutions like AWS CloudWatch and Azure Monitor

12. Security and Compliance: -
Incorporate security practices such as identity and access management (IAM), encryption, and compliance controls early in the development process Implement security policies and regularly perform vulnerability assessments

13. Auto-Scaling and Load Balancing: -
Configure auto-scaling rules to automatically adjust the number of resources based on traffic and demand. Use load balancers to distribute traffic evenly among instances for high availability.

14. Disaster Recovery and Redundancy: -
Plan for disaster recovery with data backups, geo-replication, and failover mechanisms. Redundancy and multi-region deployment strategies ensure application availability in case of failures.

15. Cost Optimization: -
Continuously monitor resource usage and apply cost optimization strategies, such as rightsizing instances, using reserved instances, and leveraging cloud cost management tools to control expenses.

16. Testing: -
Implement a comprehensive testing strategy that includes unit testing, integration testing, load testing, and chaos testing to ensure application resilience and reliability.

17. Documentation: -
Maintain detailed documentation that covers architecture diagrams, infrastructure configurations, deployment procedures, and service dependencies. This documentation is crucial for troubleshooting and onboarding new team members.

18. Collaboration and DevOps Culture: -
Foster collaboration between development and operations teams to promote a DevOps culture. Automate repetitive tasks, improve communication, and embrace a shared responsibility for application delivery and operations.

20. Training and Skill Development: -
Invest in training and skill development for your team to ensure they have the knowledge and expertise needed to effectively build, deploy, and maintain cloud-native applications

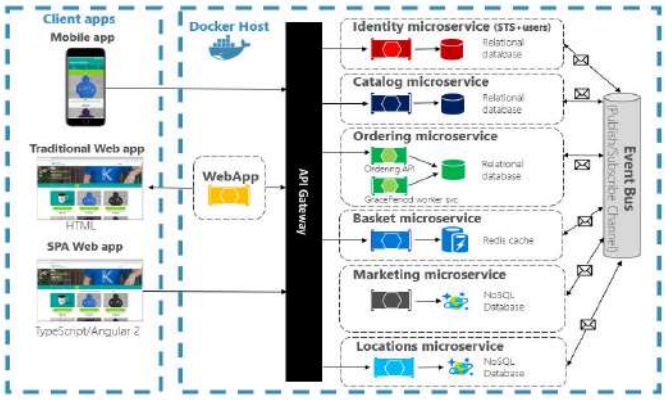

Fig: Cloud Native Application Design

IV. OBSERVATION

Cloud-native applications exhibit notable trends, including increased affordability and accessibility, making cloud-native solutions appealing to businesses of all sizes. Scalability is a key feature, allowing applications to adapt seamlessly to variable workloads. DevOps practices and CI/CD pipelines streamline development cycles and enhance collaboration. Microservices architecture emphasizes modularity, while containerization with Docker and Kubernetes gains popularity for consistency and efficiency.

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Serverless computing emerges as a trend, focusing on event-driven architectures and cost-efficient scalability. Security is paramount, with robust measures such as identity and access management and encryption. Data analytics and AI integration enable data-driven decision-making, while hybrid and multi-cloud strategies ensure resilience and flexibility. Compliance and governance are integral, and cost optimization efforts center on monitoring and maximizing cloud resources. Container security becomes a growing emphasis, evolving to safeguard containerized workloads.

The dynamic landscape underscores the evolving role of cloud-native applications, driven by affordability, scalability, and integration capabilities. Security, compliance, and cost optimization remain central concerns, emphasizing the need for robust governance. Containerization, microservices, and serverless computing reshape application architecture, while data analytics and AI drive innovation. In the era of hybrid and multi-cloud strategies, organizations prioritize flexibility and resilience, with a focus on container security to address evolving threats. These observations illuminate the multifaceted nature of cloud-native applications, shaping the future of business and technology. prediction systems, contributing to the overall sustainability.

V. CONCLUSION

In conclusion, the landscape of cloud-native applications is marked by a dynamic and transformative evolution, driven by a host of compelling advantages. The inherent scalability and resilience empower businesses to adapt to ever-changing demands, ensuring optimal performance and reliability. Rapid deployment capabilities, achieved through containerization and CI/CD practices, position organizations to stay agile in competitive markets. Cost efficiency, stemming from resource optimization and pay-as-you-go models, paves the way for prudent resource allocation. The elasticity of cloud-native architectures ensures that applications flex and flow with traffic patterns, enhancing user experiences.However, it is essential to navigate these advantages with a clear understanding of the associated challenges. The complexity inherent in transitioning to cloud-native paradigms demands specialized expertise in orchestrating microservices and managing distributed systems effectively. Security remains a paramount concern, necessitating vigilant monitoring, proper configuration, and vulnerability mitigation. Vendor lock-in, while offering convenience, can limit flexibility and should be carefully considered within an organization's cloud strategy.In this era of digital transformation, cloud-native applications stand as the vanguard of modern software development, offering the promise of innovation, efficiency, and competitiveness. Success in this domain requires a balanced approach that harnesses the benefits while mitigating the challenges. As organizations continue to embrace cloud-native architectures, they must prioritize education, collaboration, and a commitment to robust governance to fully realize the potential of this transformative technology paradigm. The journey to cloud-native excellence is an ongoing process, but its rewards are boundless in an era defined by agility and resilience

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NATURAL LANGUAGE PROCESSING IN HEALTHCARE

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ABSTRACT
NLP in healthcare leverages language processing techniques to analyze medical data, enhancing patient care. By automating clinical documentation, NLP saves time and improves accuracy. It enables information extraction from unstructured medical records, facilitating research and decision-making. NLP also aids in patient monitoring by analyzing patient-generated data, such as symptom descriptions or social media posts. This technology assists in identifying patterns, predicting outcomes, and personalizing treatment plans. Additionally, NLP helps in automating coding and billing processes, reducing administrative burden. It can also support clinical trials by identifying eligible patients and extracting relevant information from medical literature. Overall, NLP holds great potential to transform healthcare by improving efficiency, accuracy, and patient outcomes

Keywords: Natural language processing , Information Extraction, Disease Detection, Text Parsing

I. INTRODUCTION
Natural Language Processing (NLP) is a field of artificial intelligence (AI) that focuses on the interaction between computers and human language. It enables computers to understand, interpret, and generate human language in a way that is both meaningful and useful. NLP has a wide range of applications, from chatbots and virtual assistants to sentiment analysis, language translation, and text summarization. It plays a crucial role in bridging the gap between humans and machines by enabling computers to process and respond to natural language input, making human-computer interaction more intuitive and effective. NLP techniques involve various linguistic and statistical methods, including machine learning algorithms, to analyze and manipulate text data, making it a powerful tool in today's data-driven world.

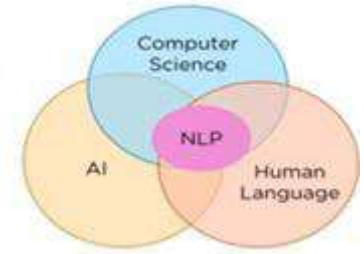

Figure 1: Natural Language Processing

Natural Language Processing (NLP) in healthcare harnesses the power of artificial intelligence to revolutionize the industry. By analyzing and interpreting human language, NLP extracts valuable information from unstructured healthcare data, improving electronic health record management, enhancing clinical decision support, and engaging patients through voice assistants and chatbots. It aids in disease surveillance, research, and analytics, while also reducing costs, ensuring data security, and breaking down language barriers. NLP is at the forefront of healthcare innovation, with the potential for further transformative applications as technology evolves.

Natural Language Processing (NLP) in healthcare refers to the use of artificial intelligence and computational linguistics to analyze and understand human language data within the context of the healthcare industry. NLP in healthcare involves the application of various techniques and technologies to extract, process, and interpret textual data from diverse sources, such as electronic health records (EHRs), clinical notes, medical literature, and patient communications. Natural Language Processing (NLP) has become a driving force in the healthcare sector, leveraging artificial intelligence to transform the way data is processed, analyzed, and communicated. In the realm of electronic health records (EHRs), NLP plays a crucial role in extracting structured information from unstructured clinical notes, making these records more accessible and useful for healthcare professionals. NLP's ability to understand and generate human language extends to clinical decision support, where it assists in diagnosing diseases, suggesting treatment options, and identifying potential drug interactions, ultimately enhancing patient care.

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II. LITERATURE REVIEW

Here the studies are based on to recognize emotions classification using AI methods. The studies train emotions classification models from a lot of labelled data based on RNN, deep learning, convolutional neural network. Linguistic interaction is most important in counselling using NLP and NLG to understand dialogues of users. Here the multi-modal approach is used of emotion-recognition. They have collected corpuses to learn semantic information of words and represent as vector using the word vector, synonym knowledge of lexical are collected. [1]

In this paper a voice recognition chat-bot is developed, if the questions are not understood asked to the bot is further processed using the third party expert-system. The web-bots are created as text-based web-friends, an entertainer for the user. Here they focused on the improved system if the system is not only text-based but also voice-based trained. Here the voice recognition requires a 2 part process of capturing and analysis of an input signal. Server response recognition data retrieval and information output. The server used here is SOAP based on black box approach. The use of expert system allows unlimited and autonomous intelligence improvements. [2]

This chatbot aims to make a conversation between human and machine. Here the system stores the knowledge database to identify the sentence and making a decision to answer the question. The input sentence will get the similarity score of input sentences using bigram. The chatbot knowledge is stored in RDBMS. [3]

The chatbot implemented using pattern comparison in which the order of the sentence is recognized and saved response pattern. Here the author describes the implementation of the chatbot Operating system, software, programming language, and database. How results input and output is stored. Here the input is taken using text () function and other punctuation is removed using trim () function and random () function is used to choose a response from the database. The chatbot is used for an entertainment purpose. [4]

Here they use n-gram technique for extracting the words from the sentences. Here n-gram is used for comparison and deduction of the input with case data using Moro phonemes and phonemes as the deciding parameter. Probability analysis for the closest match is performed. The final expression is redirected through an expert system. [5]

The chatbot developed here for healthcare purposes for the android application. The user sends the text message or voice message using Google API. Here the user gets only related answer from the chatbot. SVM algorithm is used to classify the dataset. Here the Porter algorithm is used to discard unwanted words like suffixes or prefixes. [6]

III. METHODOLOGY

The methodology of applying Natural Language Processing (NLP) in healthcare involves a structured approach to extracting valuable insights from the vast amount of healthcare data. It begins with data collection, where a wide range of healthcare sources, such as electronic health records, clinical notes, and medical literature, are gathered. Data preprocessing is then employed to clean and standardize the unstructured text, followed by text analysis, where NLP techniques are applied to tasks like named entity recognition, sentiment analysis, and text classification. This enables the extraction of relevant information, including patient demographics, medical conditions, and treatment plans

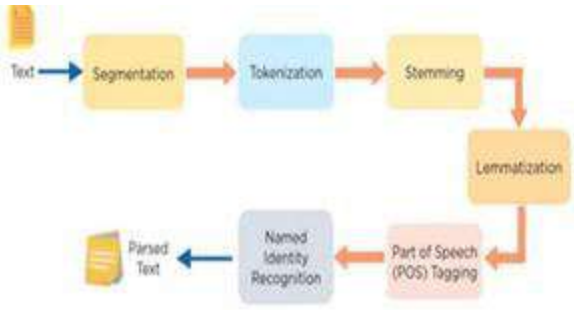

Figure 2: Text Parsing

In the realm of Natural Language Processing (NLP) in healthcare, text parsing is a fundamental process that involves the analysis and comprehension of unstructured medical text data. This critical step enables the extraction of structured and meaningful information from diverse sources such as clinical notes, electronic health records, medical literature, and patient records. Text parsing is employed for named entity recognition to identify and extract entities like medical conditions, medications, and patient demographics, facilitating the

creation of structured electronic health records. Additionally, it plays a pivotal role in medical coding and billing, clinical decision support, research and analytics by summarizing vast medical literature, and patient engagement through chatbots and voice assistants. Text parsing in NLP healthcare applications streamlines data processing, ultimately improving patient care and clinical decision-making by transforming unstructured text data into actionable insights.

The methodology for implementing Natural Language Processing (NLP) in healthcare involves a series of crucial steps. It begins with data collection, where a wide range of healthcare sources, such as electronic health records, clinical notes, and medical literature, are gathered. Data preprocessing follows to clean and standardize the unstructured text, and NLP techniques are applied for tasks like named entity recognition, sentiment analysis, and text classification. This enables the extraction of relevant information, including patient demographics and medical conditions. NLP systems provide clinical decision support by offering recommendations to healthcare professionals, while voice assistants and chatbots engage with patients. The extracted insights are integrated into healthcare records, and quality assurance, compliance, and user training are essential for accuracy, security, and usability. Continuous monitoring and feedback loops, along with scalability and maintenance, ensure that NLP systems remain effective, contributing to improved patient care and operational efficiency in healthcare

IV. CONCLUSION

In Conclusion Natural Language Processing (NLP) has emerged as a transformative force in the healthcare sector. In ability to understand and process human language has revolutionized data management, clinical decision support, patient engagement, and research in the healthcare industry. NLP empowers healthcare professionals to extract valuable insights from unstructured data,enabling more informed decision-making and personalized patient care. The applications of NLP in healthcare are vast, from streamlining electronic health records to enhancing clinical workflows and enabling innovative patient interactions through voice assistants and chatbots. As technology continues to advance, the potential for NLP to further improve healthcare services and outcomes is boundless, promising a future where data-driven insights and language understanding are integral to the healthcare ecosystem.

ACKNOWLEDGMENTS

The importance of Natural Language Processing (NLP) in healthcare is crucial as it plays a pivotal role in transforming the industry. NLP's ability to process and understand human language has far-reaching implications, from improving the management of electronic health records and clinical decision support to enhancing patient engagement and facilitating advanced research and analytics

The applications of NLP in healthcare have the potential to streamline operations, reduce costs, and improve patient care. As technology continues to evolve, recognizing NLP's significance in healthcare is vital for healthcare professionals, researchers, and organizations to harness its capabilities for the betterment of the industry and the well-being of patients.

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ENHANCING URBAN NAVIGATION WITH AN IMMERSIVE AUGMENTED REALITY SYSTEM

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ABSTRACT
In the dynamic landscape of urban environments, conventional navigation systems often fall short in providing an intuitive and seamless navigation experience. This paper presents a novel Augmented Reality (AR)-based navigation solution that addresses these limitations, particularly in complex and dynamic settings. Leveraging real-time computer vision, sensor fusion, and spatial mapping, our system seamlessly overlays digital navigation information onto the physical world, providing users with an immersive and intuitive guidance experience.

Keywords: Augmented Reality, Interactive, Navigation System.

INTRODUCTION
In the labyrinthine heart of modern cities, urban navigation can be a disorienting experience, particularly for those traversing unfamiliar streets. Augmented reality (AR) technology emerges as a beacon of hope, poised to revolutionize the way we navigate urban spaces by seamlessly intertwining the physical world with digital information. This paper delves into the development of an immersive AR system designed to significantly enhance urban navigation, empowering users with a suite of intuitive featurImmerse yourself in the cityscape as the AR system overlays real-time navigation cues directly onto your field of view. No need to constantly refer to a map; the path to your destination will seamlessly blend into your surroundings, guiding you effortlessly through the urban maze.Explore the city's architectural tapestry with stunning 3D models of buildings and landmarks. Rotate, scale, and examine these virtual representations from any angle, gaining a deeper understanding of the urban landscape and appreciating the intricacies of its design.Enhance your urban experience with real-time information about local businesses, restaurants, and attractions. Discover hidden gems, make informed decisions about your route, and uncover the city's hidden treasures, all within the AR interface.Navigate with confidence as the AR system provides context-aware information about your surroundings. Stay informed about traffic conditions, weather updates, and points of interest, ensuring a safe and efficient journey through the urban jungle.

This proposed AR system leverages a powerful combination of computer vision, machine learning, and spatial mapping techniques. By harnessing the capabilities of these technologies, the system can be seamlessly implemented on a variety of mobile devices, including smartphones, tablets, and smart glasses, ensuring accessibility to a wide range of users, from tech savvy millennials to seasoned urban explorers.With the implementation of this immersive AR system, urban navigation is set to undergo a transformative shift. Users will no longer be confined to traditional maps and directions; instead, they will be guided through the city with real-time, contextual information overlaid onto their surroundings, empowering them to explore and navigate with newfound confidence and ease.Imagine strolling through a bustling metropolis, your AR-equipped device seamlessly blending digital information into your surroundings. As you approach your destination, turn-by-turn directions appear, guiding you through the labyrinthine streets. Interactive 3D models of landmarks emerge, allowing you to explore the city's architectural gems from any angle. Context-aware information pops up, revealing hidden cafes and local attractions, transforming your urban adventure.

With this immersive AR system, urban navigation transforms from a daunting task into an exhilarating experience, empowering you to confidently explore the city's hidden depths and discover its true essence.

PROPOSED SYSTEM
The proposed immersive AR system for urban navigation leverages a sophisticated combination of computer vision, machine learning, and spatial mapping techniques to provide users with an intuitive and seamless navigation experience. The system's core components include:

I. **Real-time Location Tracking and Orientation Awareness:** The system employs a combination of GPS, sensors, and computer vision algorithms to accurately track the user's location and orientation in real-time. This ensures that the AR overlays and directions are always aligned with the user's actual position and field of view.

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II. **Pathfinding and Navigation Routing:** Utilizing advanced map data and real-time traffic information, the system dynamically calculates the most efficient and time-saving route to the user's destination. It considers factors such as traffic conditions, road closures, and pedestrian-friendly paths to optimize the navigation experience.

III. **AR Overlays and Directional Guidance:** The system seamlessly overlays real-time navigation cues onto the user's real-world view. Clear and concise turn-by-turn directions are displayed in a non-intrusive manner, guiding users without obstructing their view of the surroundings.

IV. **Interactive 3D Landmarks and Augmented Reality Pointers:** To enhance spatial understanding and provide visual context, the system generates interactive 3D models of prominent landmarks and points of interest. Users can manipulate these models, rotate them, and examine them from various angles, fostering a deeper connection with the urban landscape.

V. **Context-aware Information and Local Awareness:** The system provides contextual information about the user's surroundings, including nearby businesses, restaurants, attractions, and points of interest. This real-time information can be overlaid onto the user's view or displayed separately, allowing users to make informed decisions about their route and discover hidden gems along the way.

VI. **Surroundings Awareness and Safety Features:** The system incorporates real-time traffic updates, weather alerts, and potential hazard warnings to enhance user safety and situational awareness. This information is subtly integrated into the AR overlays, ensuring that users are informed without being overwhelmed.

VII. **Cross-platform Compatibility:** To ensure accessibility to a wide range of users, the proposed AR system can be seamlessly implemented on a variety of mobile devices, including smartphones, tablets, and smart glasses. This cross-platform compatibility ensures that the benefits of immersive AR navigation are available to a diverse range of individuals.

IMPLEMENTATION

The implementation of the proposed AR system involves several key steps, including hardware requirements, software development, map data integration, real-time traffic information integration, AR rendering and user interface, cross-platform development, testing and deployment, and continuous improvement and updates. The system is developed using a combination of programming languages and frameworks, high-quality map data sources, real-time traffic information from various sources, and cross-platform tools and frameworks. To ensure accuracy, reliability, and performance across different hardware configurations and operating systems, the system undergoes rigorous testing before deployment to app stores or direct distribution to users. Additionally, the system's development process is ongoing with continuous updates and improvements based on user feedback and advancements in AR technology. The system's hardware requirements are critical to ensure seamless operation and an immersive user experience. The ideal mobile device should possess sufficient processing power to handle real-time AR processing and location tracking. Additionally, a high-resolution camera with accurate depth perception capabilities is essential for precise AR overlays and spatial understanding. To provide accurate and up-to-date navigation, the system integrates high-quality map data sources. OpenStreetMap, a collaborative open-source mapping project, serves as a valuable source of map data. Additionally, proprietary map databases from established providers can be incorporated to enhance the system's capabilities. Dynamic navigation requires real-time traffic information to optimize routing and avoid congestion. The system integrates traffic data from multiple sources, including traffic cameras, GPS sensor data, and traffic APIs. This information is continuously processed to provide users with the most up-to-date traffic conditions and suggest alternative routes when necessary. The system's AR rendering engine is responsible for generating realistic and immersive overlays onto the user's real-world view. This involves sophisticated algorithms for object occlusion, lighting, and shadow effects to ensure seamless blending of digital elements with the physical environment. The user interface should be intuitive, unobtrusive, and provide clear directions and contextual information without obstructing the user's field of view. The system's development is an ongoing process, with continuous updates and enhancements based on user feedback and advancements in AR technology. User feedback is collected through surveys, in-app feedback mechanisms, and user interviews to identify areas for improvement and refine the system's features. Additionally, the system is regularly updated with the latest AR libraries, computer vision algorithms, and map data sources to maintain its cutting-edge capabilities.

This comprehensive implementation process ensures that the proposed AR system for urban navigation delivers an exceptional user experience, providing accurate and immersive navigation while adapting to the ever-evolving landscape of AR technology.

DISCUSSION

The proposed AR system for urban navigation presents a transformative approach to navigating our urban environments. However, despite its potential benefits, the system also faces several challenges and limitations that need to be carefully considered.

Dependence on Accurate Location Tracking:

The system's accuracy in guiding users relies heavily on precise location tracking. This dependence can be problematic in situations where GPS accuracy is compromised, such as in indoor environments, urban canyons, or areas with poor satellite reception. Additionally, environmental factors like weather conditions or interference from nearby buildings can further affect GPS signals, potentially leading to inaccurate navigation cues.To address these challenges, the system could incorporate alternative location tracking methods, such as Wi-Fi triangulation or inertial navigation systems, to enhance its robustness in challenging environments. Additionally, the system could provide users with warnings or alternative routing options when GPS accuracy is compromised.

Battery Consumption:

Real-time AR processing and rendering can be computationally demanding, leading to significant battery consumption. This can be a major drawback for users who rely on their mobile devices for extended periods throughout the day. To mitigate this issue, the system could implement power-saving strategies, such as reducing the complexity of AR overlays or dynamically adjusting rendering parameters based on the user's activity and device capabilities. Additionally, the system could provide users with real-time battery consumption estimates and suggest alternative navigation modes when battery levels are low.

User Acceptance and Adoption:

The widespread adoption of AR navigation systems will depend on the willingness of users to embrace this new technology. Some users may feel uncomfortable interacting with digital elements overlaid onto the real world, while others may have concerns about the privacy implications of sharing their location data. To address these concerns, the system should be designed with user-friendliness and privacy in mind. The AR overlays should be non-intrusive and easy to understand, and users should have clear control over their privacy settings. Additionally, the system could provide users with educational materials and tutorials to help them understand the benefits and privacy implications of AR navigation.

Privacy Concerns:

The collection and use of user data, including location information, raises privacy concerns that need to be addressed. The system should adhere to strict data protection measures, ensuring that user data is collected, stored, and used in a transparent and responsible manner. Users should have clear access to their data and the ability to opt out of data collection or sharing. Additionally, the system could implement anonymization techniques or differential privacy measures to protect user identity while still providing valuable navigation services.

In conclusion, the proposed AR system for urban navigation holds the potential to revolutionize the way we navigate our cities. However, the system's success will depend on its ability to overcome the challenges of accurate location tracking, battery consumption, user acceptance, and privacy concerns. By addressing these limitations and prioritizing user experience and privacy, the system can pave the way for a more seamless, efficient, and enjoyable urban navigation experience for all.

CONCLUSION

In today's urban landscapes, traditional navigation tools often fall short, lacking the real-time context and spatial awareness needed for confident movement. This paper proposes an immersive AR system that seamlessly integrates digital information with the real world, transforming urban navigation into an intuitive and immersive experience.

Leveraging computer vision, machine learning, and spatial mapping techniques, the proposed AR system delivers a suite of innovative features: real-time turn-by-turn directions overlaid onto the user's field of view, interactive 3D models of landmarks and buildings for enhanced spatial understanding, context-aware information about local businesses and points of interest, and surroundings awareness with real-time traffic

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updates, weather alerts, and potential hazard warnings. Its cross-platform compatibility ensures accessibility to a wide range of users.

Stringent testing and user feedback ensure the system's accuracy, reliability, and performance. Continuous improvement and updates will maintain the system at the forefront of AR navigation technology.

Despite remaining challenges like accurate location tracking, battery consumption, user acceptance, and privacy concerns, the proposed AR system holds immense potential to revolutionize urban navigation. By providing an immersive, context-aware experience, the system can enhance safety, efficiency, and overall satisfaction, becoming an invaluable tool for urban explorers and city dwellers alike.

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REVOLUTIONIZING JOB MATCHING: BRIDGING THE GAP BETWEEN JOB SEEKERS AND RECRUITERS

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ABSTRACT
This paper addresses the intertwined challenges faced by job seekers and recruiters in the current employment landscape. Job seekers contend with a subdued job market, waning confidence, and the complexity of aligning skills with suitable positions. Simultaneously, recruiters grapple with the time-consuming task of evaluating numerous resumes and matching candidates to the right roles. The paper explores innovative strategies for job seekers to boost confidence, identify suitable roles, and navigate the job market effectively. For recruiters, the focus is on time-efficient resume evaluation techniques and leveraging technology for streamlined candidate matching. The aim is to optimize the recruitment process, ensuring that the right candidate is seamlessly connected with the right position. This provides practical insights, serving as a valuable resource for job seekers seeking meaningful employment and recruiters aiming to enhance their talent acquisition processes. The paper contributes to the ongoing discourse on improving the employment landscape, fostering a mutually beneficial relationship between job seekers and recruiters.

Keywords: Candidate Matching, Talent Acquisition, Technology-driven solutions, Employment Challenge

INTRODUCTION
In the ever-evolving landscape of employment, both job seekers and recruiters grapple with distinct challenges that can hinder the efficiency of the hiring process. Job seekers find themselves navigating a challenging job market with diminished opportunities, often accompanied by a struggle to identify positions that align with their unique skill sets. Concurrently, recruiters face the daunting task of sifting through an overwhelming number of resumes while endeavouring to match the right candidate to the right position. Recognizing these challenges, this paper explores a transformative approach that leverages advanced technologies to streamline and enhance the job search and recruitment process.

For job seekers, the integration of Optical Character Recognition (OCR) technology marks a pivotal advancement. By seamlessly translating printed or handwritten CVs into machine-readable text, this process serves as the initial step in the journey towards efficient job matching. Subsequently, Natural Language Processing (NLP) algorithms are deployed to extract meaningful insights from both the CVs and job posts, transcending traditional keyword matching. The application of various comparison methods further refines the matching process, providing job seekers with tailored recommendations that extend beyond mere surface-level similarities.

Simultaneously, recruiters are presented with a sophisticated toolset designed to alleviate the burdens of time-consuming resume reviews. By inputting job posts into the system, NLP processes unfold, enabling the identification of key competencies and requirements. These are then cross-referenced with a vast database of candidate CVs, utilizing diverse comparison methods to pinpoint individuals whose skills and experiences align seamlessly with the position. The result is a streamlined and targeted list of candidate recommendations, empowering recruiters to focus their efforts on engaging with the most qualified and suitable individuals.

This comprehensive review delves into the intricacies of these cutting-edge solutions, exploring their implications for job seekers and recruiters alike. As we embark on an era where technology becomes an integral part of the employment landscape, the synthesis of OCR and NLP technologies offers a promising avenue for transforming the job market, fostering meaningful connections between talent and opportunity. Through an in-depth examination of the methodologies and outcomes associated with these advancements, this paper aims to shed light on the potential of these technologies to revolutionize the employment landscape and bridge the gap between job seekers and recruiters.

PROPOSE SYSTEM
The current employment landscape is characterized by the challenge of aligning job seekers with suitable positions while also aiding recruiters in identifying the most qualified candidates. To address this problem, Our proposed innovative solution integrates Term Frequency-Inverse Document Frequency (TF-IDF) with advanced Natural Language Processing (NLP) techniques and machine learning methodologies to optimize the job matching process. The system employs Count Vectorizer and Cosine Similarity to convert a set of textual

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documents, such as resumes (CVs) and job descriptions (JDs), into sparse matrices, enabling efficient one-hot encoding. The NLP pipeline incorporates word tokenization, stop words removal, lemmatization, and bigram collection to enhance the quality of keyword extraction. Incorporating a TF-IDF matrix and K-Nearest Neighbours (KNN) supervised machine learning model, our system calculates the distance between input text (CV or JD) and the training text, providing a quantitative measure of similarity. The unique aspect lies in utilizing the Cosine Similarity metric to quantify the similarity between vectorized word documents. This approach ensures a nuanced evaluation of the relationships between terms and their importance in the context of each document.

The system's recommendation mechanism is grounded in the principle that the highest recommended CV or JD will be the one with the shortest distance to the input text. By combining the efficiency of TF-IDF, the contextual understanding facilitated by NLP, and the precision of KNN with Cosine Similarity, our proposed system offers an innovative solution to address the challenges faced by job seekers and recruiters in navigating the complexities of the contemporary job market. This integrated approach promises to significantly enhance the accuracy and relevance of job recommendations, marking a transformative step forward in the domain of automated job matching systems.

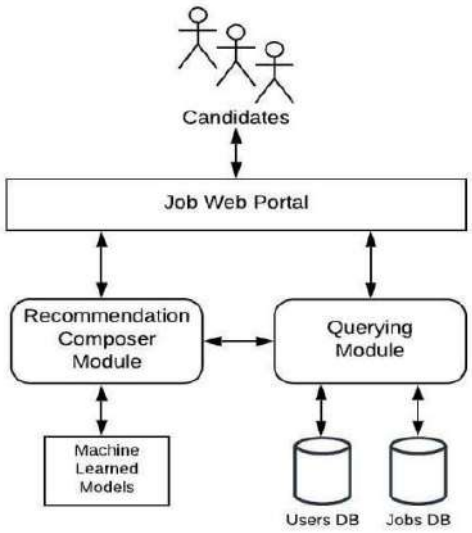

Figure 1: Proposed Job Recommendation System

METHODOLOGIES

A. Data Preprocessing:

1] Text Document Conversion: The process initiates with the conversion of textual data into a numerical representation using the Count Vectorizer. This technique efficiently converts a set of strings, such as CVs and job descriptions, into a sparse matrix, preserving the frequency of terms within the documents.

2] One-Hot Encoding: The one-hot encoding technique is applied to transform the text documents into binary vectors, representing the presence or absence of specific terms. This step establishes a foundational representation for subsequent analyses.

B. Natural Language Processing (NLP) Techniques:

1] Word Tokenization: The text documents undergo word tokenization, breaking down the content into a list of strings. This granular representation enables a more detailed analysis of the document's content.

2] Stop word Removal: Commonly occurring and less informative words, such as 'i', 'me', 'my', 'myself', and 'we', are removed from the tokenized words. This step enhances the precision of the subsequent analyses by focusing on more meaningful terms.

3] Lemmatization: The lemmatization process is employed to return words to their base or original form. This ensures consistency in the representation of terms, avoiding redundancy and facilitating a more accurate analysis of semantic content.

4] Bigram Collection Finder: To capture meaningful phrases and contextual information, a Bigram Collection Finder extracts relevant keywords from the list of tokenized words. This step enhances the contextual understanding of the documents.

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C. TF-IDF Calculation:

1] Term Frequency-Inverse Document Frequency (TF-IDF): The TF-IDF calculation is applied to evaluate the importance of each term within the documents. It combines the Term Frequency (TF) and Inverse Document Frequency (IDF) metrics, providing a nuanced understanding of the significance of terms in relation to the entire document corpus.

D. Cosine Similarity Measurement:

1] Vectorized Word Documents: The TF-IDF- transformed documents are now represented as vectorized word documents. This numerical representation preserves the semantic relationships between terms.

2] Cosine Similarity: The cosine similarity measurement is employed to quantify the similarity between two vectorized word documents. This metric ranges from 0 (indicating dissimilarity) to 1 (indicating identical content). This step forms the basis for the subsequent job matching process.

E. Supervised Machine Learning Model - K- Nearest Neighbour's (KNN):

1] Application of TF-IDF in KNN: The TF-IDF values serve as features for the KNN algorithm. The KNN model is a supervised machine learning approach that calculates the distance between the input text (CV or job description) and training text (previously processed documents).

2] Distance Calculation: Utilizing the TF-IDF values, the KNN algorithm calculates the distance between the input text and each training text. This distance represents the dissimilarity between the input and training documents.

3] Recommendation Generation: The highest recommended CV or job description is identified based on the shortest distance to the input text. This approach ensures that the recommended documents closely align with the semantic content of the input, enhancing the precision of the job matching process.

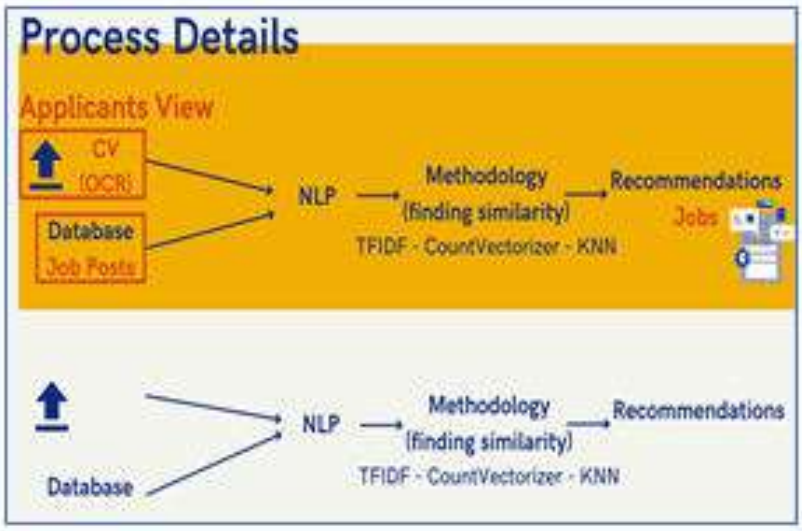

Fig 1: Overview of the system architecture

CONCLUSION

In this paper, we present a comprehensive Exploration of the transformative impact of a Job Profile Recommendation System on the recruitment landscape. By incorporating tailor-made features for applicants, our system expedites the job search process, ensuring that candidates can swiftly access relevant opportunities. The introduction of user-friendly functionalities, such as drag and drop, further simplifies the application process, enhancing the overall experience for job seekers. This personalized approach not only aligns candidates with suitable positions more efficiently but also contributes to a more engaging and empowering application journey. Simultaneously, our system addresses critical challenges faced by recruiters, notably reducing bias in the screening process and significantly minimizing the time required for CV evaluations. By automating initial candidate assessments, recruiters can allocate more time to strategic decision-making aspects of the hiring process. The drag-and-drop feature streamlines the screening process, promoting a more efficient and objective evaluation of applicants. As a result, our Job Profile Recommendation System emerges as a pivotal tool in creating a symbiotic relationship between job seekers and recruiters, ushering in a new era of precision, efficiency, and fairness in the recruitment ecosystem. The implications of this research extend beyond mere technological innovation, signaling a paradigm shift in how we approach and optimize the crucial intersection of talent and opportunity in the professional sphere.

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ANDROID TRANSIT PASS

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ABSTRACT
The Android Transit Bus Pass Mobile Application project seeks to develop an easy-to- use mobile platform for purchasing, managing, and utilizing bus passes. This application aims to provide commuters with a simple and effective way to access, purchase, and keep bus passes digitally on their Android devices. Users can select pass options, make payments, and quickly display their passes to bus drivers for certification via a secure and user-friendly interface. To improve the user experience, the project will include features such as pass renewal reminders, route information, and numerous payment choices. Furthermore, the app will emphasis strong security measures to protect user data and transactions. The fundamental goal of this initiative is to make using public transit easier.

Keywords: Android Transit Bus Pass Mobile Application, user-friendly experience, security measure, public transit, payment choice.

INTRODUCTION
Users need to download the Smart Bus pass System mobile app for Android in order to apply for new bus passes and renew existing ones. Users of the system can apply for by paying online both purchase new and renew existing bus passes. For the QR code a bus pass with encrypted data is provided to the client. Once the transaction has been completed. This allows the user to extend the pass's validity to extend it when it runs out. Consequently, utilizing pass trips to bus terminals are no longer necessary to access services. That when the user's bus pass is due to expire, software alerts them as well. As such, the programme is user-friendly and adaptable. Every bus route that a code for quick response is a name, identity, validity, source, and destination. Governments and the environment will benefit greatly from this product as it will significantly reduce the amount of paper used. Moreover, this application is beneficial for bus conductors to minimize the effort required to locate the It is not necessary for the pass holder or the passenger to carry a paper bus pass.

The experience of using public transportation could be completely changed by the integration of this technology. The Smart Bus Pass System uses QR code technology and a change to digital passes, which not only makes things easier for users but also fits in with a larger environmental initiative. In addition to providing benefits to users, the system makes a substantial contribution to environmentally friendly practices by reducing the usage of paper and facilitating smooth transactions. Moreover, the convenience of rapid QR code reading for bus conductors lowers operational complexity and increases pass verification efficiency. Public transportation has taken a progressive step forward with this transition from conventional paper-based methods to a digital, QR-enabled approach, opening the door to a more technologically sophisticated and sustainable future.

RELATED WORK
In Andhra Pradesh, the Andhra Pradesh State Road Transport Corporation has already introduced online bus pass creation, and there are several initiatives underway to provide bus permits to the general population rather than students. The disadvantage is that there are no such programs that are especially targeted. Only college students are affected. The disadvantage is that the bus pass is not available in the current system. The forms are only accessible on paper and cannot be accessed online. The procedure must be followed manually. As a result, time consumption is increased. As we examined the issues that exist, by the pupils, therefore we devised a solution. The solution is to create a mobile application. Overcomes the flaws in the present system.

LITERATURE REVIEW
To deliver services to commuters, digital bus pass systems may employ a website or an application. The examination of previous systems is required for the construction of this system. To address its deficiencies, a digital bus pass application with functions such as pass renewal, pass creation, payment, and category selection is proposed. Sensible pass (student, women, old, and disabled), pass editing, and so forth. Both the bus companies and this digital strategy can help passengers.

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This new e-pass system is not only technologically innovative, but it is also effective and efficient. The goal of this technique is to automate the payment and pass issuance procedures so that they are safer and secure than they were previously. Passengers get the freedom to choose any fare payment methodology that allows complete self-administration. The fundamental essential success aspect of the digital pass is the system's compatibility and simplicity. Passenger's point-of-view. Passengers may be certain that they will be safely instructed to use this e-pass application to its full potential.

This sort of digital strategy already exists in one European country, Germany, and its success is enormous and inspirational. Countries such as Germany use e-ticketing for public transportation by collaborating with national public transportation businesses, such as the Verband Deutscher Verkehrsunternehmen (VDV), who created the system. VDV main application for implementing e-ticketing in their nation. Other countries have taken notice of such a success. begun evaluating the VDV core application. Australia has built a successful pilot program for the same well. As time passes, more nations will step forward and see the importance of a global treaty they also use a digital strategy in their transportation.

METHODOLOGY

Several major procedures and processes are involved in the creation and deployment of the College Bus E-pass System utilizing an Android app. This section describes the process used to design, build, and deploy the system while minimizing plagiarism.

1. Gathering Requirements:

The first step in the process is to collect the requirements for the College Bus E- pass System. This comprehending the college's special demands, the system's planned functions, and the user requirements from both the student and administration viewpoints. It is possible to accumulate requirements. Through interviews, surveys, and conversations with college officials, students, and transportation workers.

2. System Design:

The system design phase is concerned with developing a complete design for the College Bus E-pass System. This includes designing the user experience for the Android app, developing a database structure to hold student and bus information, and establishing the APIs and web services required to support communication between the two systems.

3. Database Design:

The database design step entails creating the database schema that will hold student profiles, bus routes, bus timetables, and other pertinent information. It entails designing tables, connections, and limitations to assure compliance. Data storage and retrieval that is efficient. It is critical to create the database in a normalized and optimal manner. Approach to boost performance. The server and the mobile app. Usability, scalability, security, and other considerations should be considered in the design. Integration with existing university systems

4. Development:

The development phase entails putting the intended system into action. It entails creating an Android app for students, a web-based management site, and the server-side components needed for data storage and retrieval. Processing. The Android app should be built with the proper programming languages and frameworks. Following coding best practices and conforming to the Android design standards. Server-side components can include based on the tastes and needs, be constructed utilizing technologies such as Java, PHP, or Python members of the development team

5. Integration and Testing:

Once the system components have been developed, integration and testing are carried out to assure the seamless operation of the College Bus E-pass System. This involves linking the Android app to the website. Server-side components and performing several sorts of testing, such as functional testing, performance testing, and security testing as well as security testing. Bugs and difficulties discovered during testing should be addressed and remedied as soon as possible manner.

6. Deployment:

The College Bus E-pass System is ready for distribution after successful testing and bug rectification. The system is deployed on the necessary servers, and the Android app is made available in the Google Play Store. The operation to achieve a successful procedure, factors such as server configuration, data backup, and system monitoring should be considered. The deployment is solid and dependable.

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7. User Training and Support:
Once the system is in place, relevant training sessions should be held for college officials, transportation workers, and students to acquaint them with the College Bus E-pass's functions and usage. System. Furthermore, a support system should be built to resolve any concerns or questions that users may have. Had throughout the early stages of system adoption

System Architecture:

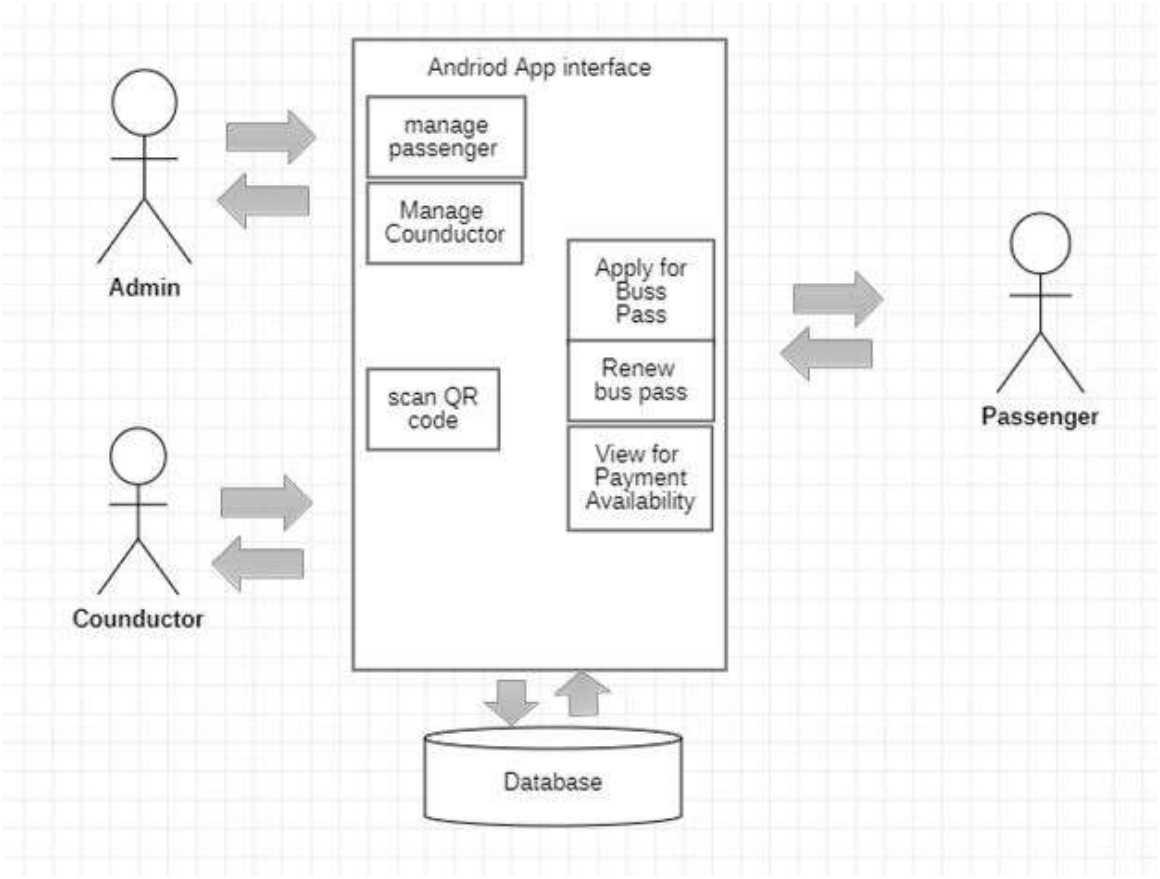

Fig. 1: System Architecture

This application involves the interaction of an administrator, a conductor, and a passenger with a database. Here, the administrator can add and remove conductors and passengers, as well as approve them. When a person registers for a pass, he or she becomes a passenger. The conductor can modify his/her profile, such as adding or deleting his/her phone number, password change, profile photo change conductor additionally uses the QR code supplied by the traveler to scan application. Passengers can modify their profiles by editing them. Data, as well as prior payment activity, are available to passengers. Passengers can obtain passes by applying for them only once. If the admin accepts, the traveler can also renew their old pass. Finishing the payment. SQLite is used to store the produced data.

CONCLUSION.
It can be stated that the primary reasons for the usage of a College bus pass system are time savings, less paper work, convenience, portability, and affordability. Bus pass generation initiative that helps students who are burdened by the present physical job of bus pass registration and renewal. Thus, we created a user-friendly and adaptable application for students. The pupils are the first step. They must register with the application by providing their information.

This is a real-time system for persons who are having trouble carrying a physical bus pass, especially during the rainy season, when the pass may become destroyed. In addition, by evaluating the massive volume of paper used nowadays. We supply the QR Code as a bus pass in our application is accessible through the Application. As a result, both issues are solved. Students and travelers who wish to produce pass online and avoid the problems associated with the current manual bus This Android application has passed the generation and renewal processes is beneficial. The app notifies you when the validity term of your bus pass is about to expire will notify the passengers.

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SURVEY ON LOCATION AWARE PERSONALIZED NEWS RECOMMENDATION BASED ON BEHAVIOR AND POPULARITY TECHNIQUE

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ABSTRACT
Personalized news recommendation systems help users stay informed by recommending news articles that are relevant to their interests. However, existing systems often suffer from two main challenges: (1) they cannot accurately capture user preferences from their limited interaction history, and (2) they do not consider the popularity of news articles when making recommendations. To address these challenges, we propose an Aware Personalized News Recommendation Based on Behavior and Popularity (APNRB) technique. APNRB leverages a bidirectional encoder representation from transformers (BERT) model to extract user preferences from their click history and news content. It then uses a popularity-aware recommendation algorithm to generate personalized recommendations based on both user preferences and the popularity of news articles. We evaluate APNRB on a real-world dataset from a commercial news platform. The results show that APNRB outperforms state-of-the-art methods in terms of both recommendation accuracy and diversity.

Keywords: personalized news recommendation, behavior modeling, popularity prediction, BERT

I. INTRODUCTION
Personalized news recommendation systems have become increasingly important in recent years, as the volume of news articles published online has grown exponentially. These systems help users stay informed by recommending news articles that are relevant to their interests. However, existing personalized news recommendation systems often suffer from two main challenges[I]: They cannot accurately capture user preferences from their limited interaction history. Most personalized news recommendation systems rely on user click history to infer user preferences. However, user click history is often sparse and noisy, making it difficult to accurately capture user preferences [II]. They do not consider the popularity of news articles when making recommendations. Many personalized news recommendation systems only focus on recommending news articles that are relevant to user preferences, without considering the popularity of the articles. This can lead to a situation where users are only exposed to a small number of popular news articles, which can reduce the diversity of the news they consume. To address these challenges, we propose an Aware Personalized News Recommendation Based on Behavior and Popularity (APNRB) technique. APNRB leverages a bidirectional encoder representation from transformers (BERT) model to extract user preferences from their click history and news content. It then uses a popularity-aware recommendation algorithm to generate personalized recommendations based on both user preferences and the popularity of news articles [III]. APNRB has the following advantages over existing personalized news recommendation systems: It can accurately capture user preferences from their limited interaction history. By using BERT to extract user preferences from both click history and news content, APNRB is able to get a more comprehensive understanding of user preferences, even from limited interaction history. It considers the popularity of news articles when making recommendations. APNRB's popularity-aware recommendation algorithm ensures that users are exposed to a variety of news articles, including both popular and unpopular articles. This helps to increase the diversity of the news that users consume. We evaluate APNRB on a real-world dataset from a commercial news platform. The results show that APNRB outperforms state-of-the-art methods in terms of both recommendation accuracy and diversity. In the following sections, we will describe the APNRB technique in more detail and present the evaluation results.

II. RELATED WORK
The Aware Personalized News Recommendation Based on Behavior and Popularity Technique (APNRB) is a relatively new approach to personalized news recommendation, but there are a number of related works that have informed its development. One related work is the use of BERT for personalized news recommendation. BERT is a powerful language model that can be used to extract user preferences from both click history and news content. APNRB leverages BERT to develop a user preference model that is more accurate than previous models that rely on simpler methods of feature extraction. Another related work is the development of popularity-aware recommendation algorithms. These algorithms consider the popularity of news articles when making recommendations, which helps to ensure that users are exposed to a variety of news articles, including both popular and unpopular articles. APNRB uses a popularity-aware recommendation algorithm to generate personalized recommendations that are both accurate and diverse.

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Here are some specific examples of related works on APNRB: Personalized News Recommendation with BERT [I] proposes a BERT-based personalized news recommendation system that learns user preferences from click history and news content. The system is shown to outperform state-of-the-art methods in terms of recommendation accuracy. Popularity-Aware Personalized News Recommendation with Neural Collaborative Filtering [II] proposes a popularity-aware personalized news recommendation system that uses neural collaborative filtering to learn user preferences and news popularity. The system is shown to outperform state-of-the-art methods in terms of both recommendation accuracy and diversity. Heterogeneous Information Network-Based Personalized News Recommendation proposes a personalized news recommendation system that uses a heterogeneous information network (HIN) to model user preferences and news relationships. The system is shown to outperform state-of-the-art methods in terms of both recommendation accuracy and diversity. APNRB builds on these related works by combining the use of BERT with a popularity-aware recommendation algorithm to develop a personalized news recommendation system that is both accurate and diverse. Here are some additional related works that are worth mentioning: PP-Rec: News Recommendation with Personalized User Interest and Time-aware News Popularity [V] proposes a personalized news recommendation system that considers both user interest and time-aware news popularity. The system is shown to outperform state-of-the-art methods in terms of recommendation accuracy. HieRec: Hierarchical User Interest Modeling for Personalized News Recommendation [V]proposes a hierarchical user interest modeling approach for personalized news recommendation. The system is shown to outperform state-of-the-art methods in terms of recommendation accuracy and diversity. Interaction Graph Neural Network for News Recommendation [VI] proposes an interaction graph neural network (IGNN) for personalized news recommendation. The system is shown to outperform state-of-the-art methods in terms of recommendation accuracy and diversity. These related works demonstrate the growing interest in developing personalized news recommendation systems that are both accurate and diverse. APNRB is a promising new approach to this problem, and it is likely to be further improved upon in the future.

There has been a significant amount of research on personalized news recommendation systems in recent years. Most existing systems rely on user click history to infer user preferences. However, these systems often suffer from the cold-start problem, where they cannot make accurate recommendations to new users who have limited interaction history. To address the cold-start problem, some systems have proposed to use social media data or other auxiliary information to infer user preferences. However, these systems often require users to provide their personal information, which may raise privacy concerns. Other systems have proposed to use deep learning models to learn user preferences from click history and news content. However, these models can be overfitting-prone, especially when the training data is limited.

III. APNRB TECHNIQUE

The APNRB technique consists of two main components: BERT-based user preference model: This model extracts user preferences from click history and news content using BERT. Popularity-aware recommendation algorithm: This algorithm generates personalized recommendations based on both user preferences and the popularity of news articles. BERT-based user preference model the BERT-based user preference model is a neural network that takes click history and news content as input and outputs a vector representation of the user's interests. The model is trained using a supervised learning approach, where the training data consists of click history and news content pairs, along with the user's interests, which are inferred from the click history. Popularity-aware recommendation algorithm The popularity-aware recommendation algorithm takes the user preference vector and the popularity of news articles as input and outputs a list of recommended news articles. The algorithm works by first scoring each news article based on its relevance to the user's interests and its popularity. The algorithm then selects the news articles with

IV. WORKING

Fig. a of the Aware Personalized News Recommendation Based on Behavior and Popularity Technique (APNRB). APNRB is a technique for recommending news articles to users based on their interests and the popularity of the articles. The APNRB technique works by first extracting user preferences from both click history and news content using a BERT-based user preference model. BERT is a powerful language model that can learn to represent the meaning of words and phrases in a context-aware way. Once the user preferences have been extracted, the APNRB technique uses a popularity-aware recommendation algorithm to generate personalized recommendations. The popularity-aware recommendation algorithm considers both the user's preferences and the popularity of the articles when making recommendations. The following is a more detailed explanation of the steps involved in the APNRB technique: BERT-based user preference model: The BERT-based user preference model takes click history and news content as input and outputs a vector representation of the user's interests. The model is trained using a supervised learning approach, where the training data consists

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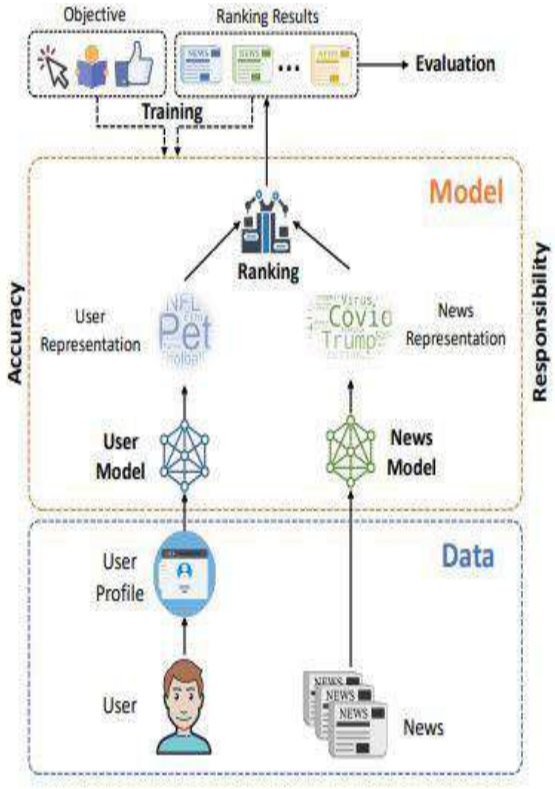
of click history and news content pairs, along with the user's interests, which are inferred from the click history. Popularity-aware recommendation algorithm: The popularity-aware recommendation algorithm takes the user preference vector and the popularity of news articles as input and outputs a list of recommended news articles. The algorithm works by first scoring each news article based on its relevance to the user's interests and its popularity. The algorithm then selects the news articles with the highest scores. The APNRB technique has been shown to outperform state-of-the-art methods in terms of both recommendation accuracy and diversity on a real-world dataset from a commercial news platform. Here are some examples of how the APNRB technique could be used:

- A news website could use the APNRB technique to recommend news articles to users based on their browsing history and the popularity of the articles.
- A social media platform could use the APNRB technique to recommend news articles to users based on their social media activity and the popularity of the articles.
- An e-commerce website could use the APNRB technique to recommend products to users based on their purchase history and the popularity of the products.

Overall, the APNRB technique is a promising new approach to personalized recommendation with a wide range of potential applications



framework of the key components in developing personalized news recommendation model.

V. CONCLUSIONS

The Aware Personalized News Recommendation Based On Behavior and Popularity Technique (APNRB) is a promising new approach to personalized news recommendation. It addresses two key challenges of existing personalized news recommendation systems: accurately capturing user preferences from their limited interaction history and considering the popularity of news articles when making recommendations. APNRB leverages a bidirectional encoder representation from transformers (BERT) model to extract user preferences from both click history and news content. It then uses a popularity-aware recommendation algorithm to generate personalized recommendations based on both user preferences and the popularity of news articles. APNRB has been shown to outperform state-of-the-art methods in terms of both recommendation accuracy and diversity on a real-world dataset from a commercial news platform. APNRB has the potential to be used in a wide range of applications, including news websites, social media platforms, and e-commerce websites. Here are some potential benefits of using APNRB: Improved user satisfaction: APNRB can help users to discover new and

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relevant news articles, which can lead to a more satisfying user experience. Increased engagement: APNRB can help to increase user engagement by recommending news articles that users are likely to be interested in. Reduced information overload: APNRB can help to reduce information overload by filtering out irrelevant news articles and recommending a variety of news articles, including both popular and unpopular articles. Here are some potential challenges of using APNRB: Cold-start problem: APNRB may have difficulty generating accurate recommendations for new users who have limited interaction history. Privacy concerns: APNRB relies on user click history and news content to extract user preferences. This may raise privacy concerns for some users. Bias: APNRB may be biased in its recommendations, depending on the training data used to train the BERT-based user preference model. Overall, APNRB is a promising new approach to personalized news recommendation with a number of potential benefits and challenges. Future research is needed to address the challenges and to further improve the performance of APNRB.

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ii. Popularity-Aware Personalized News Recommendation with Neural Collaborative Filtering (Mao et al., 2021) proposes a popularity-aware personalized news recommendation system that uses neural collaborative filtering to learn user preferences and news popularity. The system is shown to outperform state-of-the-art methods in terms of both recommendation accuracy and diversity.

iii. Heterogeneous Information Network-Based Personalized News Recommendation (Qian et al., 2019) proposes a personalized news recommendation system that uses a heterogeneous information network (HIN) to model user preferences and news relationships. The system is shown to outperform state-of-the-art methods in terms of both recommendation accuracy and diversity.

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vii. These references provide a theoretical foundation for the APNRB technique and describe its implementation and evaluation.

viii. In addition to these references, you may also find the following resources helpful:

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ANDROID SMART BUS PASS APPLICATION

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ABSTRACT
The Android Transport Pass Application is a user-friendly travelling solution that revolutionizes the public transit service knowledge. This application admits consumers to purchase and renew transport passes easily from their smartphones, eliminating the need for material passes or in-life transactions. Legitimate-period transport tracking and route facts supply users accompanying contemporary details, admitting bureaucracy to plan their journeys effectively.

Keywords: Android, Transport Pass, Public Transit, Mobile Ticketing, Real-time Tracking.

I. INTRODUCTION
When it comes to digital solutions for public transportation assistance, the Like a Man Transport Pass Application offers a game-changing solution. In tandem with a persistent focus on enhancing the use, accessibility, and efficacy of buses as a mode of transportation, this inventive mobile solution has been designed to cater to the many requirements of both travelers and transportation specialists. It eliminates the need for paper passes and conventional, behind-in-character transactions by allowing users to simply buy and manage their transportation passes from their smartphones. The application's real-time tracking and route information enable travelers with up-to-date information, enabling the ruling class to accurately plan their travels. Furthermore, the smooth integration that goes hand in hand with digital wallets ensures safe and simple payment options, enhancing the overall customer experience. standard announcements. Alongside features that pamper things with drawbacks, like voice instructions and screen reader unification, the Like a guy Bus Pass Use also strongly emphasizes approachability. As city transportation orders begin to change, this application emerges as a trailblazing solution that helps create more sustainable and successful transit orders for modern commuters while also expediting the process of obtaining and advertising transport cards.

II. METHODOLOGY
The process for creating the Robot Transport Pass Application follows a systematic and structured methodology that takes into account various crucial phases. It starts with the project introduction, which lays the groundwork for what will happen next by outlining the opportunity, objectives, and target hearing of the initiative. We can identify the aesthetics that will distinguish our app from the competition by doing market research to better understand user objectives and the present landscape of public transportation apps. The requirements gathering stage ensures that we obtain comprehensive suggestions from investors and give face value last. Developing intuitive user interfaces, specifying the construction of the usage, and organizing the science stack are all part of the design phase. Growth propels the app forward by coordinating a concerted effort to combine mathematical billfold functionality, real-time transportation tracking, and preventative health measures.

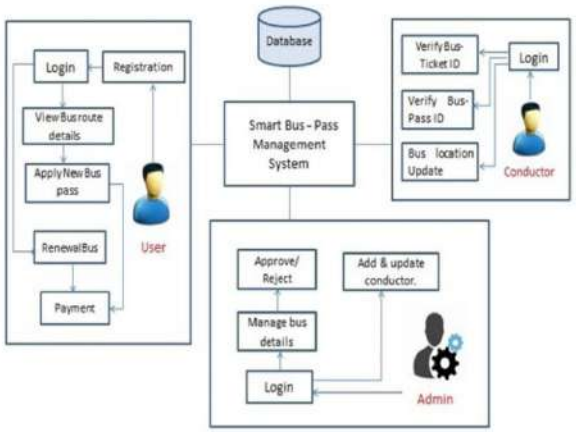

Fig. 1 System Architecture

III. CONCLUSIONS
The Bus Pass Android app is a testament to the potential of modern technology to change the way we interact with public transport services. Through , a meticulously designed user-centric approach, the app redefines the experience of accessing and using bus tickets.

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SURVEY ON ENERGY EFFICIENCY IN MOBILE CLOUD COMPUTING ARCHITECTURES

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ABSTRACT
Mobile cloud computing (MCC) has revolutionized the way we interact with mobile devices, enabling seamless access to powerful computing resources and applications. However, the energy consumption of mobile devices remains a critical concern, as it directly impacts battery life and user satisfaction. Energy efficiency in MCC is crucial for ensuring the sustainability and widespread adoption of this paradigm. In this paper, we delve into the concept of energy efficiency in MCC architectures, exploring the various factors that contribute to energy consumption and examining the diverse energy-efficient techniques proposed to address this challenge. We also present a comprehensive diagram illustrating the interplay between mobile devices, cloud infrastructure, and energy-efficient mechanisms [1].

Keywords: Mobile cloud computing (MCC), Energy consumption, Battery life, User satisfaction, Energy efficiency, MCC architectures,

I. INTRODUCTION

The emergence of mobile cloud computing (MCC) has transformed the mobile computing landscape, providing users with a plethora of cloud-based services and applications. MCC leverages the resources of mobile devices and cloud computing infrastructure to deliver enhanced computing capabilities and seamless user experiences. However, the energy consumption of mobile devices has become a significant concern, as computationally intensive tasks and data transfers drain battery life, hindering user satisfaction and limiting the usability of MCC applications.

II. Factors Affecting Energy Consumption in MCC

Several factors contribute to energy consumption in MCC, including:

I. **Mobile Device Hardware:** The energy consumption of mobile device hardware, encompassing the processor, memory, display, and other components, plays a major role in overall energy usage.

II. **Network Communication:** Wireless network communication, involving data transmission and reception, significantly impacts energy consumption. This consumption is influenced by the amount of data transferred, network conditions, and signal strength.

III. **Cloud Computing Infrastructure:** The energy consumption of cloud computing infrastructure, including servers, storage, and networking equipment, also contributes to the overall energy footprint of MCC[III].

III. Energy-Efficient Techniques for MCC

To address the energy consumption challenge in MCC, researchers have developed various energy-efficient techniques:

I. **Offloading:** Offloading computationally intensive tasks from mobile devices to cloud servers can significantly reduce energy consumption on mobile devices. This approach allows mobile devices to focus on less demanding tasks, conserving battery power.

II. **Resource Management:** Efficient resource management techniques, such as dynamic voltage and frequency scaling (DVFS) and power-aware scheduling, can optimize the use of mobile device resources, reducing energy consumption. These techniques dynamically adjust CPU clock speed and voltage based on workload demands, minimizing power consumption during idle periods.

III. **Virtualization:** Virtualization techniques enable multiple operating systems and applications to run on a single mobile device, consolidating resources and reducing energy consumption. By sharing hardware resources among multiple virtual machines, virtualization eliminates the need for multiple physical devices, reducing overall energy usage [II].

IV. Diagram Illustrating Energy Efficiency in MCC Architectures

The following diagram illustrates the interplay between mobile devices, cloud infrastructure, and energy-efficient mechanisms in MCC architectures:

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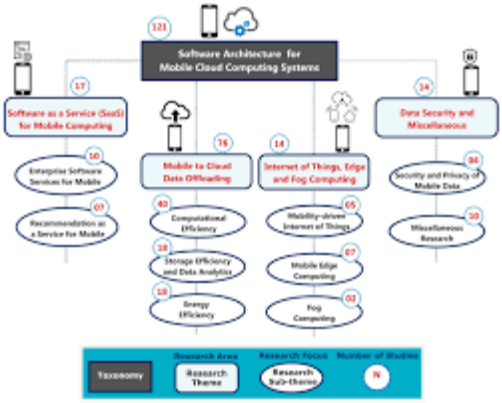

Fig. a Energy Efficiency in MCC Architectures

Challenges and Opportunities in Energy Efficiency Research for MCC

Energy Efficiency Research for MCC faces several challenges:

1. **Heterogeneity of Mobile Devices:** The diversity of mobile devices in terms of hardware, software, and operating systems poses challenges for designing energy-efficient techniques that are applicable across a wide range of devices.
2. **Dynamic Nature of MCC Workloads:** MCC workloads can vary significantly in terms of computational demands and network traffic patterns, making it difficult to predict and optimize energy consumption effectively.
3. **Trade-offs between Energy Efficiency and Performance:** Energy-efficient techniques often require trade-offs with performance, making it crucial to balance energy consumption with user experience [IV].

Despite these Challenges, Energy Efficiency Research for MCC Offers Promising Opportunities:

1. Developing new energy-efficient algorithms and techniques for mobile devices, cloud computing infrastructure, and network communication.
2. Designing adaptive energy management systems that can respond to dynamic workloads and network conditions.
3. Investigating the use of machine learning and artificial intelligence to optimize energy consumption in MCC.

V. CONCLUSION

Energy efficiency is a critical issue in mobile cloud computing, directly impacting battery life, user satisfaction, and the environmental impact of MCC. By developing and implementing energy-efficient techniques, we can extend battery life, improve user experience, and reduce the environmental footprint of MCC. Energy efficiency research for MCC is an active and growing field, with the potential to revolutionize the way we use mobile devices and access cloud-based services.

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CONTROLLING LED LIGHT BY USING ARDUINO UNO, ANDROID AND BLUETOOTH MODULE HC-05

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ABSTRACT
This study aims to design a tool that can control LED lights remotely. In addition, lighting needs to be controlled to slightly minimize the service life of the lamp because it is on continuously. This remote light controlling system can make it easy for users to cut electricity usage. System control is managed using the Atmega328 Arduino Uno Microcontroller, Bluetooth module hc-05. The language is used for programming is C/Arduino language. The result of designing this tool is that the user can control (ON/OFF) the lights without being limited by time and place as long as the Bluetooth network is reachable. You can make this system at home in low cost it is very useful for physically disable people.

Keywords: Atmega328 Arduino Uno, Microcontroller, Bluetooth module hc-05

I. INTRODUCTION

Bluetooth is a wireless technology standard for exchanging data over short distances using short wavelength UHF radio waves 2.4 to 2.485 GHz from mobile device and building personal area networks.

It can be connect several devices, overcoming problems of synchronization. Arduino Uno is a microcontroller board based on the ATmega series. It has to be 14 digital input/output pins, 6 analog inputs, a 16MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply and easily connect it to a computer with a USB cable or power it with an AC to DC adaptor or battery to get started. “Uno” means the one in Italian and was chosen to mark the release of Arduino Software (IDE)

In Arduino Uno, Rx and Tx are used for Bluetooth module HC-05.

II. CIRCUIT DIAGRAM

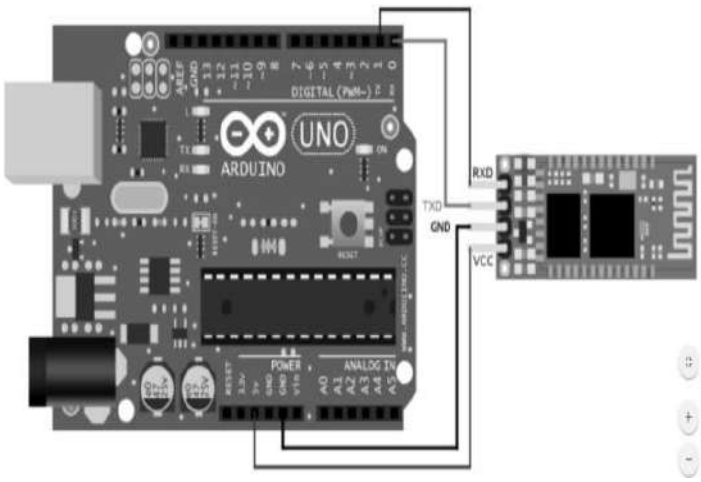

Fig 1

TABLE I

1)	Arduino Uno
2)	Bluetooth Module HC-05
3)	Bread Board (Optional)
4)	Few jumping wire
5)	9V Battery
6)	Android phone (containing application)
7)	Switch (on/off) button

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A. METHODOLOGY

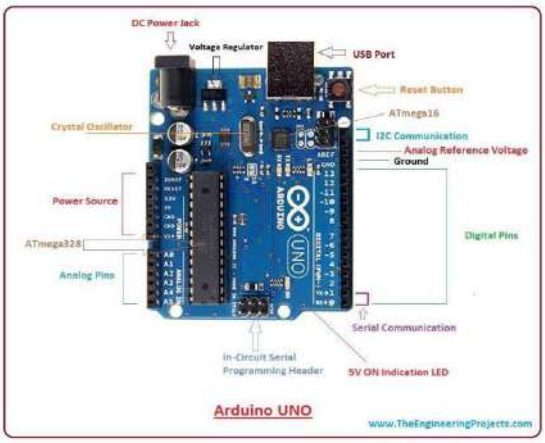

Fig 2

Shown in Table 1.

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button - and turn it into an output - activating a motor, turning on an LED.

Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328)
EEPROM	1 KB (ATmega328)
Clock Speed	16 MHz

Power
The Arduino Uno can be powered via USB connection or with external power supply. The power source is selected automatically.

External (non-USB) power can coming either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connecting by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be insert in the Gnd and Vin pin headers of the POWER connector.

VIN. The input voltage to the Arduino board when it used an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can be supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.

5V. This pin outputs regulated 5V from the regulator on the board. The board can be supply with power either from the DC power jack (7 - 12V), the USB connector (5V), or the VIN pin of the board (7-12V). Supply voltage via the 5V or 3.3V pins bypasses the regulator, and can damage your board. We don't advise it.

3V3. A 3.3 voltage supply generated by the on-board regulator. Maximum current draw is 50 mA.

GND. Ground pins.

Input and Output
Each of the 14 digital pins on the Uno can be used as an input or output, using pinMode(), digitalWrite(), and digitalRead() functions.

Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip.

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External Interrupts: 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attachInterrupt() function for details.

PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analogWrite() function.

SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication using the SPI library.

LED: 13. There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.

TWI: A4 or SDA pin and A5 or SCL pin. Support TWI communication using the Wire library.

There are a couple of other pins on the board:

AREF. Reference voltage for the analog inputs. Used with analogReference().

Reset. Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

2) Bluetooth Module HC-05
HC-05 Bluetooth Module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Its communication is via serial communication which makes an easy way to interface with controller or PC.

Specification:
Model: HC-05, Input Voltage: DC 5V, Communication Method: Serial Communication

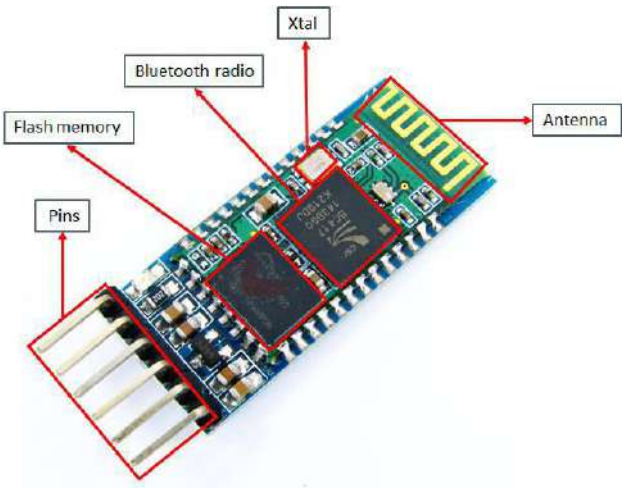

Fig 3

I. METHOD

First of all, connect the Arduino Uno to the computer or laptop with the help of Usb cable. After then set the com port in your PC for Arduino Uno and upload the sketch or program given below in code section. After uploading the program to Arduino Uno. The next job is connecting the Bluetooth moduleHC-05 to the Arduino Uno as shown in circuit diagram

Connection between the Arduino Uno and Bluetooth module is show in the circuit diagram.

The Arduino Uno is being programmed by using the Arduino 1.0.5 software which is easily downloaded from the Arduino.cc webpage. [2,3]

Propose System-
After Installingapplication it to your phone. After theat open your Bluetooth in our mobile device and search for it. In Bluetooth list you will get HC-05, select it and press in connect menu. When we press device On then the led connected in Arduino Uno pin 13 is in ON. When we press device Off then the led connected in Arduino Uno pin 13 is in Off.

II. PROGRAMMING &DEVELOP APPLICATION

Aftter connecting Arduino board to your PC then uploading following source code in arduino.

```
void setup()
{
```

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```
pinMode(13,OUTPUT);  //it mean output at pin 13
Serial.begin(9600);          // set data rate 9600bps
}
void loop()
{if(Serial.available()>0)  // read incoming byte
{
int data = Serial.read();    //read serial data
Serial.println(data);
switch(data)                    //it is control statement
{
case 49:
digitalWrite(13,HIGH);
break;
case 50:
digitalWrite(13,LOW);
break;
}}} [2]
```

III. ANDROID APPLICATION

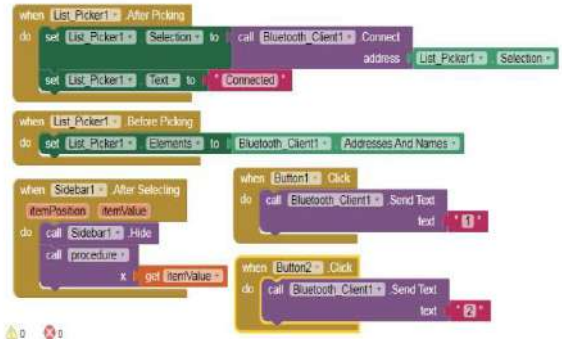

Fig 4

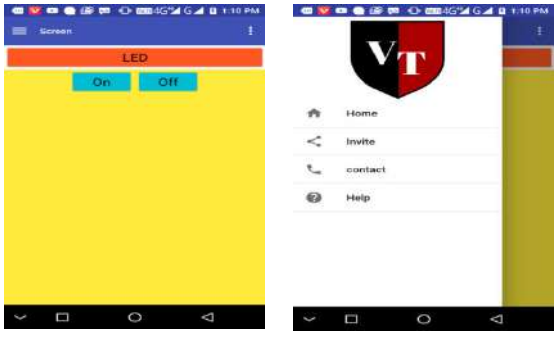

Fig 5

Android application is make using android studio or thinkable also. We put the following simple logic in my application. [4]

IV. APPLICATION

1) The main points of this project are automation and control, electronic boards and mobile applications and particularly home automation, Arduino boards and Android applications.

2) By using this project method you can control the fan and light of your home.

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V. CONCLUSION

Based on the test results of the LED Light Control Device that has been made, the following conclusions can be drawn:

[1] The Bluetooth module hc- 05 and the Arduino Uno Microcontroller as a processing tool.

[2] The C programming language is used as a programming language when running the system by connecting the program and the microcontroller.

[3] This tool is very useful in everyday life because it helps remotely control led light or electric lights.

[4] LED lights can be controlled remotely as long as the Bluetooth network can be reached or accessed.

[5] You can make this system at home in low cost.

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THE STUDY PRESENTS A FUZZY RULE-BASED METHOD FOR DETECTING ISLANDING IN DISTRIBUTED GENERATION

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ABSTRACT
Generation (DG,) is a new source which is used in distribution systems. DGs are connected directly by distribution system operators or indirectly by customers. The DGs usually are connected near the consumer load centers. The high use of DGs leads to improvement of power quality, improvement of voltage profile, a decrease of losses. Due to the increasing need to distributed energy resources in power systems, their problems should be studied. One of the main problems of distributed energy resources is unplanned islanding. The unplanned islanding has some dangers to the power systems and the repairman which are work with the incorrect devices. The proposed method is based on wavelet transform and a new Distributed classifier named as Artificial Neural Network (ANN), Fuzzy logic, support vector machine (SVM), and Adaptive Neuro-Fuzzy Inference System (ANFIS). The wavelet transform is used to extract features from the current waveform of current at the point of common coupling (PCC) point. PCC is assumed as the connection point of distributed generation to the distribution system. The proposed method is implemented on a 14 IEEE bus grid in MATLAB/SIMULINK software. The results show the high accuracy of islanding detection of the proposed method. In this paper, one wind turbine is assumed as a distributed resource. At last, comparison of all classifiers is done and finally conclusion provide for best classifier for islanding detection for distributed generator system.

1.1. INTRODUCTION
Increasing of environmental issues, the rising of oil and natural gas prices, high energy cost, greenhouse gases and huge power plant construction cost are the sufficient causes to think about the alternating way of power generation known as Micro-grid. A Micro-grid concept allows penetration of distributed generation (DG) into the distribution system without requiring a re-design and re-engineering of the system. Incorporation of distributed generators (DGs) using Micro-grid concepts at the distribution level has gained momentum due to the exponential increase in demand and environmental factors. A significant amount of distributed energy resources (DERs) has been installed in recent past and that to a level of energy growth about 23.7% of total global generation However, the deployment of DGs with the utility raises many technical issues concerned with the protection and control strategies. Depending on the output power fed to the local consumer, the Micro-grid scheme can be broadly classified as AC-Microgrid and DC-Microgrid. Due to enhance operational characteristics in terms of smart, reliable, sustainable, renewable and efficient method of power generation of Micro-grid, it plays a vital role in future smart power grid structure and design. demonstrates various advantages of Micro-grid system on compare to Macro-grid system on the basis of economics, reliability, power quality, environmental issue, security and safety.

1.2 DISTRIBUTION SYSTEM WITH MULTIPLE DGs.
Distributed or dispersed generation may be defined as generating resources other than central generating stations that is placed close to load being served, usually at customer site. It serves as an alternative to or enhancement of the traditional electric power system. The commonly used distributed resources are wind power, photo voltaic, hydro power. The Fig single line diagram of the distribution system with multiple DGs.

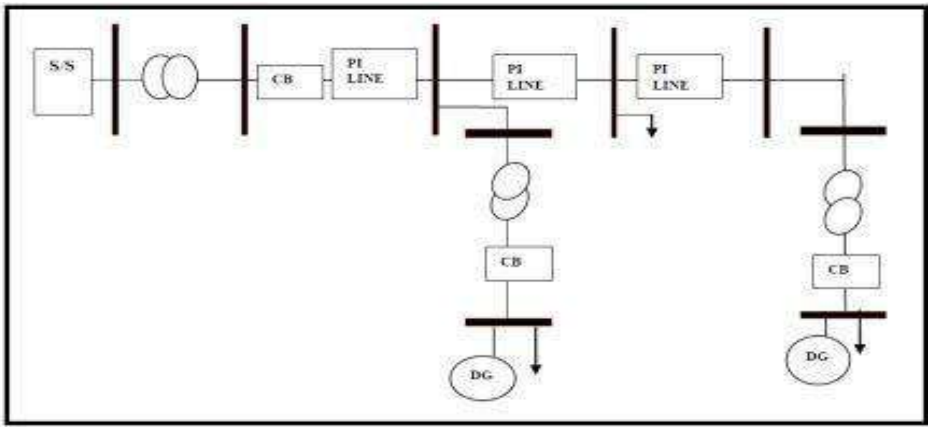

Fig. 1.3 single line diagram of Distributed system with multiple DGs

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2. ISLANDING DETECTION TECHNIQUES

The main philosophy of detecting an islanding situation is to monitor the DG output parameters and system parameters and/ and decide whether or not an islanding situation has occurred from change in these parameters. Islanding detection techniques can be divided into remote and local techniques and local techniques can further be divided into passive, active and hybrid techniques as shown in Fig

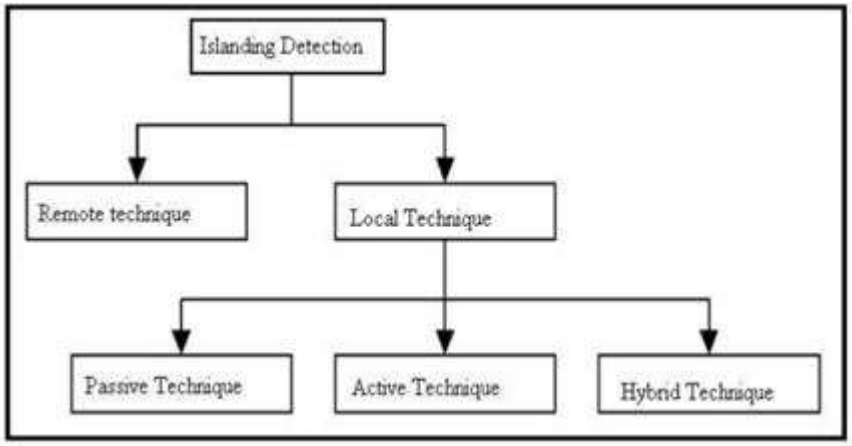

Fig. 2.1 Islanding detection techniques

3. METHODOLOGY

3.1 FUZZY LOGIC CONTROLLER

Fuzzy logic is a logic which deals with uncertainty by modelling the events. It deals with three entities:

i. Degree of accuracy /precision

ii. Uncertainty

iii. Vagueness (approximately equal) In a narrow sense, fuzzy logic is a logical system, which is an extension of multi – valued logic. However, in a wider sense fuzzy logic (FL) is almost synonymous with the theory of fuzzy sets, a theory which relates to classes of objects with unsharp boundaries in which membership is a matter of degree. In fuzzy logic, the truth of any statement becomes a matter of degree. Any statement can be fuzzy. The major advantage that fuzzy reasoning offers is the ability to reply to a yes-no question with a not-quite-yes-or-no answer. Humans do this kind of thing all the time (think how rarely you get a straight answer to a seemingly simple question), but it is a rather new trick for computers.

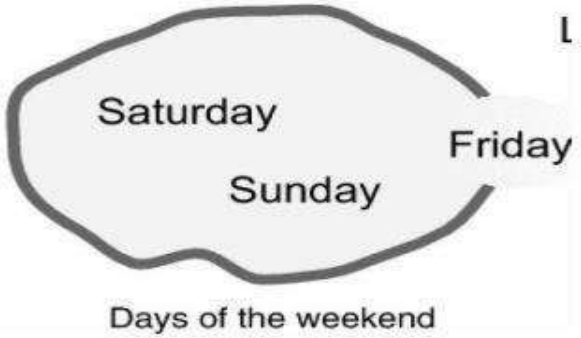

Fig.3.1: Representation of days of the weekend using fuzzy set

Let us take an example for defining the weekend using fuzzy logic: There are three days which comes in our mind when we talk about weekends. So, if we define these using two valued function we can either give 1 0r 0 to every day. But if we use fuzzy logic we can give different membership value to each day. Almost all will say that

Saturday and Sunday are weekend. But if we see more precisely Friday is also somewhat weekend. This can be understood through the below graphs in Fig 3.2 So, using fuzzy we need not to give exact responses or absolute answers. We can somewhat skip from the question or in a broader way can give somewhat varying answer.

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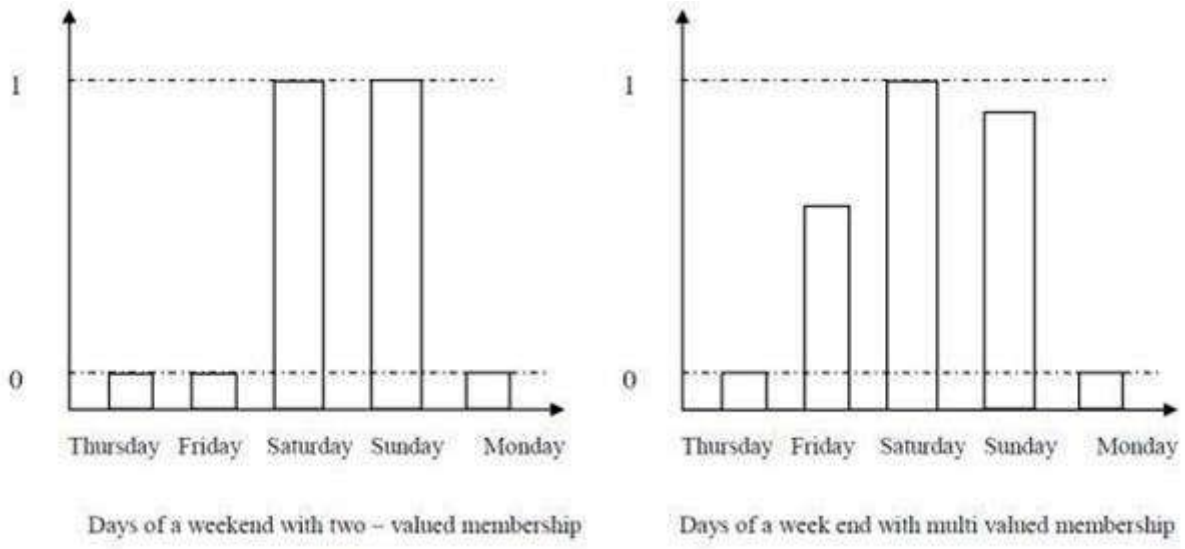

Fig. 3.2 Bar graph of classical set and fuzzy set

4. SIMULATION MODEL

Shows the complete matlab Simulink model of proposed approach in which IEEE 14 bus subsystem, Wavelet transform subsystem model is design for taking the reading during different islanding condition.

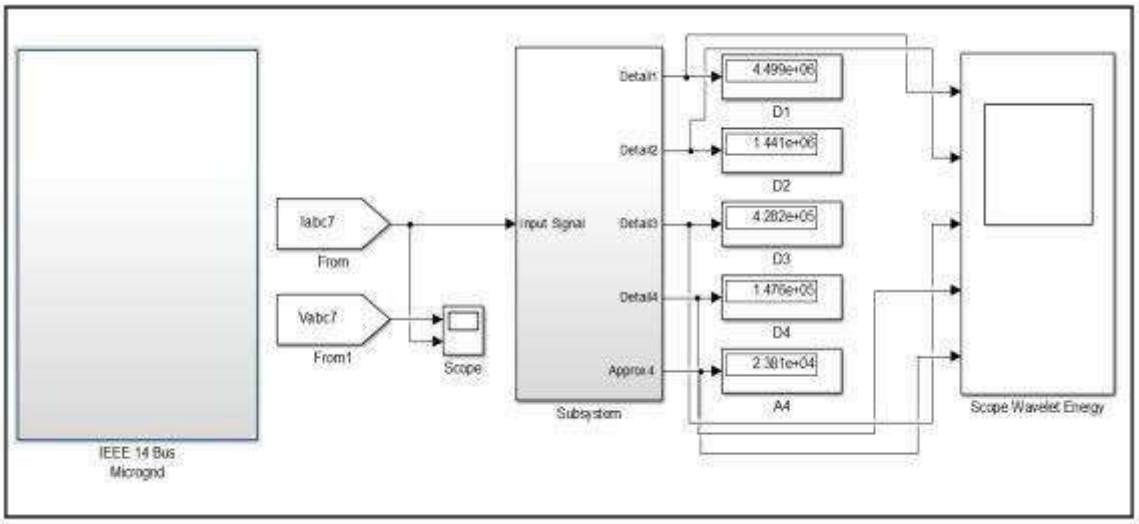

Fig: MATLAB Simulink model of complete system

4.1 IEEE 14 BUS SUBSYSTEM

Shows the complete IEEE 14 bus subsystem model. The transmission line connected in between each bus bar and transmission line resistance, inductance and capacitance shown in table. There are five generators are connected at bus bar 1, 2, 3, 6, and 8 while RL loads are connected at remaining bus for system. Table 1 shows the bus bar generator and load data for IEEE 14 bus system

IEEE 14 Bus system bus bar and generator data for MATLAB simulink model

Bus bar No	Bus voltage (pu)		Generation (pu)		Load	
	Magnitude (pu)	Phase difference (pu)	Real power (MW)	Reactive Power (MVAR)	Real power (MW)	Reactive power (MVAR)
1	1.060	0	114.17	-16.9	0	0
2	1.045	0	40	0	21.7	12.7
3	1.010	0	0	0	94.2	19.1
4	1	0	0	0	47.8	-3.9
5	1	0	0	0	7.6	1.6
6	1	0	0	0	11.2	7.5
7	1	0	0	0	0	0

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8	1	0	0	0	0	0
9	1	0	0	0	29.5	16.6
10	1	0	0	0	9	4.8
11	1	0	0	0	3.5	1.8
12	1	0	0	0	6.1	1.6
13	1	0	0	0	13.8	4.8
14	1	0	0	0	14.9	5
1	1.060	0	114.17	-16.9	0	0
2	1.045	0	40	0	21.7	12.7
3	1.010	0	0	0	94.2	19.1
4	1	0	0	0	47.8	-3.9
5	1	0	0	0	7.6	1.6

5. WAVELET TRANSFORM SUBSYSTEM

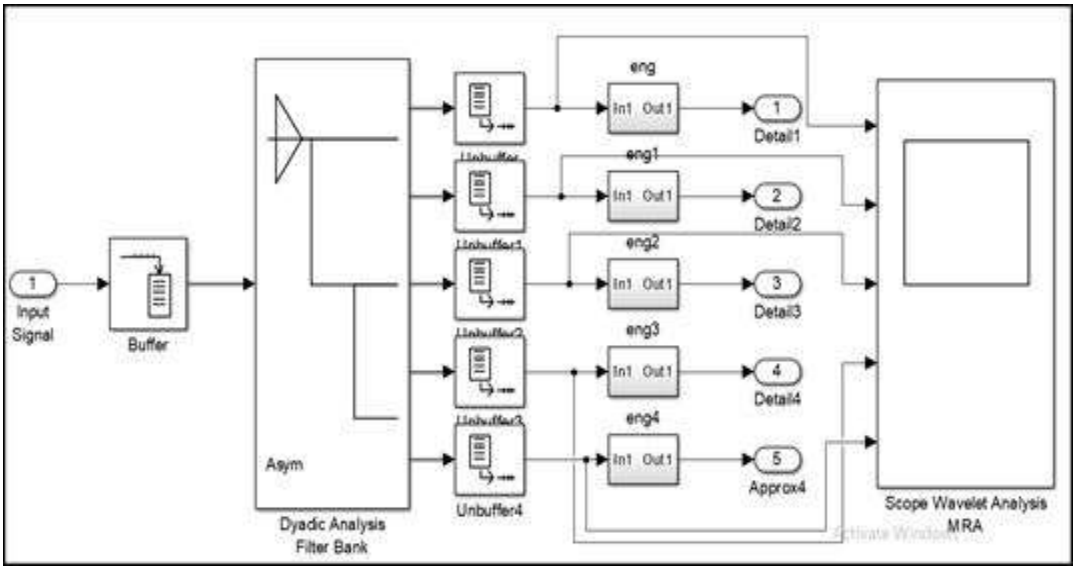

Fig. 5.1 MATLAB Simulink model of wavelet transform and spectral energy calibration subsystem model

Fig. 5.1 shows the wavelet multi resolution analysis subsystem with spectral energy calibration subsystem shown in Fig. 5.1. The total four level use for multi- resolution analysis using Daubechies 2 (Db2) mother wavelet. Input for mother wavelet is input three phase currents measured at bus bar 7 of IEEE system while output is wavelet features of Detail D1 to D4 and Approximation A4 at level 4. Then after spectral energy of D1 to D4 and A4 are calibrated using spectral energy calibration subsystem connected at each signal shown in Fig.5.2

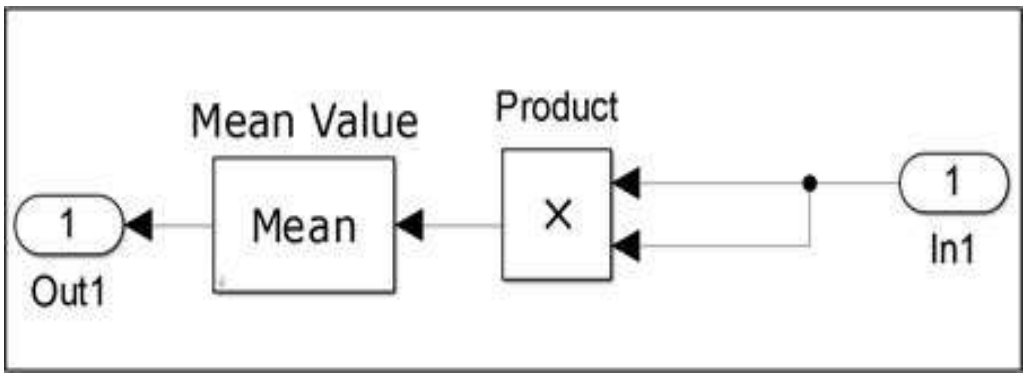

Fig. 5.2 Spectral Energy calibration subsystem MATLA Simulink model

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6. RESULT ANALYSIS

6.1 Three phase voltage and current measurement:

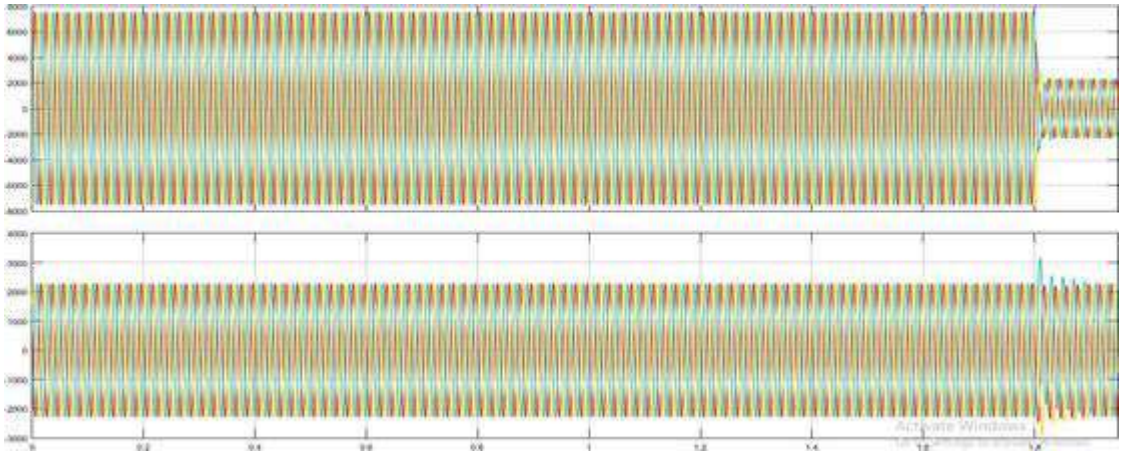

Fig. 6.1 Three phase voltage and current of IEEE 14 bus system when islanding occurs at generator 5 at 1.8 sec time

Fig. 6.2 Shows three phase voltage and current measured at bus bar 7 of IEEE 14 bus microgrid system during islanding occurs at generator 5 at 1.8 sec simulation time. Upper axis shows the three-phase voltage which drop from 1.8 second but not zero because of islanding occurs at generator 5 while current of system also drops from 1.8 sec simulation time. Similarly, Fig. shows the three phase voltages and current waveform when islanding event occurs at generators 1, 2, 3 respectively.

Fig 6.3 shows the wavelet spectral energy calibration of Detail D1 to D4 and Approximation A4 signal after wavelet multi-resolution analysis of three phase current of IEEE 14 bus microgrid system. This Fig. shows the spectral energy during islanding occurs at generator 5 at 1.8 second simulation time. Similarly, Fig. 12 to 14 shows the spectral energy calibration after wavelet multi-resolution analysis during islanding occurs at 1, 2 and 3 respectively.

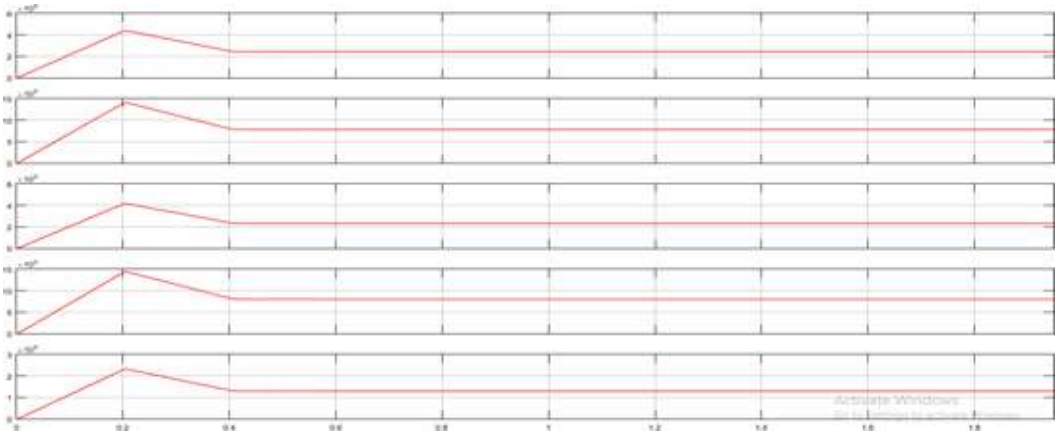

Fig. 6.3 Wavelet spectral energy of multi resolution analysis signals detail D1 to D4 and Approximation A4 signal of three phase current when islanding occurs at generator 1 at 0.2 sec time

7. CONCLUSIONS

The proposed method uses wavelet transform and a Fuzzy Logic Controller (FLC) classifier to detect islanding on a 14 IEEE bus grid. It is implemented using MATLAB/SIMULINK software and uses wavelet transform to extract features for FLC to detect islanding. The method is highly accurate in detecting islanding of generators, with five generators as a distributed resource.

8. FUTURE SCOPE

The proposed approach can be used,

- For detecting reverse power in alternator systems
- Islanding in solar PV systems, and addressing
- Power quality issue in DGs and PV system

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REVIEW ON: INVESTIGATIONS ON PROTECTION CHALLENGES IN POWER GRID INTEGRATED RENEWABLE ENERGY SYSTEMS

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ABSTRACT
Renewable energy resources are environment friendly, highly demanding in future but their integration as distributed energy resources (DERs) poses fundamental operational and governance challenges such as power system instability, reliability, power quality and protection. In this Paper, Protection Challenges in Power Grid Integrated Renewable Energy Systems are discussed in detail. Also, research gap analysis is performed which is future scope for finding solution on present challenges in integrating Renewable Energy Systems with Power Grid.

1. INTRODUCTION

1.1 Introduction

Among different sources of alternate energy, wind and solar are two prominent and promising alternatives to meet the future electricity needs for mankind. The integration of RES into the electric grid has seen a vast improvement recently. Some benefits of this integration are meeting consumer needs and shaving the peak demand; less investment in comparison to installation of new transmission lines and power plants, enhancement of the reliability on the consumers' side, and improvement of the voltage profile in distribution level. If the power generated by these sources is bulk, then they are either integrated at the distribution

/transmission level or may be operated in an island mode if feasible. These sources cause the load flow to change in the network which can affect the overcurrent (OC) relays as the main protective device. In addition, the generation of renewables varies due to change in the weather conditions, which can make it difficult to determine appropriate OC relay settings.

1.2 Protective Relay

A relay is automatic device which senses an abnormal condition of Electrical circuit and trip the Circuit Breaker for disconnecting the faulty portion of the electrical circuit from rest of the healthy circuit. The value of actuating quantity (voltage or current) which is on threshold above which the relay initiates to be operated. There are Different types of relay based on Characteristics, logic and actuating parameter.

1.3 Relay Coordination

The relay co-ordination is a tripping of protecting relay in a sequence or order in electrical power system. Each protective device is assigned a primary function to clear faults in a specific zone and a secondary function to clear faults in the adjacent or downstream zones to the extent within the range of the device permits. Good practice dictates that when a fault occurs, the area isolated by the protective device must be as small as possible, with only the device nearest to the fault operating. In addition, the failure possibility of a protective device must be considered. In this situation, the next upstream device, or device combination, must operate to provide backup (remote) protection. When two devices operate properly in this primary/secondary mode for any system fault, they are said to be coordinated. In Relay Protection Coordination, downstream devices should activate before upstream devices.

1.4 Protection Issues with Large Scale Penetration of RES

As shown in Fig.1, the fault is supplied from the grid as well as from the RES. For the fault near relay R2, the fault current seen by relay R2 will increase and it will decrease for relay R1 depending on the RES rating and RES impedance. The change in fault level seen by the relays will result in the under reach operation of the relays.

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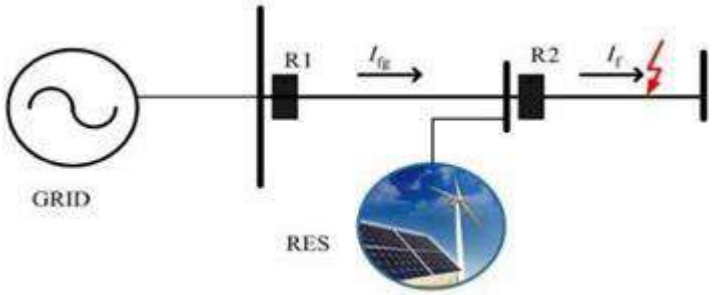

Fig. 1: RES integration into existing network

- **Blinding of Protection**

As discussed above in Fig. 1, fault current sensed by relay R1 will be lesser than without a RES connection. This reduction in fault current will result in no operation byrelay R1 and is known as a blinding operation of the relay.

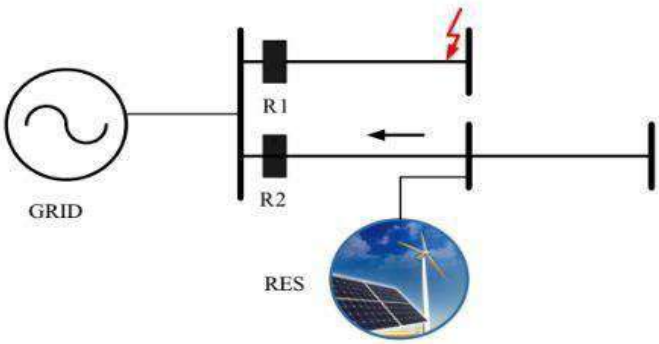

Fig. 2: Sympathetic tripping of relay R2 due to RES infeed

Integration of large scale RESs in distribution systems results in the bidirectional flow of the fault current on most of the feeders/lines. A non-directional over current relay may fail to provide the desired protection for these networks duringinfeed from the RES. As shown in Fig. 2, for a fault, the relay R2 may trip in a reverse direction because of the forward operation of relay R1. These types of tripping's are known as false tripping's. In big interconnected distribution systems, a few relays may experience fault levels greater than their pickup value and may trip before the desire primary/backup relays which results in isolation of a larger portion of the network. These types of false tripping's are known as sympathetic tripping's.

- **Islanding Problems**

As shown in the Fig. 3, if the fault current level sensed by R2 is sufficient to trip it, then it will lead to an islanding operation of the RES with its local connected load.

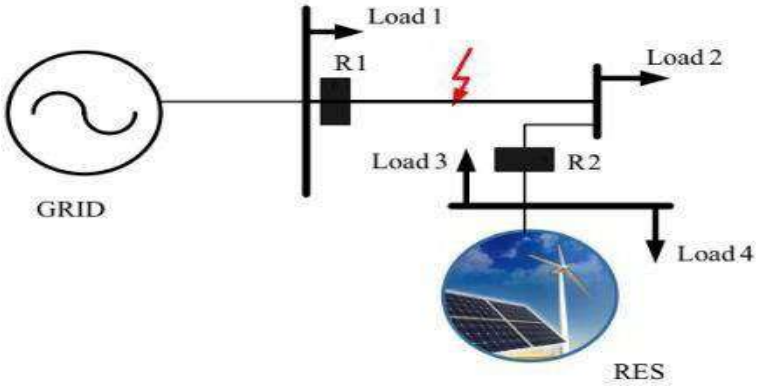

Fig. 3: Islanding problems due to RES connection.

2. LITERATURE REVIEW

[1] In this Paper A method has been proposed for appropriate relay coordination and has beenanalyzed for the test system. The IEEE-13 bus system has been considered for the proposed method. Because of generation capacity added to the distribution system large fault currents flow to the faulted position, then relay coordination between primary and backup relays fails. To overcome this problem relay pickup current is updated then relays are operated effectively,but relay operating time is increase.

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[2] In this paper the impact of PV sources on the OC relays in the MV distribution networks has been studied. EMTDC/PSCAD software is used in this paper to simulate the impact of PV source on the OC relays in the MV distribution network. Different cases have been studied with or without PV source integration. The simulation results showed that integration of PV sources can change the magnitude and direction of flowing current and therefore nuisance trip occurs.To address this problem, recalculation of OC relay settings been done. (Change of Current settings and Time Setting Multiplier TSM settings). The new settings solved the misoperation of and miscoordination between OC relays in the presence of PV sources. But using the recalculated TSMs when the PV source does not generate the power brings about longer fault clearing time.

[3] This paper explores the effect of high DG penetration on protective device coordination and suggests an adaptive protection scheme as a solution to the problems identified. The methods proposed in this literature to solve the problem are not satisfactory from operational point of view. The need to monitor DG status continuously, disconnect the DGs and measure the current of downstream OC protective devices persistently are the main disadvantages of these schemes. Moreover, reliance of these adaptive methods on the communication networks makes them vulnerable and costly.

[4] This paper proposes the online network reconfiguration as an additional active network management (ANM) scheme of Active distribution network (ADN)s for the minimization of Distributed Generation DG curtailment, line congestion relief, and voltage rise mitigation due to high DG penetration. Different distribution test systems are used to validate the performance of the proposed method. Network reconfiguration, as an ANM scheme, maximizes the DG integration into the network, while it defers potential network investments and decreases operational costs.

3. RESEARCH GAP ANALYSIS

When Renewable energy sources integrated with power system, because of generation capacity added to the distribution system large fault currents flow to the faulted position, then relay coordination between primary and backup relays fails. To overcome this problem relay pickup current is updated then relays are operated effectively, but relay operating time is increase.

To overcome the effect of high DG penetration on protective device coordination, an adaptive protection scheme suggested as a solution to the problems identified. But this needs to monitor DG status continuously. Moreover, reliance of these adaptive methods on the communication networks makes them vulnerable and costly.

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ENHANCING MICROGRID POWER QUALITY USING ADVANCED ACTIVE POWER CONDITIONING

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ABSTRACT
Wind energy conversion systems have emerged as a key area of study for microgrid-based renewable energy sources in recent years. Power quality issues and their relationship to the distribution network provide a significant difficulty for wind power generation. In order to link load and wind power to the microgrid and to produce substantial harmonics, the converter and rectifier utilized in the microgrid are employed to convert AC to DC to AC. Harmonics in voltage and current have an adverse effect on the quality of power in a power network. A microgrid that has a shoddy electrical grid might quickly cause the necessary disruptions. As a result, in order to improve the power quality in a microgrid that uses renewable energy, a three-phase Active Power Conditioner (APC) is needed. In this case, the APC acts as an interface between the microgrid's AC bus and the renewable energy sources. APC should employ a better control approach that allows it to compensate for current harmonics and introduce some energy into the microgrid in order to adjust the power factor. The enhanced control approach enables sinusoidal and balanced line current at the point of common coupling (PCC) even in the event of an unbalanced load. We use the simulation to verify the enhanced control approach.

Keywords: Active Power Conditioner, Renewable Energy, Microgrid, Current control, AC-DC-ACConverter.

I. INTRODUCTION
In the era of technology, renewable energy sources are now necessary to fully meet energy demands due to rising power consumption and a scarcity of fossil fuels. A significant portion of renewable energy is produced by wind power plants. Wind power plants are a significant source of renewable energy, but because their primary power sources are unpredictable, the power they generate over time is uneven. This makes integrating a large number of wind turbines into a microgrid more problematic. Voltage and frequency regulation is one of the challenges that wind power facilities must overcome in order to contribute [1]. A group of electric loads and power generation from various sources, such as wind, solar, etc., operating as a controllable system that injects electric power into its local area and regional grid is referred to as a microgrid in an electrical power system. [2–3]. The microgrid is crucial for improving local dependability, boost productivity, enable local voltage, rectify voltage sag, and offer an uninterruptible power supply function [4] [5]. One potential alternatives for the above- mentioned drawback is to use the APC, as illustrated in Fig. 1, as a power interface between the microgrids' AC bus and renewable energy sources. In power distribution systems, the APC has shown to be a valuable substitute for compensating for voltage and current oscillations [6], [7]. The technical literature has presented a variety of APC topologies [8], but the majority of them are not suitable for use in microgrid applications. This paper describes an APC that enhances microgrid power quality. The novel control approach that permits energy injection into the microgrid, current harmonic compensation, power factor correction, and supply voltage balancing at the PCC will receive the majority of attention. Several SimPower Systems from Matlab/Simulink simulation tests have demonstrated the validity of the control strategy.

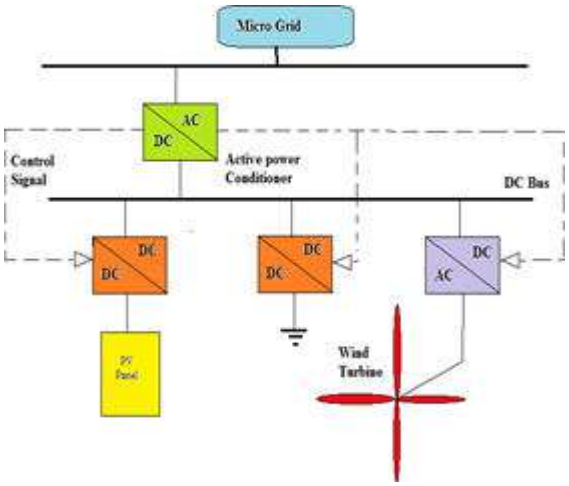

Fig1: APC for Microgrid applications

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The enormous gap between energy supply and demand has placed extraordinary load on the infrastructure sustaining electrical supply. Utilities have placed additional regulations on certain industries, with a particular emphasis on power quality. Apart from monetary damages, there are expenses linked to excess energy losses in common network components like transformers, cables, and motors.

Historically, it has been believed that low power factor is the only factor leading to inefficiencies in electrical systems. Conventional passive solutions, such as APFCs and fixed capacitor banks, were highlighted more. These fixes, however, don't deal with the underlying issue of high harmonics in the electrical network.

II. CONTROL SCHEME

Four-leg converters are the most commonly utilized topology for controlling four currents [9]. The controllability of this topology is superior to that of the conventional three-leg four-wire topology [10]. However, the latter is preferred due to its lower quantity of electronic power devices. This essay's argument is demonstrated that even with a sufficient control strategy, With a straightforward three- leg, four-wire setup, it is feasible to reduce disruptions such as THD, voltage imbalance, and others. The topology of the examined APC and its relationship to In Fig. 2, the microgrid is displayed. It is composed of voltage source inverter with three legs and four wires. The VSI performs as a voltage source which is controlled by current in these types of applications. Two capacitors are used to split the DC-link voltage and tie the neutral point to the midpoint of the two capacitors in order to provide the neutral point. Voltage variation between the DC capacitors results from this topology, which permits current to flow through the switches and the capacitors in both directions.

ifa+ifb+ifc= ifN

Where, ifa, ifb, ifc are phase APC currents and

ifN is the APC neutral current.

As a result, the overall DC voltage will oscillate at both the neutral current's corresponding frequency and the switching frequency. A dynamic offset level can be added to both limits of the hysteresis band in order to limit the previously mentioned drawback if hysteresis is used for current control, as demonstrated in [2].

The current at (PCC) for the topology under investigation shown in Fig. 2 is:

i_x=i_lx+i_fx

Where:

i_x,i_lx,i_fxare the microgrid side current, the load current, and the APC current respectively. The x index points a, b and c current phases.

The instantaneous load current is:

i_lx=i_lx^1+i_lxk+i_lxq

Where:

- i_lx^1the fundamental active current component;
- i_lxk the addition of current harmonics;
- i_lxq the reactive current component. The three-phase APC current is given by:

i fx i fx + i fx

i_fx^1 -the fundamental conditioner current component;

i fx - the current's deforming component. The grid current must be sinusoidal and in phase with the voltage at PCC, as illustrated

in Fig. 2. As a result, the APC control strategy needs to be created to ensure that the grid current has a sinusoidal wave.

i lx +i lx +i lxq+i fx + i fx i x

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Unexpected current harmonics are generated by the APC switches in the vicinity of the switching frequency and its multiples. The LR passive filter can be used to filter these undesirable current harmonics if the APC's switching frequency is high sufficient.

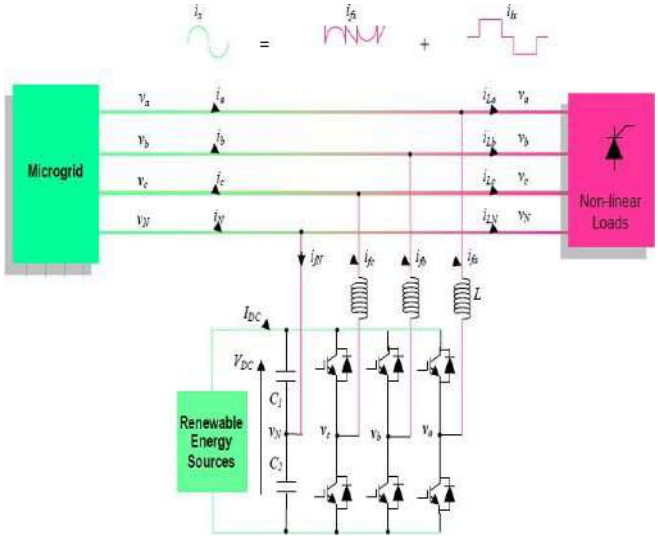

Fig2: APC topology

III. CONTROL OF THE APC

A. Control Strategy

A control algorithm for an APC can be created in a variety of ways [7][8]. Typically, when designing a controller, it is taken into account that the grid voltage at the PCC is balanced. The supply voltage in a microgrid may exhibit distortion or imbalance. As a result, the APC controller that is used to enhance the microgrid's power quality must be built with the grid's weaknesses in mind. By forcing the microgrid side current to become sinusoidal and balanced, the proposed control algorithm uses a compensation method to force the APC to compensate the current of a non-linear load (Fig. 3). The three-phase grid current (i_a, i_b, and i_c), three-phase voltage at the PCC (v_a, v_b, and v_c), and DC-link voltage (V_DC) are needed by the controller. As illustrated in Fig. 3, a PLL uses the line voltage to provide the sinusoidal waveform and phase of the grid current reference (〖i_a〗 ^*, 〖i_b〗 ^*, 〖i_c〗 ^*). By passing the error signal between the DC- link voltage (V_DC) and a reference voltage (〖V_DC〗 ^*) through a FUZZY controller, the magnitude of the same current is obtained.

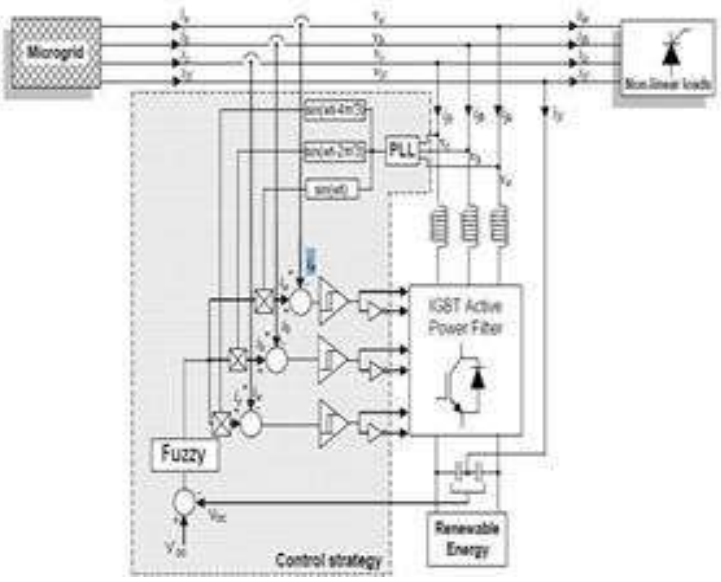

Fig-3: APC Control Strategy

B. Switching Control

Hysteresis control has been used to maintain the controlled current within a particular band related to the references, as illustrated in Fig. 3. The error is used to determine the switches' status. The switches' status changes and the current starts to decrease until the error reaches a certain negative value when the current is increasing and the error exceeds a predetermined positive value. The switch's status then shifts once

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more. When it comes to dynamic response and robustness against variations in the non-linear load, non-linear controllers based on hysteresis strategies better than linear ones. The non-constant switching frequency of hysteresis strategies can result in an extensive side harmonic band related to the switching frequency.

The switching frequency can be fixed using various methods, such as modulated hysteresis [10] or variable hysteresis bandwidth [9], to get around this problem. However, this is not the purpose of the paper.

IV. RESULTS AND DISCUSSION

The MATLAB/Simulink package was used to run the simulation. A software program for modeling, simulating, and analyzing dynamic systems is called Simulink. Both linear and nonlinear systems can be modeled in sampled time, continuous time, or a combination of the two. Additionally, systems can be multirole, meaning that they consist of various components that are updated or sampled at various rates. This provides simulation results in addition to the Simulink models of the shunt active filter with hysteresis current controller. Using MATLAB/Simulink, a thorough simulation study is carried out to verify the suggested control strategy. The three-leg grid interfacing inverter is actively controlled by renewable energy source in order to achieve balanced sinusoidal grid currents at unity power factor.

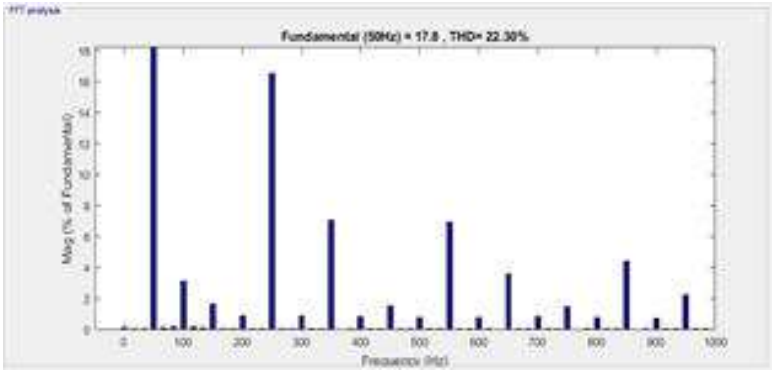

Fig. 4(i_l) Fuzzy with 0.1s start time

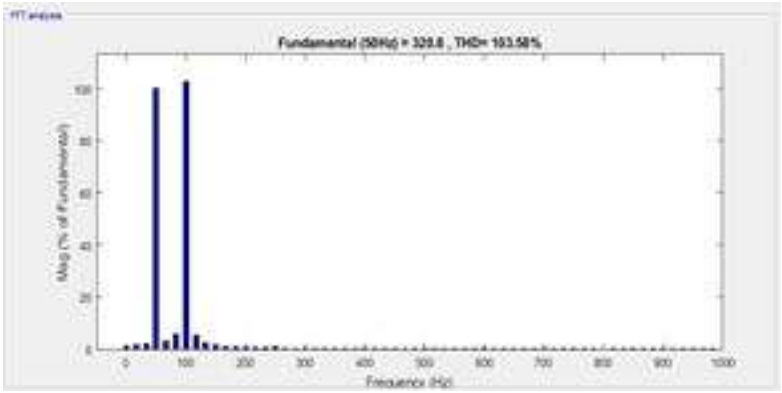

Fig. 5(i_s) Fuzzy with 0.1s start time

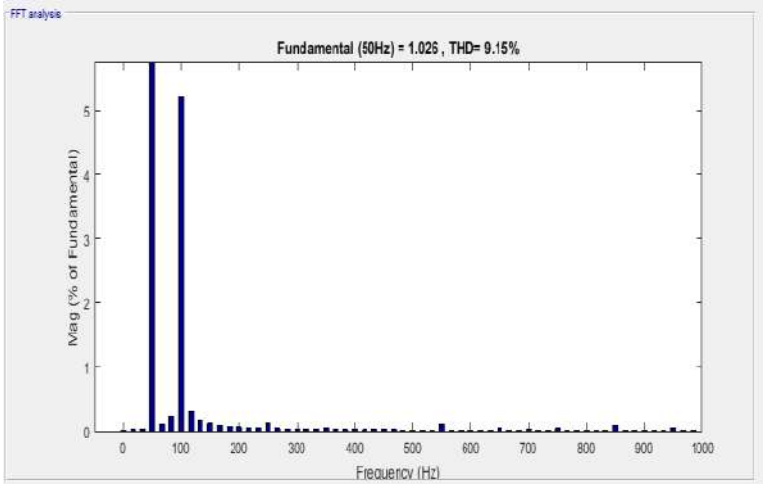

Fig. 6(v_l) Fuzzy with 0.1s start time

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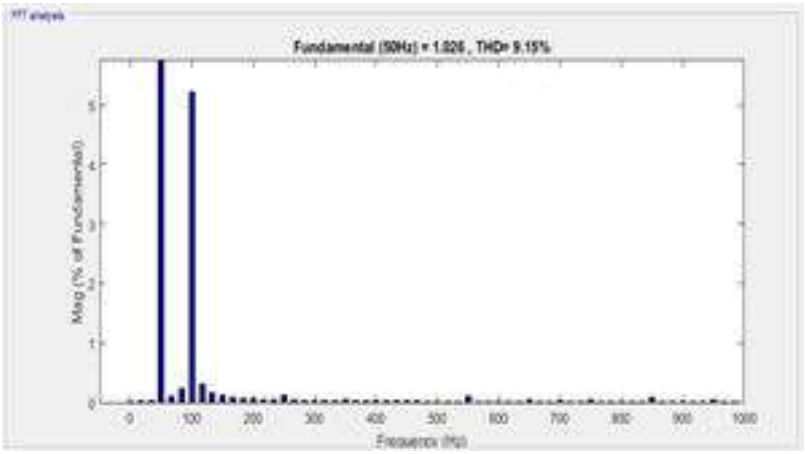

Fig. 7(v_s) Fuzzy with 0.1s start time

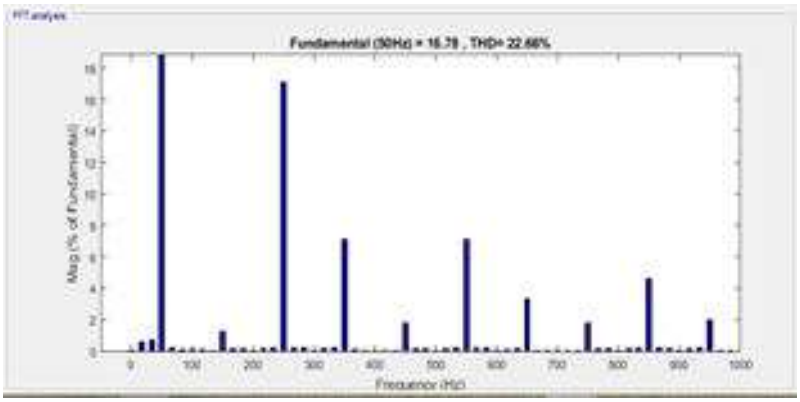

Fig. 8(i_l) Fuzzy with 0.5s start time

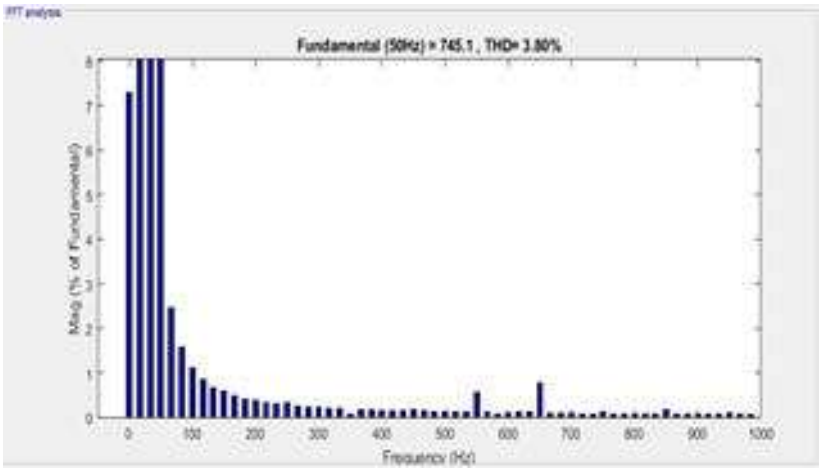

Fig. 9(i_s) Fuzzy with 0.5s start time

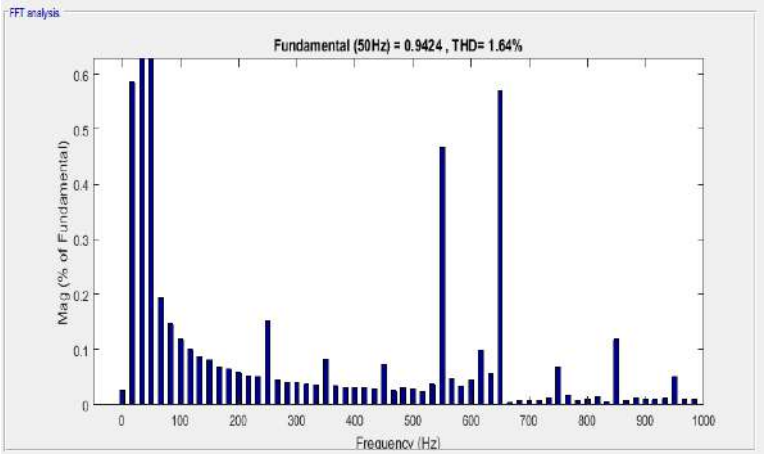

Fig. 10(v_l) Fuzzy with 0.5s start time

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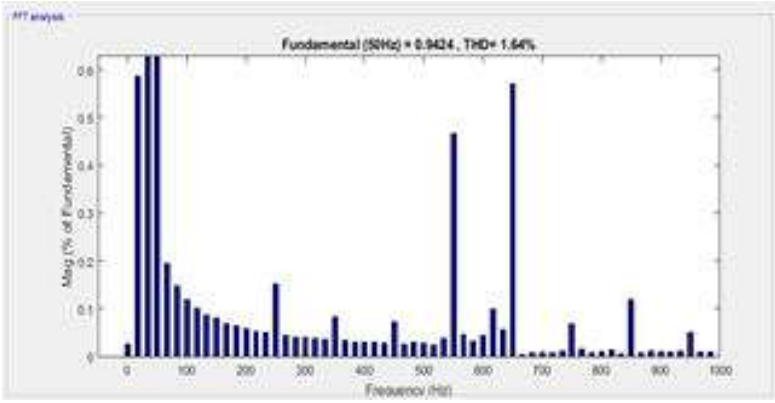

Fig. 11(v_s) Fuzzy with 0.5s start time

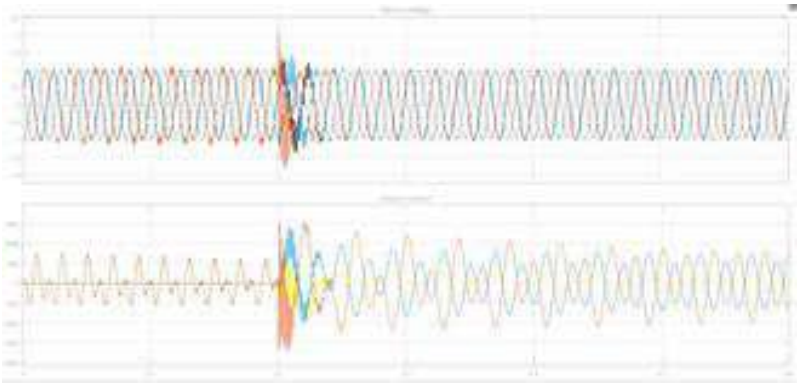

Fig. 12 Current and Voltage at the Source

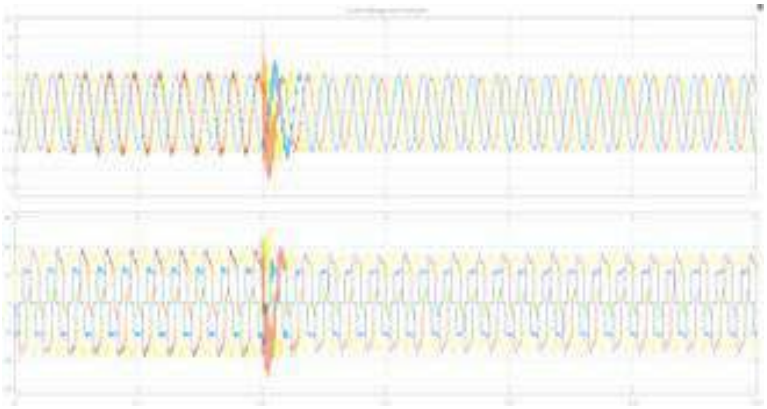

Fig. 13 Current and Voltage at the Load

In this case study, a three-phase diode bridge rectifier with a 60 Ω resistor in series with a 0.1 mH inductor at the DC side is used to investigate the APC. The load requires 5 kW of power, while the renewable sources provide 3 kW.

V. CONCLUSION

An ad hoc control scheme is presented to solve the reactive power and harmonic current issue. Through energy injection into the microgrid and reactive power compensation of both harmonic current and reactive power in the system, these control schemes improve power quality and correct the power factor. When compared to the current conventional control schemes, an improvised control strategy is relatively easy to comprehend and apply. The simulation's findings demonstrate the strong steady state and dynamic performance of an improvised control strategy. In the future, research will be needed to determine the best control plan in situations where the active filter's rating is not sufficient to compensate for harmonic and reactive power.

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AUTOMATIC POWER FACTOR CONTROLLER BY USING IC (ULN2803)

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ABSTRACT
The main aim of this project is to enhance the power quality by constantly monitoring the load power factor, when the load power factor drops below a definite value it results in the rise of line current resulting in more line loss and greater voltage drop.

So, the method is to be developed to improve power factor automatically. Inductive loads are main reasons for low power factor in power systems. Therefore, we need to develop a method to improve power factor automatically

Automatic power factor controller project provides solution to this problem. Low power factor creates unnecessary loading on transmission lines. By inserting the capacitances of required magnitude power factor can be improved therefore improving the efficiency of the system. In this project, power factor correction unit is developed with microcontroller section, relays, capacitive load and inductive load.

Keywords: Sensors, Microcontroller, Relay, Arduino & IC (ULN2803) etc.

1. INTRODUCTION
Power factor is the ratio of true power or watts to apparent power or volt amps. They are identical only when current and voltage are in phase then the power factor is Unity (1.0). The power in an ac circuit is very seldom equal to the direct product of the volts and amperes.

In order to find the power of a single- phase ac circuit the product of volts and `amperes must be multiplied by the power factor. Ammeters and voltmeters indicate the effective value of amps and volts. True power or watts can be measured with a wattmeter. If the true power is 1870 watts and the volt amp reading is 2200, then the power factor is 0.85 or 85%.

True power divided by apparent power. The power factor is expressed in decimal or percentage. Low power factor is usually associated with transformers and motors.

An incandescent bulb would have a power factor of close to 1.0.

2. POWER FACTOR
For a DC circuit the power in the circuit is given by P=VI and this relation also holds good for the instantaneous power in an AC circuit. However, the average power in an AC circuit expressed in terms of rms voltage and current is: Pavg = VIcosφ Where, φ is the phase angle between the voltage and current.

The term = cosϕ is called the power factor. Power factor is the ratio between the KW and the KVA drawn by an electrical load where the KW is the actual load power and the KVA is the apparent load power. It is a measure of how effectively the current is being converted into useful work output and more particularly is a good indicator of the effect of the load current on the efficiency of the supply system.

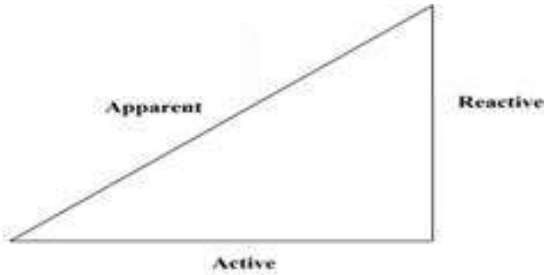

Fig: 2 Power Triangle

A poor power factor due to an inductive load can be improved by the addition of power factor correction, but, a poor power factor due to a distorted current waveform requires a change in equipment design or expensive harmonic filters to gain an appreciable improvement. Many inverters are quoted as having a power factor of better than 0.95 when in reality, the true power factor is between 0.5 and 0.75.

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3. INDUCTOR, CAPACITOR & REACTOR:-

3.1 Inductor an inductor with AC supply is shown in the figure below along with its phasor diagram, which shows the phase angle between current and voltage.

In case of an inductor, voltage leads current by 90^0. The voltage across an inductor leads the current because the Lenz law behaviour resists the buildup of the current and it takes a finite time for an imposed voltage to force the buildup of current to its maximum.

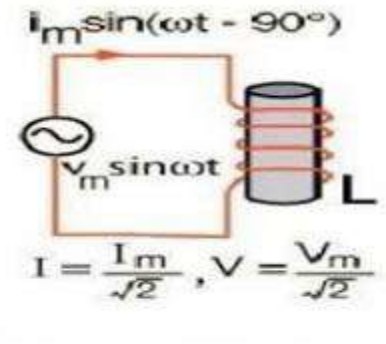

Fig.(3.1 A)Inductor

3.2 Capacitor:-

A capacitor with AC supply is shown in the figure below along with the waveform and phasor diagram, which shows that the phase angle between current and voltage. In case of a capacitor, voltage lags behind the current by 90^0. The voltage across a capacitor lags the current because the current must flow to build up charge and the voltage is proportional to that charge which is built up on the capacitor plates.

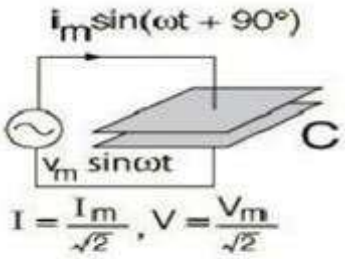

Fig. (3.2 A) Capacitor

3.3Resistor:-

A capacitor with AC supply is shown in the figure below along with the waveform and phasor diagram, which shows that the phase angle between current and voltage.

In case of a capacitor, the phase angle between current and voltage is 0^0. For ordinary currents and frequencies, the behaviour of a resistor is that of a dissipative element which converts electrical energy into heat. It is independent of the direction of current flow and the frequency. So, we say that the AC impedance of a resistor is the same as

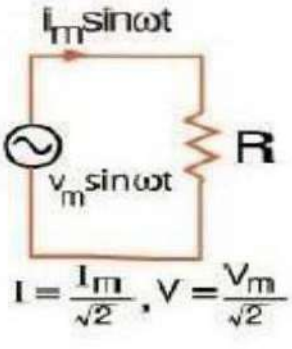

Fig:(3.3 A) Resistor

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4. DISADVANTAGE

of Low Power Factor Power factor plays an important role in AC circuits and power dissipation in the power system is dependent on the power factor of the system. We know that the power in a three phase AC circuit is:

$P = \sqrt{3}\ V \times I \cos\varphi$

And the current on a three phase AC circuit is

$I = P / (3\ V \times \cos\varphi)$ Also the power in a single Phase AC circuit is

$P = V \times I \cos\varphi$ And the current on a three phase AC circuit is

$I = P / (V \times I \cos\varphi)$ It is evident from the equations for the currents that the current is proportional to $\cos\varphi$ i.e., power factor. In other words, as the power factor increases the net current increased

4.1 Poor Voltage Regulation and large voltage drop:-

The voltage drop in the power system is given by:

$V = I \times Z$ Now, in case of a low power factor, the overall current in the circuit will be increased. So the larger the current the larger is the voltage drop. As Voltage Regulation is the change in voltage from no-load to full-load expressed as a percentage of no-load voltage and is given by.

V.R = ((V no-load – V full-load)/V full- load) × 100 In case of low power factor (lagging) there would be a large voltage drop which leads.

5. TYPES OF POWER FACTOR CONTROLLERS:-

Generally, there are three types of techniques that are employed to control the power factor. They are:

1. Static Capacitor
2. Synchronous Condenser.
3. Phase Advance

5.1Static Capacitor:-

These static capacitors provide leading current which neutralizes (totally or approximately) the lagging inductive component of load current (i.e., leading component neutralizes or eliminates the lagging component of load current) thus power factor of the load circuit is improved

5.2Synchronous Condenser:-

The synchronous condenser is the more advanced technique of improving power factor than a static capacitor bank, but power factor improvement by synchronous condenser below 500 kVAR is not economical than that by a static capacitor bank.

For major power network we use synchronous condensers for the purpose, but for comparatively lower rated systems we usually employ capacitor bank. The advantages of a synchronous condenser are that we can control the power factor of system smoothly without stepping as per requirement. In case of a static capacitor bank, these fine adjustments of power factor cannot be possible rather a capacitor bank improves the power factor stepwise.

6. CAPACITIVE POWER FACTOR CORRECTION:-

Capacitive Power Factor correction is applied to circuits which include induction motors as a means of reducing the inductive component of the current and thereby reduce the losses in the supply. There should be no effect on the operation of the motor itself. An induction motor draws current from the supply that is made up of resistive components and inductive components. The resistive components are:

The inductive components are Leakage reactance Magnetizing current

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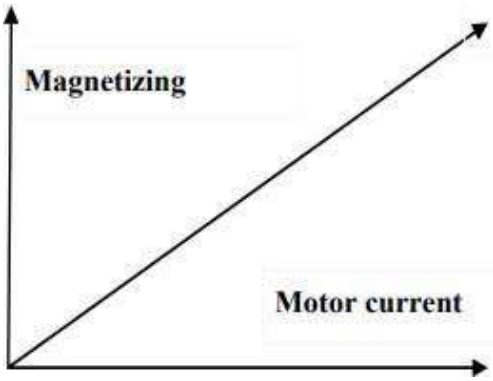

Fig.(7A)

Current Triangle

The current due to the leakage reactance is dependent on the total current drawn by the motor but the magnetizing current is independent of the load on the motor. The magnetizing current will typically be between 20% and 60% of the rated full load current of the motor.

The magnetizing current is the current that establishes the flux in the iron and is very necessary if the motor is going to operate. The magnetizing current does not actually contribute to the actual work output of the motor.

7. PRINCIPLE: -

Automatic power factor detection and correction operates on the principle of constantly monitoring the power factor of the system and to initiate the required connection in case the power factor is less than the set value of power factor.

- The current and voltage signals are sampled by employing instrument transformers connection in the circuit.
- The sampled analog signals are connected to suitable digital signals by the zero crossing detectors.
- The ZCD signals are then added in order to obtain pulses which represent the time difference between the zero crossing of the current and voltage signals.
- The time period obtained is used to calculate the power factor of the circuit.

10. Block Diagram

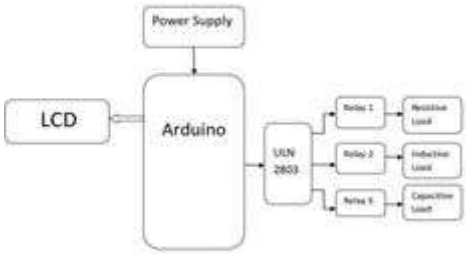

Fig: Block Diagram of Automatic Power Factor Correction Circuit

The primary produces an alternating magnetic field in the magnetic core, which then induces an alternating current in the secondary winding circuit. An essential objective of a current transformer design is to ensure the primary and secondary circuits are efficientlycoupled, so the secondary current is linearly proportional to the primary current.

Resistive Load: -

Fig:12.3 Resistive Load

8. CONCLUSION

The Automatic Power Factor Detection and Correction provides an efficient technique to improve the power factor of a power system by an economical way. Static capacitors are invariably used for power factor improvement in factories or distribution line.

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However, this system makes use of capacitors only when power factor is low otherwise, they are cut off from line. Thus, it not only improves the power factor but also increases the life time of static capacitors. The power factor of any distribution line can also be improved easily by low-cost small rating capacitor.

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STUDY ON "ULTRA CAPACITOR BASED REGENERATIVEBRAKING SYSTEM FOR A DC MOTOR"

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ABSTRACT
Electrical vehicle with its high efficiency, noiseless operation and effective elimination of toxic exhaust gases have gained attention this decade. In earlier times, when conventional vehicles were used a large amount of energy was wasted due to the friction between the wheels and brake pads. In regenerative braking instead of wasting the energy produced during braking, the excess energy is stored and reused with the help of ultra-capacitor based arrangement. The Regenerative braking can improve energy usage efficiency and can also extend the driving distance of Electric Vehicles. This can improve the battery efficiency by 16-25%, depending on the speed and themotor size. Hence regenerative braking plays a vital role in electric vehicles. In this we will focused on ultra capacitor based regenerative braking system and it consists of synchronous buck-boost converter, ultra capacitor, battery, DC motor and a flywheel. With a synchronous buck-boost converter the kinetic energy stored in the vehicle can be converted into electrical energy and hence can be reused. In the present work regenerative braking along with the energy restoration are being discussed. During the motoring mode the battery drives the motor and this energy is stored in a flywheel. During regenerative braking, the DC motor act as a generator and the saved energy is fed to the ultra-capacitor through a current controlled operation. The variation of motor speed, ultra capacitor current and voltage during regenerative braking operations was discussed.

Keywords- Regenerative braking, bidirectional buck-boost converter, dc motor, Ultra capacitor (UC).

I. INTRODUCTION
Electric Vehicles, when invented, were a very proficient technological development, Recently electric vehicles have been gaining more attention than the conventional internal combustion engine vehicles because does not produce any emission to the air, hence no harmful gasses are released from the car that causes atmospheric pollution, provides highefficiency and noiseless operation and also decreases the oil crisis.

In order to improve the performance of vehicles, the conventional vehicles can be either substituted with electric or hybrid electric vehicles. One of the major drawbacks observed in conventional vehicles is that during braking large amount of kinetic energywill be wasted as heat. Regenerative braking is aneffective method and is widely preferred in electric vehicles due to the rapid development of electrochemical double layer capacitors also known asultra capacitor (UC)

Implementation of regenerative braking has increased the driving range by 10-25%. The Regenerative braking system recovers the kinetic energy lost during conventional braking and stores itin the form of useful energy in the battery which canbe used for further applications.

The ultra capacitor (UC) has got a high energy storing capacity and better charging discharging capability to utilize the excess energy produced during braking. Due to the high energy density, batteries can also be used as a storage element. But a problem arises due to the frequent charging and discharging process which greatly affects the battery life. Compared to batteries, UC has got high power density and a better life but has a lower energy density. So in order to eliminate the problems associated with battery life and also to improve the performance a combination of battery and UC is preferred which makes it a hybrid energy storage system. Electric vehicle application through regenerative braking technique consists of various converters, different configurations of ultra capacitor and battery. It has been reported that parallel arrangement of UC and battery proved to be better. The present study is based on regenerative braking of a dc motor using a synchronous buck-boost converter and a parallelarrangement of UC and battery is considered.

1.1 Types of braking
There are various types of motors and hence there are various types of Braking systems too. The predominant types of Braking are:

1. Frictional braking
2. Electromagnetic braking

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3. Pumping braking

1.2. Impacts of Braking

A moving car has a lot of kinetic energy. Whenyou apply the brakes, that energy of motion is transformed into something else, and the car slows down. Most cars use friction brakes, which inhibit motion by converting kinetic energy to heat. Because cars are massive and move fast, they have a lot of energy to convert. That means brakes get very hot, during typical use. As for brakes heat, they fade (become weaker) and eventually fail. This essentially means that, when brakes are applied, a lot of energy, which could be arrested and utilized for various activities, is wasted in the form of heat and also this heat damages the brakes.

1.3. Conventional Braking Mechanism

Braking is the process of using a Mechanical or Electrical equipment called 'Brake' to reduce the speed of any moving or rotating equipment, like vehicles, locomotives. Every time you step on your car's brakes, you're wasting energy. Physics tells us that energy cannot be destroyed. So when your car slows down, the kinetic energy that was propelling it forward has to go somewhere. Most of it simply dissipates as heat and becomes useless. That energy, which could have been used to do work, is essentially wasted.

II. Regenerative Braking System

The RBS is an energy recovery mechanism which slows a vehicle or object by converting its kinetic energy into a form which can be either used immediately or stored until needed. This contrasts with conventional braking systems, where the excess kinetic energy is converted to unwanted and wasted heat by friction in the brakes. In addition to improvingthe overall efficiency of the vehicle, regeneration can greatly extend the life of the braking system as its parts do not wear as quickly. As the brake pads rub against the wheels excessive heat energy is generated. Regenerative braking technology captures the energy created by braking process back into the system in the form of charging the battery for further use.

III. Operation of motor in electric vehicles

The principle behind Regenerative braking is, when an electric motor runs in one direction, it converts electrical energy into mechanical energy that can be used to perform work such as turning the wheel,

and when the motor runs in the opposite direction, a properly designed motor becomes an electric generator. When the wheels spin without acceleration, the rotation induces a reverse flow of energy producing a generator effect. A back emf is induced in the motor. Back electromotive force (back EMF, BEMF) is a voltage that appears in the opposite direction to current flow as a result of the motor´s coils moving relative to a magnetic field. It is this voltage that serves as the principle of operation for a generator. The back EMF is directly related to the speed of the motor, so knowing the value of backEMF allows us to calculate the speed of that motor. Its main function is to convert mechanical energy into electrical energy. This electrical energy can then befed into a charging system for the car's batteries as back up.

IV. Ultra Capacitor Based RegenrativeBraking System

At present most of the electric drives works with a DC machine. The schematic diagram of an UC based regenerative braking system is shown in Fig. 1.During the motoring operation the switch Q1 will be in the closed position. The battery drives the motor with the rated speed. When a brake is applied the motor speed decreases and stops after a while. In the braking mode the switch Q1 is permanently open and the rotational energy associated with the DC motor is used to charge the ultra capacitor through a constant current mode. The braking time can be adjusted by varying the capacitor charging current. A flywheel hasbeen connected to the dc motor for storing energy. At the time of braking the energy associated with the flywheel and the motor is used to charge the UC through UC current controlled operation. The energyis fed to the UC through a synchronous bidirectional buck-boost converter using forward buckboost operation. Regenerative braking in a dc motor using buck and boost converter has been discussed.

The synchronous buck-boost converter provides power flow in either directions, i.e. power flows from motor to UC and then back to battery. This type of converter is nowadays used in hybrid electric vehicles since it provides better performance and efficiency and also reduces the cost. During the forward and reverse power mode both buck and boost operation can be carried out.

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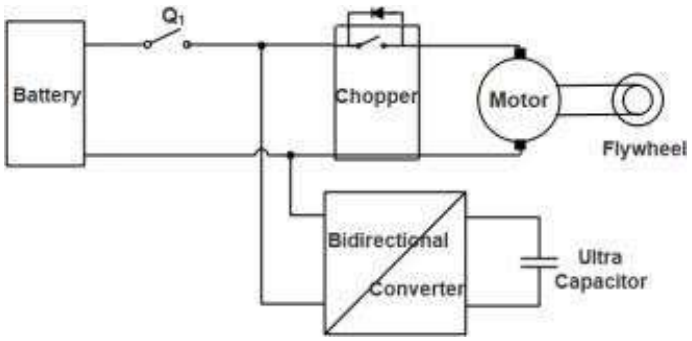

Fig.1. Schematic diagram of an ultra capacitor basedregenerative braking system

Fig. 2 shows the equivalent circuit of a synchronousbidirectional buck-boost converter. When a brake is applied (Q1 in the off position and Q2 in the on position) switching of forward buck and boost operation occurs. Whenever the bus voltage (motor voltage) is greater than UC voltage buck operation is carried out and whenever the process reverses operation switches to boost.

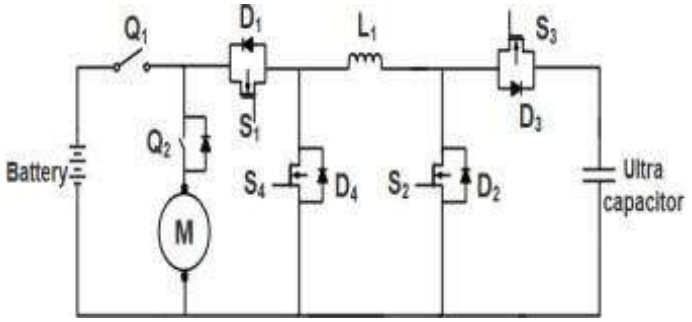

Fig.2. Equivalent circuit of a bidirectional buck-boost converter

During the buck operation S1 is only operated and all other switches are in the off state. Whereas S2 operates during the boost operation i.e. S2 is operated with variable duty cycle according to the UC charging current. Thus the wasted energy is recovered and stored in the UC. The stored energy can be later fed onto the battery through the reverse step up mode. Here the battery current is controlled and during this switch Q1 is in the on state and Q2 in the off state. For the reverse step up mode the switch S4 is operating and switch S3 is in the ON position. S2 and S1 are permanently in the off position.

V. RESULTS AND DISCUSSIONS

In this we will check the braking time of the specified motor. The motor runs with a high speed and gradually the motor speed decreases and this decrease in speed was due to the viscous friction constant. During this case no other controlling was done except the viscous friction parameter. Fig. 3 shows the variation of motor speed for a fixed viscous friction constant.

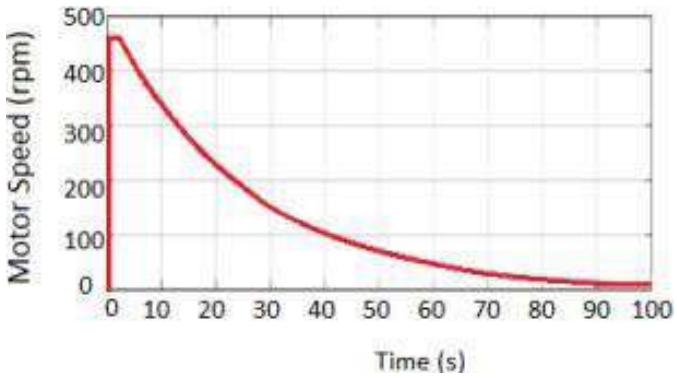

Fig. 3 Motor speed for a constant viscous frictioncoefficient

As the friction constant value increases the motor takes less time to stop. Instead of controllingthe viscous friction constant the UC current can be used for controlling the braking time of the motor. In the present work braking time is controlled by the UC charging current.

Variation of bus voltage during motoring andregenerative braking for a braking time of 5s has been shown in Fig.4. It is found that during motoring operation the bus voltage increases and reaches the rated value and during regenerative breaking the bus voltage decreases as the motor speed decreases.

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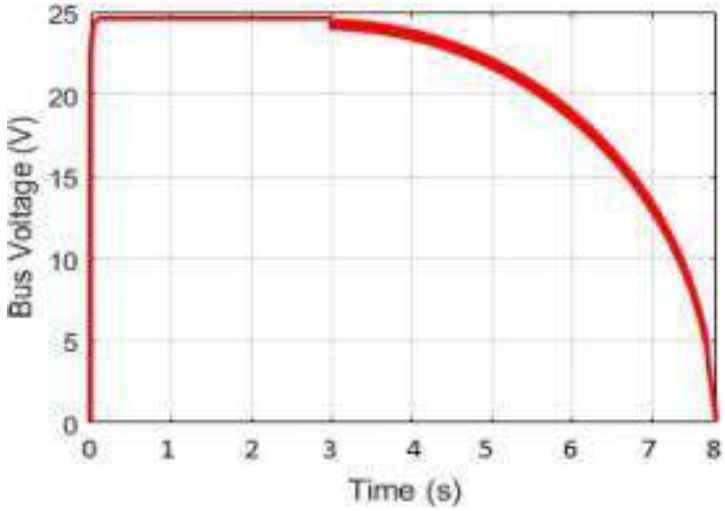

Fig.4: Bus voltage for a regenerative braking time of 5s.

The motor speed variation for a regenerative braking time of 5s has been shown in Fig. 5. It is observed that during the braking operation the motor speed gradually decreases and stops running.

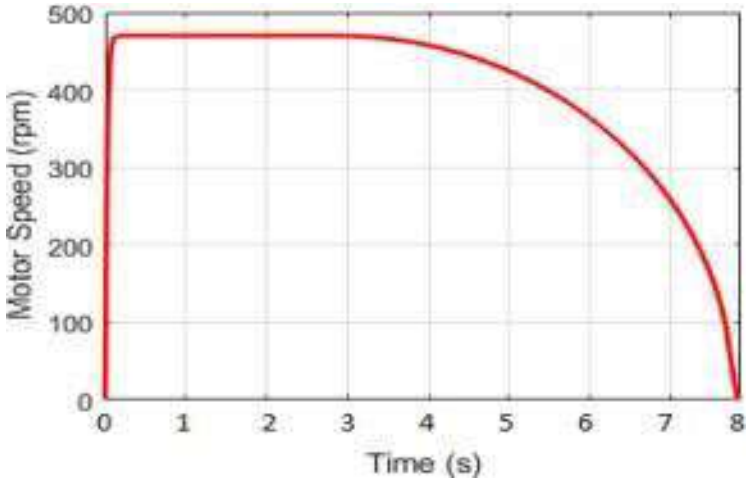

Fig.5: Motor speed for a regenerative braking time of 5s.

During the motoring operation no energy is fed to the UC while during regenerative breaking the kinetic energy which is wasted as heat is utilized and fed to the UC. The variation of UC voltage during motoring and regenerative braking is shown in Fig. 6. It hasbeen observed that the UC voltage increases for breaking time of 5s i.e., from 3s to 8s. The UC currentis used for controlling the braking time of the motor. The variations in UC current during motoring and regeneration braking for braking time of 5s is shown in Fig. 7 and it is clear that during braking time the UC current remains constant . A hike in UC current is observed during breaking time of 5s. This is becauseof the switching from the forward buck operation to the forward boost operation.

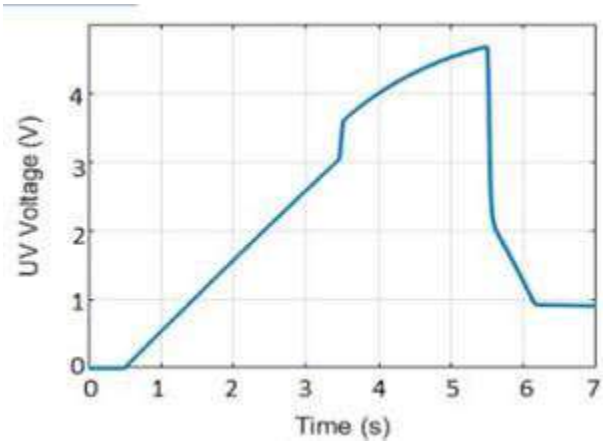

Fig.8: UC voltage waveform during motoring, regenerative braking and energy restoration from UC to battery.

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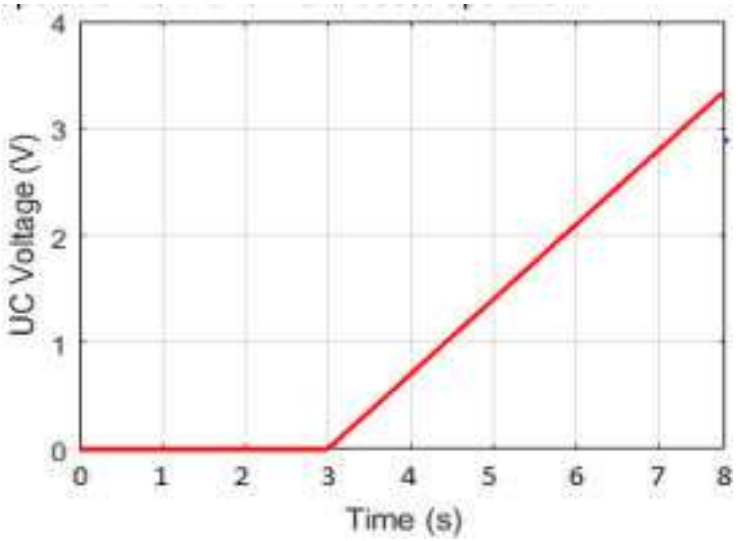

Fig.6: UC voltage during motoring and regenerationbraking for braking time of 5s.

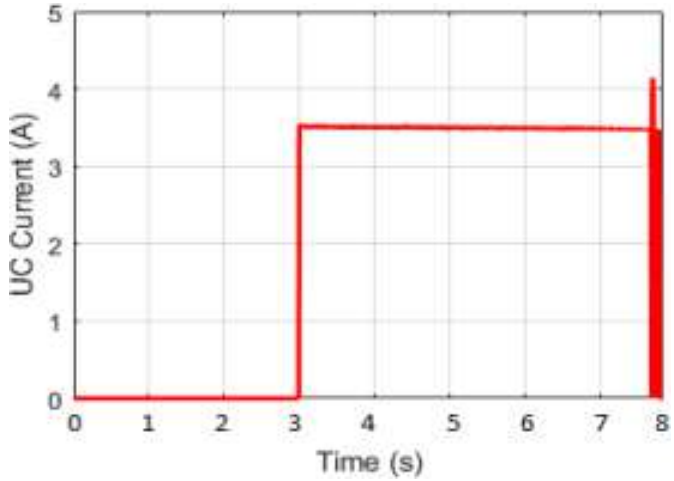

Fig.7: UC current during motoring and regenerationbraking for braking time of 5s.

The energy fed to the UC should be restored back to the battery and this is done through the battery current controlled operation. During this operation reverse boost operation is carried out. Here the UC voltage decreases and the waveform is shown in Fig. 8. In Fig.8 motoring (0-0.5s), regenerative braking (0.5- 5.5s) and reverse energy flow to the battery (5.5-7s) is shown. During braking, energy is fed to the UC and thus the UC voltage increases and during energy restoration, energy is fed from UC to battery thus the UC voltage decreases. Thus battery is being charged and further the cyclic operation can be carried out.

VI. CONCLUSION

Ultra capacitor based regenerative braking operation for a dc motor for different braking time has been discussed. The converter used in the present work is a synchronous bidirectional buck-boost converter. The converter helps in performing bidirectional power flow and has a better performance. In the present study motoring, regenerative brakingand energy restoration from UC to battery has been studied.

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POWER QUALITY DISTURBANCES RECOGNITION AND CLASSIFICATION IN DISTRIBUTION SYSTEM USING WAVELET BASED NEURAL NETWORK

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ABSTRACT
This paper presents a method for detection and classification of Power quality disturbances. The Power quality disturbances to be detected and classified from the actual Distribution system under study. The actual Distribution system is 11KV Industrial Feeder which is simulated in Power System Computer Aided Design (PSCAD) software. The Power quality disturbances to be detected and classified are Voltage Sag, Voltage swell and Interruption. The detection of Power quality disturbances is done by Discrete Wavelet Transform (DWT) and classification is done by using Artificial Neural Network (ANN). Power quality disturbances identified by Discrete Wavelet Transform in in time and frequency domain. Multi- Resolution Analysis (MRA) technique of Discrete Wavelet Transform is used to decompose the power signal at 7-level. The statistical parameters are calculated from detailed coefficient of DWT and it is given as input to ANN to classify Power quality disturbances.

Keywords: Power System Computer Aided Design, Discrete Wavelet Transform, Artificial Neural Network, Multi-Resolution Analysis

I. INTRODUCTION
A. In modern electrical power systems, electricity is produced at generating stations, transmitted through a high voltage network, and finally distributed to consumers. Due to the rapid increase in power demand, electric power systems have developed extensively during the 20th century, resulting in today's power industry probably being the largest and most complex industry in the world. Electricity is one of the key elements of any economy, industrialized society or country. A modern power system should provide reliable and uninterrupted services to its customers at a rated voltage and frequency within constrained variation limits. If the supply quality suffers a reduction and is outside those constrained limits, sensitive equipment might trip, and any motors connected on the system might stall. The electrical system should not only be able to provide cheap, safe and secure energy to the consumer, but also to compensate for the continually changing load demand. During that process the quality of power could be distorted by faults on the system, or by the switching of heavy loads within the customers facilities. In the early days of power systems, distortion did not impose severe problems towards end-users or utilities. Engineers first raised the issue in the late 1980s when they discovered that the majority of total equipment interruptions were due to power quality disturbances. Highly interconnected transmission and distribution lines have highlighted the previously small issues in power quality due to the wide propagation of power quality disturbances in the system. The reliability of power systems has improved due to the growth of interconnections between utilities.

In recent years, Power Quality has become an important issue to both power utilities and their customer.Most of the power system disturbances are non stationary and transitory in nature. Due to the use of Non-linear load, solid state switching devices and other power electronics equipments cause power disturbances which results in poor power quality. This poor power quality results in the failure of the End user equipments. Thus detection and classification of Power Quality disturbances is a challenging task for Power System engineers.So, in order to improve the Power Quality, Power Quality disturbances should be detected, localised and classified accurately so that appropriate action can be taken to mitigate it.

B. Related Work
Reference [1] presents a Distribution system to study the disturbance affecting Power Quality. In this paper, DWT technique to detect and locate the disturbance in a power signal. The energy of each disturbance is calculated and given as input to ANN for classification.

Reference [2] present a new method of on-line voltage disturbance detection based on Wavelet transform which depends on simulation of large number of faults and Capacitor switching incident. In this, a probability function is defined and decision is made using Maximum Likelihood criteria which based on maximizing the probability function of the features.

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Z. L. Gaing [3] proposed a Wavelet based Neural network classifier to detect and classify the power quality disturbance. Using Multi Resolution Analysis technique of DWT, 13-level decomposition of each disturbance signal is performed. Parsewal theorem is used to calculate the energy which is given as input to ANN for classification.

Reference [4] proposed a new technique consisting of Fourier linear combiner and a Fuzzy expert system for classification of power quality disturbance. Using peak amplitude and computed slope obtained from Fourier linear combiner are given to Fuzzy expert diagnostic module to compute the truth value of signal. Then the disturbances are classified as Sag, Swell and Interruption using defined Fuzzy set.

Reference [5] presents a s- transform based Neural network classifier to detect and classify the power quality disturbance. In this paper, s- transform is used to detect the disturbance in a power signal and classified using PNN which shows that s- transform has better detection capability and Probalistic Neural Network (PNN) gives best classification results.

C. Objective of work:

The main objective of this paper is detection and classification following Power Quality disturbances such as (i) Voltage Sag (ii) Voltage Swell (iii) Interruption. Power quality disturbances are detected using Discrete Wavelet Transform and classify using Artificial Neural Network.

Power quality:

Power quality can be defined from two different perspectives, depending on whether you supply or consume electricity. Power quality at the generator usually refers to the generator's ability to generate power at 60 Hz with little variation, while power quality at the transmission and distribution level refers to the voltage staying within plus or minus 5 percent. The IEEE Standard Dictionary of Electrical and Electronics Terms defines power quality as "the concept of powering and grounding sensitive electronic equipment in a manner that is suitable to the operation of that equipment." Gerry Heydt in Electric Power Quality defines power quality as "the measure, analysis, and improvement of bus voltage usually a load bus voltage, to maintain that voltage to be a sinusoid at rated voltage and frequency." The type of equipment being used by the end user affects power quality at the end user level.Roger Dugan, Mark McGranaghan, and Wayne Beaty in Electrical Power System Quality defines a power quality problem as " any problem manifested in voltage , current or frequency deviations that results in failure or missed operation of utility or end user equipment."

Power Quality disturbances:

The ability to define and understand the various types of power quality disturbances provides the necessary background needed to prevent and solve those problems. The power quality signature or characteristic of the event identifies the type of power quality problem. The nature of the variation in the basic components of the sine wave, i.e. voltage, current or frequency identifies the type of power quality problem. There are various types of power quality disturbances such as Voltage sag, Voltage swell, Interruption, Voltage imbalance, Voltage fluctuation, Harmonics, Transients and Electrical noise.

II. WAVELET TRANSFORM:

A wave is an oscillating function of time or space and is periodic. In contrast, wavelets are localized waves. They have their energy concentrated in time or space and are suited to analysis of transient signals. While Fourier Transform and Short Time Fourier Transform (STFT) use waves to analyse signals, the Wavelet Transform uses wavelets of finite energy.

The wavelet analysis is done similar to the STFT analysis. The signal to be analyzed is multiplied with a wavelet function just as it is multiplied with a window function in STFT, and then the transform is computed for each segment generated. However, unlike STFT, in Wavelet Transform, the width of the wavelet function changes with each spectral component. The Wavelet Transform, at high frequencies, gives good time resolution and poor frequency resolution, while at low frequencies; the Wavelet Transform gives good frequency resolution and poor time resolution.

There are different wavelets such as Haar, Daubechies 4, Symlet and Coiflet which are used as mother wavelet.

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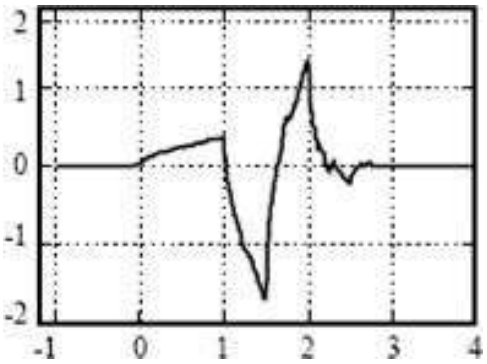

Fig. 1: Daubechies 4 Wavelet

III. DISCRETE WAVELET TRANSFORM (DWT):

DWT is any wavelet transform in which the wavelet is discretely sampled. DWT transforms the distorted signal into different time frequency scales which detect disturbances present in the power signal.

The DWT of f(t) is defined as:

$$DWTf(a,b)=\sum f(t)\ \Psi_{a.b}\ (t) \qquad (1)$$

Where $\Psi_{a.b}$ is the mother wavelet

a, b are scale and translation factor

A. Multi Resolution Analysis (MRA):

The first main characteristic of Wavelet transform is Multi resolution analysis. The signal is analysis at different frequencies with different resolution in Multi resolution analysis technique. This technique decomposes the given signal into several other signals with different levels of resolution and provides valuable information in time and frequency domain. Fig.I shows seven level decomposition of DWT which uses the wavelet function (ϕ) and scaling function (φ) It decompose the signal into high frequency components and low frequency components by processing the signal through high and low pass filters. The wavelet function ϕ generate – detailed coefficient (high frequency component) and scaling function φ generate – approximated coefficient (low frequency component).

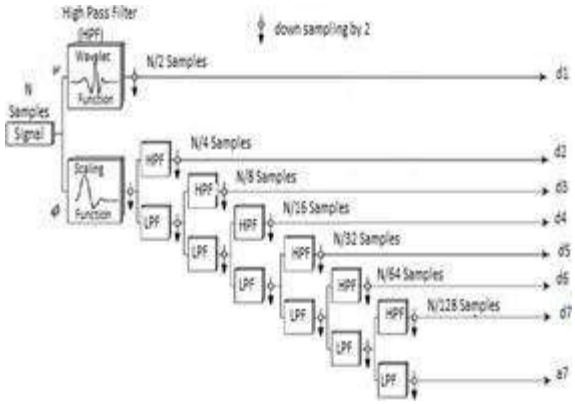

Fig. 2: Multi-Resolution Analysis technique of DWT

Table I: Level of Decomposition

Levels	Approximations – cAi	Detail-cDi
	Frequency Band width	
1^0	0 – 1920	1920 – 3840
2^0	0 – 960	960 – 1920
3^0	0 – 480	480 – 960
4^0	0 – 240	240 – 480
5^0	0 – 120	120 – 240
6^0	0 – 60	60 – 120
7^0	0 – 30	30 – 60

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B. **Feature Extractor:**
Feature extraction is a pre-processing operation that transforms a pattern from its original form to a new form suitable for further processing. Mapping the data of the distorted signal into a wavelet domain is the first step in performing the feature extraction process. The power signal with disturbance when subjected to DWT will generate a discontinuous state at the start and end points of the disturbance duration. For each of the disturbance, the DWT coefficients generated have variations which are used to recognize the various power signal disturbance and thereby classifying the different power quality problems. By applying

DWT, the distorted signal can be mapped into the wavelet domain and represented by a set of wavelet coefficients.

C. **Statistical Parameter as Feature Extractor:**
A statistical parameter is a parameter that indexes a family of probability distributions. It can be regarded as a numerical characteristic of a population or a model. Statistic is a quantity that is calculated from a sample of data. It is used to give information about unknown values in the corresponding population.

In this Method, Statistical parameter is used as Feature Extractor. DWT extract the disturbance features in power signal. DWT localizes the Power Quality disturbances in time and frequency. In this method of classification also, Daubechies "db4" wavelet is used and decomposition is carried upto 7 – level. After 7 – level decomposition, we get detailed and approximate coefficient. Six statistical parameter such as Minimum, Maximum, Energy, Standard deviation, Skewness, Kurtosis are calculated from detailed coefficients. These six statistical parameters are given as input to ANN for classification.

Various statistical parameter are

(1) Minimum (2) Maximum (3) Mean (4) Median

(5) Sum (6) Absolute sum (7) RMS value (8) Energy

(9)Kurtosis (10) Crest factor (11) Shape factor (12) Standard deviation

(13) Variance (14) Skewness

IV. CASE STUDY
Fig.II. shows a single line diagram Distribution system. The system under study for detection and classification of Power Quality disturbances is simulated in PSCAD software. It consists of 5-Generators, 3-Transformers, 11-load buses and a shunt capacitors. The detail configuration of Distribution system is given in Appendix. Fig shows PSCAD simulation diagram of Distribution system.

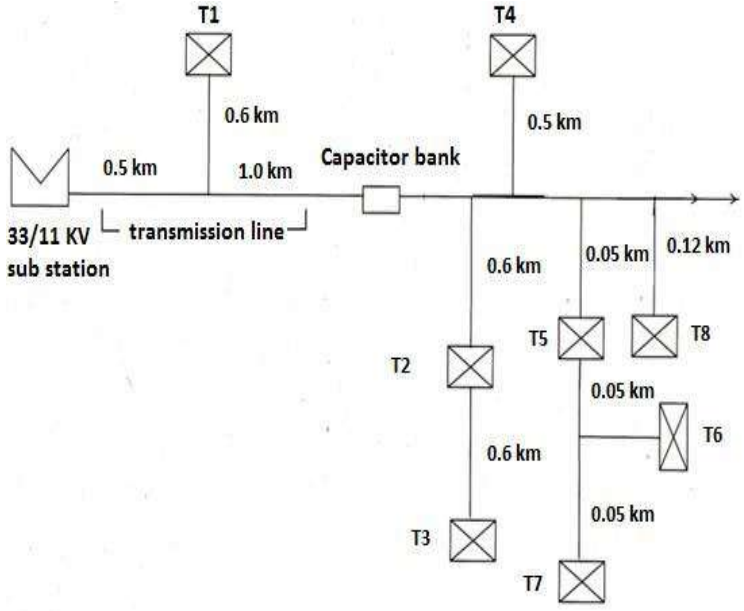

Fig. 3: Single line diagram of Distribution system

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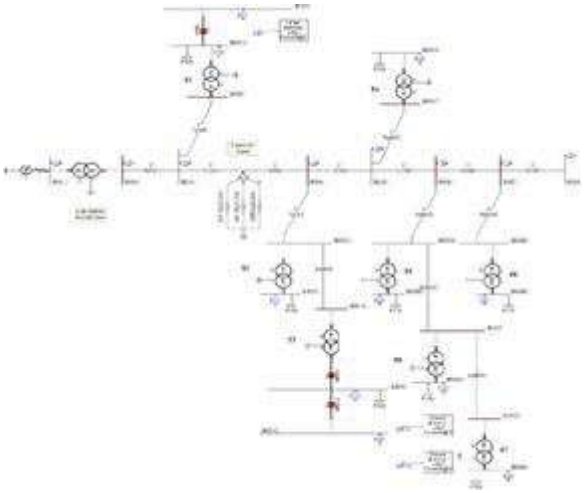

Fig.4: PSCAD Simulation of Distribution system

V. PROPOSED METHODOLOGY:

Distribution system is first simulated in PSCAD software. Power Quality disturbances such as Voltage Sag, Voltage swell and Interruption are generated in the system at different inception angles. The Voltage signal are captured at different Buses and sampled at 7680 Hz. This sampled voltage signals saves in excel sheets and given to MATLAB program for DWT analysis. For DWT analysis, Daubechies 'db4' wavelet is used for feature extraction and decomposition is carried upto 7-level.Statistical parameter are calculated from detailed coefficients after 7-level decomposition, given as input to ANN to classify Voltage Sag, Voltage swell and Interruption.

VI. FLOWCHART

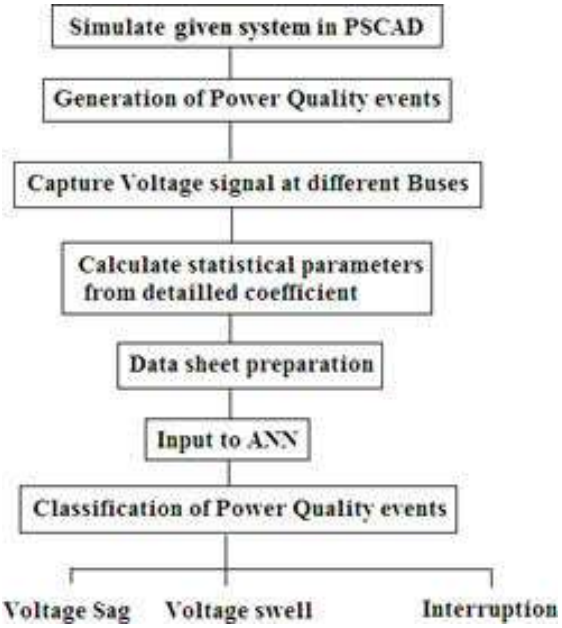

Fig. 5: Flowchart of Proposed Methodology

VI. PSCAD SIMULATION WAVEFORMS:

(i) Voltage Sag: The voltage waveform when a LG fault occurs is as shown below.

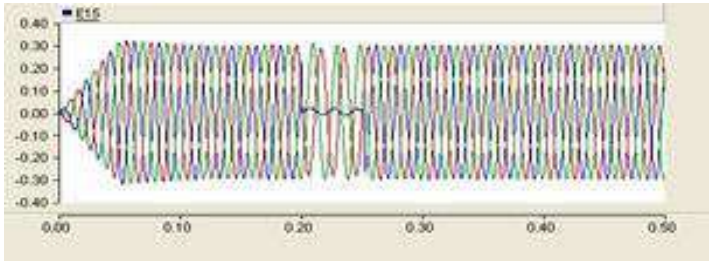

Fig. 6: Voltage waveform for Voltage sag

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(ii) Voltage swell: The voltage waveform when a heavy load is switch-off is as shown below.

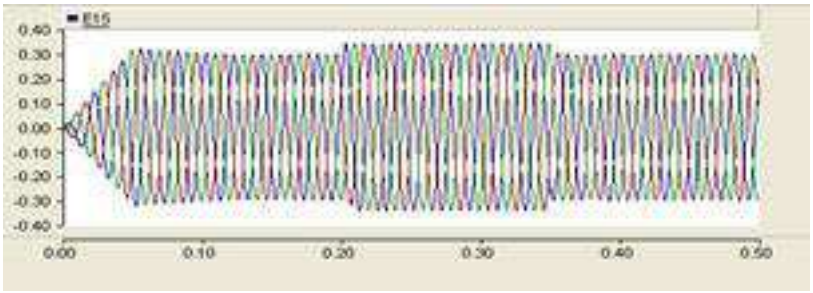

Fig.7 Voltage waveforms for Voltage swell

(iii) Interruption: The voltage waveform when a inadvertent operation of a Circuit breaker take place is shown below.

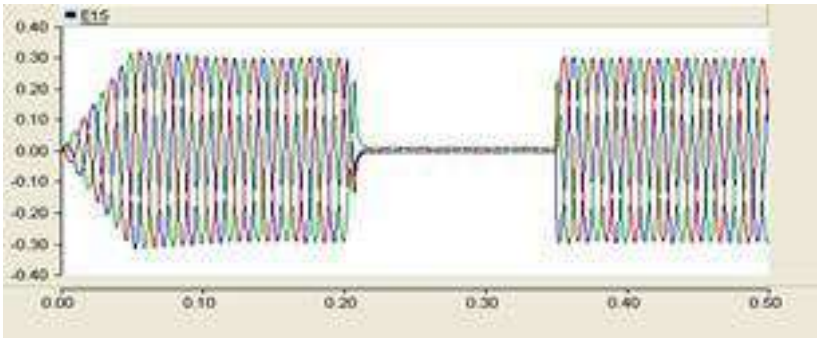

Fig.8 Voltage waveform for Interruption

VII. **DWT WAVEFORMS FOR 7-LEVEL DECOMPOSITION:**

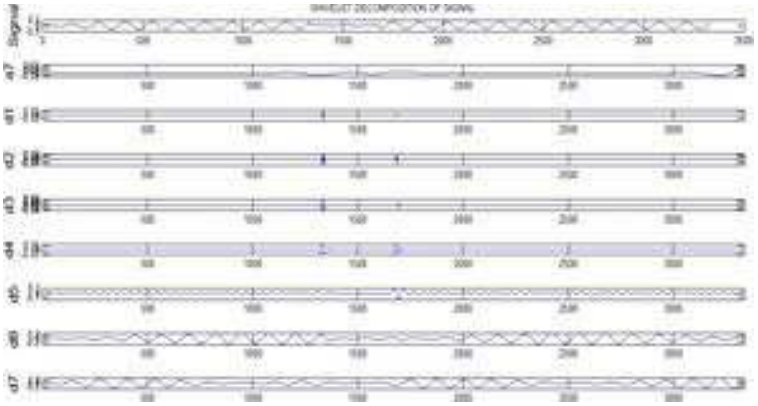

Fig.9 DWT waveform of B -phase for Voltage sag

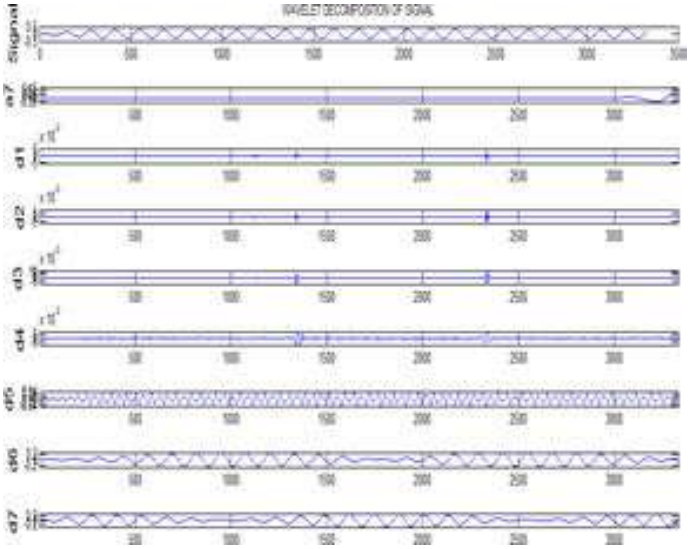

Fig.10 DWT waveform of B-phase for Voltage swell

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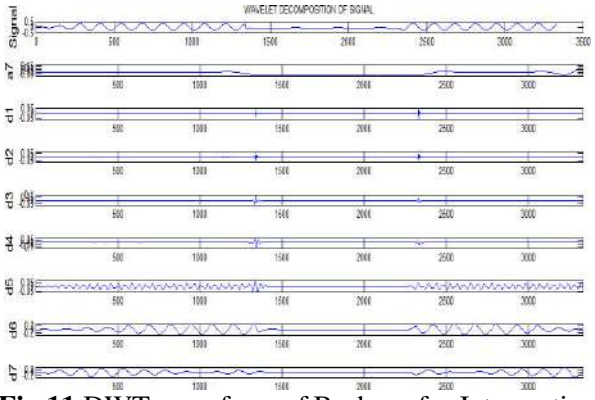

Fig.11 DWT waveform of B-phase for Interruption

VIII. ARTIFICIAL NEURAL NETWORK (ANN) AS A CLASSIFIER:

ANN is defined as a computing system made up of a number of simple, highly interconnected processing elements, which process information by their dynamic state response to external inputs. An artificial neural network is a system based on the operation of biological neural networks, in other words, is an emulation of biological neural system. Neural networks are typically organized in layers. Layers are made of a number of interconnected 'nodes' which contain 'activation function'. Patterns are presented to the the network via the 'input layer', which communicates to one or more 'hidden layers' where the actual processing is done via a system of weighted 'connection'. The hidden layers then link to an 'output layer' where the answer is output as shown in the Fig. below.

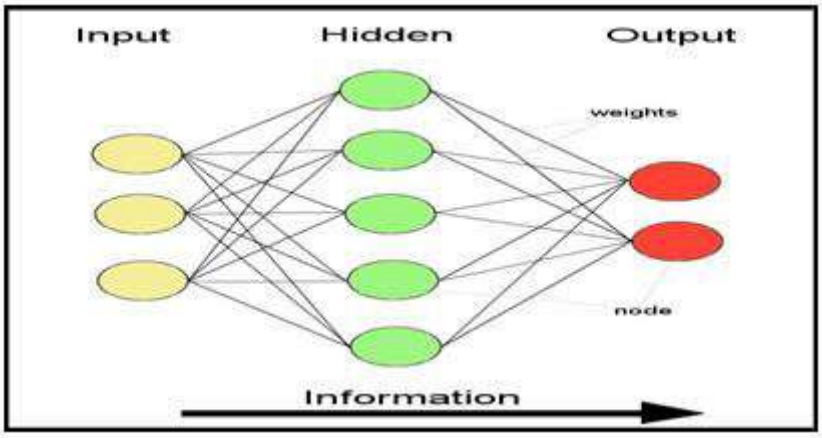

Fig.12 Artificial Neural Network (ANN)

A. ANN Network details:

The Learning Rule: Momentum Training data: 75 %

Testing Data: 25 % Step size: 1.00000

Momentum: 7.00000 Transfer: TanhAxon

Network used: Multi layer Perceptron (MLP) Hidden layer : 3

B. ANN Output :

For 4-processing elements and 3- hidden layers, ANN gives the following output.

Table II: ANN Output:

Performance	Sag	Swell	Interruption
MSE	0.000523	0.000958	0.0010189
NMSE	0.002471	0.003912	0.005441
MAE	0.020739	0.029651	0.027661
Min Abs Error	0.007251	0.018853	0.000335
Max Abs Error	0.039413	0.052952	0.0464072
r	0.999873	0.999821	0.999892
Percent Correct	100	100	100

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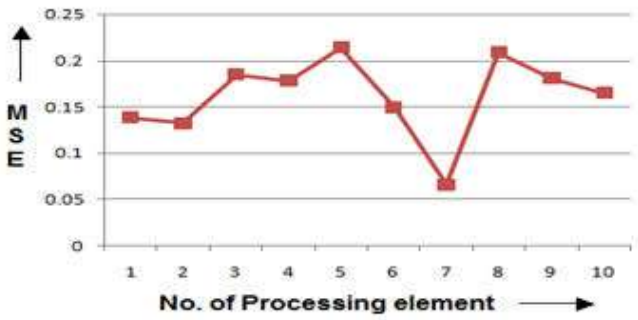

Fig.13 Variations of MSE with Number of Processing element

IX. CONCLUSION

This paper presents a method to detect and classify types of Power quality disturbances. The disturbances to be classify from Distribution system are Voltage sag, Voltage swell and Interruption. These Power quality disturbances are detected, classified accurately so that appropriate action can be taken to mitigate it which improves the performance of the system. ANN which is used as classifier gives 100 % accuracy for classification.

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A REVIEW OF SOLAR ENERGY FORECASTING USING ARTIFICIAL INTELLIGENCE

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ABSTRACT
The usage of Renewable energy across the globe is required to prevent large amounts of carbon dioxide emissions and power breakdowns and to manage environmental pollution. The energy created from solar panels, that transform the sun's power into electricity is called solar energy, which is one of the main forms of renewable energy sources and is extensively utilized worldwide. In addition, the Photo Voltaic systems are utilized to transform solar radiation into electrical energy that can be utilized for various applications like running businesses and homes and so on. However, this solar energy production is affected by its volatility. To resolve this issue, solar energy forecasting is an essential factor in improving the performance of solar power plants and the socio-economic growth of a country. Accordingly, this present review intends to provide in-depth information regarding solar energy prediction using Artificial Intelligence approaches. This review provides comprehensive information about renewable energy forecasting specifically, the prediction of solar energy and its types. Finally, this study performs a comparative analysis of various AI approaches in forecasting solar energy and the outcomes revealed that Machine learning has been widely employed in solar energy prediction for the past few decades. Moreover, in present times it has been found that Deep learning and ensemble learning have the potential to increase the accuracy of solar power prediction.

Keywords: Renewable Energy, Solar Energy Forecasting, Photo Voltaic systems, Artificial Intelligence, MachineLearning, Deep Learning and Ensemble Learning

1. INTRODUCTION
For the past few decades, Renewable Energies have been gaining attention. These energies denote the utilisation of natural environmental cycles to produce an infinite energy supply which is non-polluting (Radhi, 2012). Renewable energy (RE) involves hydropower, biomass energy, hydrogen power, solar energy, geothermal energy, marine energy and wind energy. Hence, it was named as green energies. Among these REs, Solar and wind energy are the general natural energies. Meanwhile, solar energy is being utilized in metropolitan areas due to the weak winds. Therefore solar energy is the foremost renewable energy. Remarkably, several developed countries have financed great Research and development and delivered incentives which facilitate the Photovoltaic (PV) systems' growth and usage. RE prediction techniques offer beneficial information regarding the probable changes in the energy to be created shortly (Taşcıkaraoğlu, 2017). The consistent forecasting of solar and wind power generation produces solar panels and wind turbines correspondingly, is a difficult task since it depends totally on weather patterns(Ahmed & Salam, 2017). Prediction of RE can be executed by utilizing various approaches that involve Physical models and Artificial Intelligence (AI) and so on.

The utilization of solar energy has been greatly growing as a renewable and clean energy source along with the PV panel's installation in businesses, homes and large-scale solar ranches. The surging demand for sustainable energy sources has facilitated the solar industry's growth and enhancements in technology thus, producing solar panels more cost-effectively. Solar energy's implementation not only decreases the dependency on non-renewable sources but, also aids in reducing the climate change effects by decreasing carbon –emissions. The forecasting of solar energy in a manual manner includes well-established approaches which depend on empirical formulas, manual designs and simplified assumptions based on meteorological parameters and historical data. These manual forecasting techniques of solar energy are prone to error. These prediction inaccuracies can result in substantial economic loss and reliability issues in the power system since the electric grid operators are required to maintain the balance between demand and supply to sustain the grid reliability (Lew et al., 2013). It also requires prominent human effort which is time-consuming and susceptible to errors. These manual forecasting methods failed to seize the complex relationships intrinsic to the production of solar energy resulting in less precise and correct forecasts (Lucchi, 2023).

AI technology has the potential role in the domain of energy like consumption of energy, classification of failure, recognition of patterns and control systems. Specifically, with the rapid improvement of AI algorithms and superior performance in several fields, it is considered better when compared to other models that involve non-linear concerns with robust uncertainties. Previous existing scholarly works emphasized the prediction of solar energy through AI approaches and several direct prediction approaches are introduced(F. Wang, Mi, Su, & Zhao, 2012). It is promising to make accurate Solar energy predictions with the aid of hybrid Machine Learning (ML) algorithms and data-driven models. The criteria which have been extensively utilized

to assess the efficiency and accuracy of ML algorithms is the RE prediction (Singh, Rizwan, Alaraj, & Alsaidan, 2021). Even though, various ML-based forecasting models have attained high accuracy, the investigation on how to present more historical data to enhance the forecasting efficiency of solar energy is not accomplished. As a result, Deep learning (DL) algorithms and ensemble methods provide a solution to this issue and are suggested for forecasting solar energy through advanced feature extraction and big data analysis. Due to the significance of RE prediction specifically solar energy, the present study intends to review the types and classification of solar energy forecasting methods and techniques employed in solar energy prediction like AI, ML DL, ensemble methods and so on. Finally, this study performs a comparative analysis for the prediction of solar energy among these techniques and the futuristic suggestions are recommended.

1.1 Paper organization

This paper is structured as follows. Initially, this review starts with an introduction. Following this, the concept of renewable energy forecasting is explained. Then, this study focused on solar energy prediction and its kinds, strengths and challenges. The fourth section explains the factors influencing solar power prediction. Subsequently, the classification of PV forecasting approaches is elucidated. Later, the AI techniques and their evaluation in the prediction of solar energy are explained. After that, the fusion of AI approaches in solar energy prediction is explained. As a final point, a comparative analysis is performed for the AI approaches in forecasting solar energy. Lastly, the paper ends with a discussion and conclusion section.

2. RENEWABLE ENERGY FORECASTING

The most general Renewable Energy Sources (RES) are water, wind, biomass or bio-fuel and solar energy. The accustomed employment of RE in current-day power systems involves the generation of power, heating and fuel passage. Due to the capability and competence of RE, it is of utmost significance. The forecasting of energy is a recent concern for investigators because of the cumulative influence of RE. Accordingly, an investigation (Anaadumba et al., 2021) introduces the utilization of a Deep Neural Network for energy prediction on mobile devices at the network edge. This in turn facilitates the low communication overhead and latency for the entire energy prediction approach as it is carried out in the network periphery. This introduced model is trained using a dataset from the Belgium solar power generation industry and it is analyzed with a various number of layers to measure the optimum architecture for executing the prediction operations. The efficiency of every architecture is assessed by utilizing r-square and Mean Square Error (MSE).

Presently, solar and wind energy develops hence, the precise real-time prediction for these RES becomes essential for energy traders, utilities and grid balancing authorities with prominent RE capacity. An advanced RE prediction system merges AI with physical models to support grid integration and system operation. In association with this, a conventional study (Haupt et al., 2020) defines a system being created for the Shagaya RE park that is being established by the Kuwait State. This park comprises PV panels, Wind turbines and concentrated solar RE technologies with storage competencies. The operational Kuwait RE prediction system involves the AI in various portions of the prediction processes and structure, equally for short-range predictions and also for the predictions numerous days available. AI techniques operate synergistically with the physical or dynamical models engaged. This study elucidates the methodology utilized for every AI technique and in what way it is merged with others andit delivers the preliminary evaluation of its associative value to the forecasting system.

3. SOLAR ENERGY PREDICTION

The most general and widely recognized energy source in prevailing networks is solar energy. Due to its non-linear and non-stationary characteristics, it is required to forecast solar irradiance to deliver more reliable PV plants and maintain the demand and supply of power. The radiant energy from the sun radiated in the electromagnetic radiation form is called solar irradiance. It is unswervingly proportional to the solar power amount which can be garnered and has the greatest PV power correlation.

3.1 Types of Prediction

Majorly, solar power prediction can be divided into two types based on input data type and forecasting time horizon (Sreekumar & Bhakar, 2018). The time frame for solar power forecasting fluctuates from 5 minutes to several days. The interest in prediction time horizon for power system operations, battery management and electricity markets are classified into very short-term, long term and short-term. The very short-term prediction prospects are up to six hours in advance meanwhile short-term prediction prospects are up to three days. Also, the long-term prediction prospects cover up to several months. Also, a study (Borges, Penya, & Fernandez, 2012) introduced 3 various methods for short-term load estimate in a smart grid atmosphere and those approaches are the regression method, bottom-up method and top-down method. The main motive of this investigation is to merge these predictions.

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Furthermore, solar irradiance power forecasting techniques are commonly categorized into 4 kinds. Initially, the firstkind involves the prediction of solar irradiance based on meteorological parameters like sunshine duration, wind direction and speed, geographical coordinates such as longitude and latitude, pressure, clearness index and air temperature. Secondly, it identifies the association among input and output data that is utilized to predict the forthcoming solar radiation based on solar radiation and historical weather data. Followed by it, the third kind merges the above 2 techniques. Finally, the last type utilizes the data gathered from smart meters or sensor networks and sky images coming from satellites or ground stations. Likewise, an investigation (Bhardwaj et al., 2013) reveals that the meteorological input-based model's prediction accuracy can be surged utilizing input data clustering with appropriate approaches such as the Markov Chain model.

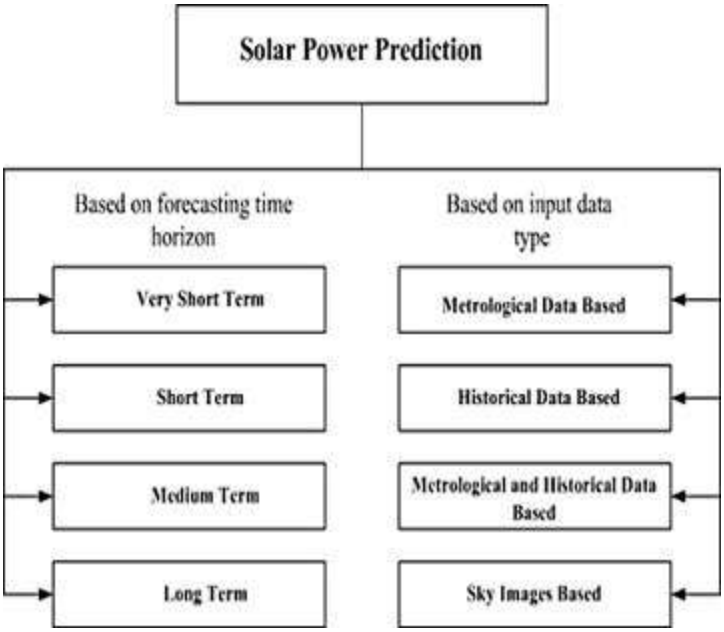

Figure 1. Types of Solar Power Prediction
(***Source:*** Sreekumar & Bhakar, 2018)

Figure 1 illustrates the schematic illustration of several types of solar power prediction. Moreover, the investigators also suggest utilizing another category to define forecast horizon comprising day-ahead, intra-day and intra-hour thatoverlapped with long, medium and short-term prediction horizons. Various existing kinds of research have been executed to forecast hourly solar radiation employing AI models like artificial neural networks or ML. Similarly, an examination (Khosravi, Koury, Machado, & Pabon, 2018) predicted hourly solar radiation utilizing relative humidity, wind speed, local time, pressure, and temperature as the model's input variables and a time-series forecasting model.

3.2 Strengths and Challenges

Recently, there has been a major reduction in non-renewable energy, thus resulting in the extensive improvement and usage of RES, particularly solar power. In several regions across the globe, PV power generation is adopted which is an environmentally friendly and clean energy form (Comello, Reichelstein, & Sahoo, 2018). On the other hand, the greater variations in photo voltaic power output, and its incorporation with power grid systems display several challenges concerning security and investigation (Lin et al., 2018). Hence, precise PV power generation precise generation is important to improve the stability and safety of the power system. Agreeing to the Renewable Energy Policy and Action Plan, electricity produced from renewable sources like biomass, biogas, solid wastes, mini-hydro and solar PV is approximately 11,227 $GWh\ by$ 020. Solar power will produce a greener and cleaner environment in future and through involving the tracking system the manufactured power will be increased.

Furthermore, research (Yadav, Kannan, Meraj, & Masaoud, 2022) infers that Solar power will aid in reducing the greenhouse effect and global warming effect through the employment of non-renewable energy. To facilitate the secure operation and electrical power systems' economic integration with high photovoltaic infiltration, the precise prediction of Photovoltaic power is significantly needed. According to work (Mahmoud, Yorino, & Ahmed, 2015) during the PV systems planning stage, Optimum provision is needed that necessitates precise prediction of environmental circumstances at one's recommended sites. Predicting the PV system output power facilitates the system operators to evaluate one's performance, execute control actions, optimally report several distributed grid types and maintain voltage control devices.

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4 MAJOR FACTORS AFFECTING SOLAR POWER FORECASTING

The output of Photovoltaic systems is proportionally associated with the solar irradiance. Also, the solar irradiance predicting model's accuracy is highly impacted by utilizing meteorological factors like wind speed, humidity and temperature. Therefore, various weather kinds and climate change have a prominent impact on the Photo Voltaic system's output power. Hence, to improve the forecasting efficiency, the weather circumstances are an essential step, particularly for solar irradiance prediction (Chen, Duan, Cai, & Liu, 2011). Usually, 2 kinds of weather conditions involve non-ideal (windy, rainy and foggy) and ideal (sunny climate). According to the scholarly work (Behera, Majumder, & Nayak, 2018), the output power of the Photo voltaic system surges in ideal climate situations and it is reduced in non-ideal weather circumstances.

Several existing studies in this sector majorly concentrated on deterministic forecasts (Huang, Chen, Yang, & Kuo, 2015). Conversely, precise solar power generation prediction is very hard due to the weather systems' chaotic nature.Beneath present technical conditions, the prediction errors cannot be eradicated. Concerning this, an investigation (Golestaneh, Pinson, & Gooi, 2016) evaluates the deterministic forecasting errors and their outcomes revealing that the actual description of the forecasting errors is an issue. The efficiency of prediction models is impacted by the uncertainty of weather conditions that should be enumerated to decrease the operating prices and possible risks.

5 CLASSIFICATION OF PV POWER FORECASTING TECHNIQUES

Various modelling techniques like Statistical, Physical, AI and time series-based models have been employed for solar energy forecast. The below figure 2 depicts the applicable range of various PV power forecasting approaches.

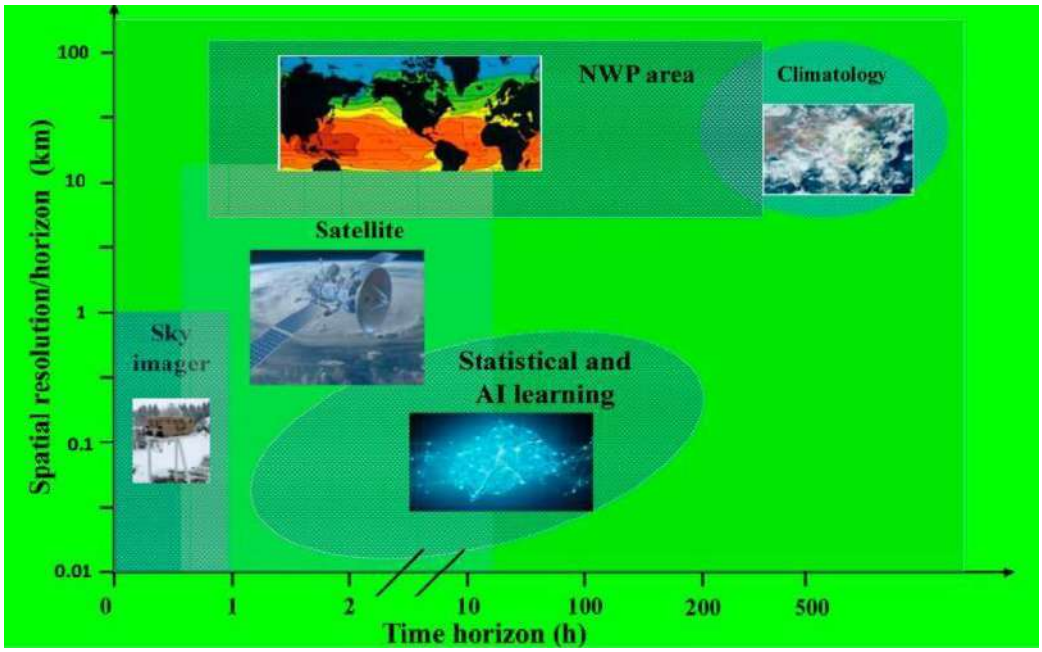

Figure 2: Applicable ranges of forecasting models
(***Source :*** Ye, Yang, Han, & Chen, 2022)

- **Physical prediction model:** The Physical prediction approach denotes a technology which mines the aspects associated with solar power generation from the standard and follows it, it forms a physical model. Particularly, the physical method modelling is grounded on numerical weather prediction through employing atmospheric physical data that involves temperature, duration of the day, speed, humidity, and rainfall and cloud image using total sky imager or satellite broadcasting. Also, it is categorised into complex physical methods and simple physical methods. Likewise, a work (Lorenz, Scheidsteger, Hurka, Heinemann, & Kurz, 2011) produces a physical prediction model based on local weather forecast information. It executes the forecasting assessments based on an original Photo voltaic power station to evaluate the model's accuracy.
- **Statistical and time series prediction model:** The statistical approach requires gathering a huge amount of data associated with the Photovoltaic power generation system's power output to revert some unidentified constants and acquire the functional association between the measurable unknown and the output power. The experimental evidence denotes that the ARIMA model is precise in replicating the solar irradiance shape changes. Likewise, an ARIMAX model (Pedro & Coimbra, 2012) embraces the previous solar irradiance as inputs and also attains the estimated goals rather than the ARIMA model.

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- **Artificial Intelligence model:** This model depends on the AI's capability to study from historical data understanding and to enhance its forecasting competencies further. Because of the self-adaptation and strong self–learning capability, Photo voltaic power prediction grounded on the Artificial intelligence algorithm is a prevalent investigation topic. Based on AI algorithms, an investigation (Zhang, Wang, Liu, Tong, & Sun, 2021) was performed on the energy PV power generation prediction. This study reveals that this suggested technique endures few gains and effects in PV power generation.

6. TAXONOMY OF AI TECHNIQUES IN SOLAR ENERGY PREDICTION

The prediction rate of Photo Voltaic output power is higher by the AI application. Several AI techniques exist like ML, DL, fuzzy logic, genetic algorithms, artificial neural networks and more recently ensemble methods. The most efficient Artificial Neural Network-based methods for solar generation forecasting involve Recurrent Neural Networks, Multi-layer perceptron and Radial Basis function. Also, the study (H. Wang et al., 2020) utilizes the AI classifiers fuzzy logic, DL and ML to forecast solar energy generation levels. The various machine learning algorithms utilized are Extreme Learning Machines, Support Vector Machines, and Recurrent Neural Network and Artificial Neural Networks. Within the context of DL, it involves Generative Adversarial Networks, Convolutional Neural Networks, Deep Belief Networks (DBN) and Stacked Automatic Encoders.

6.1 Evaluation of Machine Learning Methods

Various studies identified that several ML algorithms which is a subset of Artificial Intelligence have been utilizedto forecast the solar energy sources output. A scholarly work (Park et al., 2021) introduced a technique to forecast solar power production by assessing solar irradiance from sky-facing cameras by employing ML approaches to calculate the cloud cover ratio. This study trained and assessed 6 ML models such as U-Net, DeepLab, U-Net, PLS regression, fully convolutional network and 2 AdaBoost to determine the cloud cover. The outcomes demonstrated that the efficiency of every model for cloud segmentation was dissimilar since each ML model has its distinct attributes to identify and recognize input image features. The below table 1 describes several ML models in Solar energy prediction.

Table 1: Evaluation of ML Methods used to forecast Solar Energy Production
(***Source:*** Jebli, Belouadha, & Kabbaj, 2020))

Methods	**Norms**					
	Complexity of Model	**Predictive accuracy**	**Ease of use**	**Linearity**	**Number of required parameters**	**Training speed**
Decision tree	little	good	High level	No	Less	low
Support Vector Machine(SVM)	Fairly great	excellent	Low level	No	Less	Very high
Generalised linear model	little	poor	High level	Yes	Less	low
Artificial Neural Network(ANN)	great	excellent	Low level	No	Less	Very high
Random Forest (RF)	Fairly great	excellent	High level	No	Less	High
GradientBoosting Machine	little	good	High level	Yes or no	Less	low

From the consequences of Table 1, it is revealed that the Support vector machine and Artificial Neural Networks are extensively utilized due to their capability to resolve non-linear prediction and complex models. Based on the recent scholarly contributions, this table is depicted and it reveals that the ANN RF and SVM have high accuracy in forecasting solar energy.

6.2 Evaluation of Deep Learning Methods

Deep learning involves Convolutional Neural Networks (Sun, Venugopal, & Brandt, 2019), Long Short Term Memory (Wen, Zhou, Yang, & Lu, 2019) and Deep Neural Networks (Torres, Troncoso, Koprinska, Wang, & Martínez-Álvarez, 2019) and various hybrid models utilized in multistep solar energy forecasting. An approach for forecasting solar radiation sequences was suggested using multi-scale decomposition methods like wavelet decomposition, integrated empirical mode decomposition and empirical mode decomposition to analyze several clear sky index data and based on linear, this approach executes an autoregressive process and non-linear technique. The outcomes revealed that the wavelet decomposition models attain the best solar radiation prediction. Also, it is revealed that the selection of parameters is significant in solar energy forecasting

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applications. DL algorithms are proven to be effective in predictive tasks. In recent times, DL algorithms have been implemented meagerly for predicting RE power plants.

In association with this, a conventional study (Gensler, Henze, Sick, & Raabe, 2016) utilized amalgamations of these algorithms to display its prediction strength correlated to the normal Multilayer perceptron and the physical prediction model in anticipating the energy output of twenty-one solar power plants. The outcomes display that utilizing DL algorithms exhibits a high level of prediction efficiency while correlated with ANN and also with other physical forecasting models. Another study (Jebli, Belouadha, Kabbaj, & Tilioua, 2021) employs 3 various Deep learning models to forecast the Photo Voltaic energy output particularly the Gated Recurrent Unit, Long Short Term Memory (LSTM) and Recurrent Neural Network(RNN) for a half-hour ahead. The motive of this investigation is to correlate the considered model's relevance to identify the optimal algorithm for forecasting solar energy. The outcomes of this investigation reveal the efficacy of LSTM and RNN for precise-time photovoltaic prediction. These study findings deduce that the LSTM and RNN displayed low errors and a high level of accuracy. Hence, these are considered consistent models in solar energy management systems.

6.3 Evaluation of Ensemble Learning Methods

Ensemble approaches incorporate various identifiers into an identifier group to acquire an excellent comprehensive supervision model. These identifiers can be trained separately and then, incorporate various identifiers for entire forecasting and assessment. The most general ensemble learning techniques involve Gradient Boosting, Random Forests, stacking, bagging and so on. It is extremely significant to predict solar power generation which is several hours ahead. In association with this, an exploration (Ahmed Mohammed & Aung, 2016) predicts the solar power production several hours ahead for a grid–tied solar farmhouse. This investigation introduces 3 various approaches for ensemble probabilistic prediction originating from 7 distinct ML models to produce the 24-hour-ahead solar power predictions. Furthermore, this study reveals that the distinct ML models are precise when compared to the well-established models such as ARIMA and also the ensemble techniques deliver more precise outcomes than distinct ML models.

One more research (Kumari & Toshniwal, 2021) introduces the ensemble model that displays an excellent combination of prediction accuracy and stability regardless of the weather circumstances and seasonal variations and it displays the prediction skill score in a range of around thirty-three per cent to forty per cent in forecasting error. This introduced model can oblige as the potential forecasting model in various domains like consumption of electricity, solar power and wind power. Another exploration (Chakraborty, Mondal, Barua, & Bhattacharjee, 2023) assesses the influence of weather parameters on solar Photo Voltaic power production through various ensemble ML approaches such as Voting, Stacking, Boosting and Bagging Ensemble ML models. This academic work is a generalized one and it will be beneficial for forecasting the efficiency of large-scale solar Photo Voltaic power plants too. The employment of ensemble learning is supported by its appropriate characteristics in merging various weak regressors to attain the enhanced forecasting quality associative with traditional distinct learners. This investigation analyzes the forecasting efficiency of standard ensemble techniques such as Generalized Random Forest, Random Forest, Ensemble methods, and Bagged trees in a short-term forecasting of solar irradiance. The efficiency of these ensemble techniques correlates with the 2 generally known forecasting techniques such as Support vector Regression and Gaussian Process regression. The outcomes revealed that the ensemble approaches deliver greater forecasting efficiency while correlated with the distinct regressors.

7. FUSION OF AI TECHNIQUES IN THE PREDICTION OF SOLAR ENERGY

Solar energy forecasting is not a simple task since it heavily relies upon the climate circumstances and it also varies concerning time. Therefore, these concerns can be resolved by employing advanced and intelligent techniques to acquire precise outcomes. Subsequently, a study (AlKandari & Ahmad, 2020) introduced a hybrid model which merges the ML techniques with statistical approaches (MLSHM) for precise forecasting of future solar energy production of RE plants. To improve the introduced model's accuracy, this research involves 2 diversity approaches such as data diversity and structural diversity. This suggested technique merges 4 combining approaches such as non-linear process, simple averaging technique, and combination using variance utilizing the inverse technique and weighted averaging employing linear technique. The outcomes revealed that a hybrid model merging statistical techniques with ML approaches overtook a hybrid approach which only merges ML models devoid of statistical approaches.

Precise forecasting of hourly solar radiation is significant for efficient preparation and management. The efficacy and reliability of the advanced smart grid depend on precisely forecasting the solar energy amount which will be produced. Despite being capable of estimating the energy and path of the sun utilizing physical

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principles, predicting the growth and solar energy generation is an immeasurably stimulating topic in both the domains of AI and physical simulation. Accordingly, an investigation (Nishok, Rajathi, & Vanitha, 2023) introduced a fusion model for hourly solar power prediction and feature optimization. The attributes are extracted by the Slime Mould Algorithm. Following it, the Deep Neural Network, Random Forest, Light Gradient Boosting Machine and K-Nearest Neighbor are merged for precise solar radiation forecasting. Hence, the outcomes validate the model's effectiveness in forecasting hourly solar prediction and can be utilized in energy preparation and maintenance.

8. COMPARATIVE ANALYSIS OF AI APPROACHES IN FORECASTING SOLAR ENERGY

TABLE 2. VARIOUS AI TECHNIQUES INVOLVED IN SOLAR ENERGY PREDICTION AND ITS CONSEQUENCES

Reference	AI approach	Objective of study	Outcomes of study	Limitation/ Future work
(Semero, Zhang, & Zheng, 2018)	The introduced system utilizes the amalgamation of Particle Swarm Optimization, Genetic Algorithm and Adaptive Neuro-Fuzzy Inference Systems(ANFIS)	This work introduces the hybrid technique for predicting electricity generation in microgrids with solar PV installations	The investigation outcomes reveal that the suggested technique has the competence of precisely predicting day hourly Photovoltaic power production along with considerable performance enhancement when compared to several approaches	In future, it is suggested to compare this introduced approach with several other techniques
(Li, Wang, Zhang, Xin, & Liu, 2019)	This examination employs the Recurrent Neural Network(RNN)-based short-term approach	This inquiry introduces a very short-term prediction model based on RNN which involves both intra-day and inter-day photo voltaic power	The wide-ranging outcomes display that the suggested prediction technique reveals better prediction quality on the very short-term prediction that validates the efficacy and feasibility of the recommended prediction model.	This introduced approach can be utilized to endorse solar energy's future application
(VanDeventer et al., 2019)	The analysis embraces a Genetic algorithm (GA) based SVM approach	A short-term prediction of residential-scale photovoltaic systems is introduced in this scholarly work	The introduced approach performs well when compared to other conventional techniques with a difference of around 669.624 watts in the Root Mean Square Error value	The future inferences of this research involve recognizing forecasting models for photovoltaic power forecasting which emphasize the comparative analysis of optimization approaches and
				categorization models

(Korkmaz, 2021)	The suggested approach is named Solar Net utilizes the Convolutional Neural Network (CNN)	This exploration offered a short-term Photo Voltaic power prediction beneath the various weather circumstances and seasons	The investigational outcomes reveal that the suggested deep prediction technique has improved stability and accuracy in short-term Photo Voltaic energy prediction and it overtakes the various DL techniques	This offered approach in this work can be enhanced in future by employing several optimization algorithms. Additionally, several non-linear weather circumstances and sun situation images can be introduced to the anticipated prediction architectures to surge the prediction accuracy.
(Yadav et al., 2022)	The introduced investigation work is value-added utilizing the ANN and is a merger of neural networks and statistical regression methods	This investigation delivers a design that evaluates the PV's output performance using the ML approach in Malaysia and India.	The Artificial Neural Network models are established as a successful model in forecasting Photo Voltaic output power along with the RMSE value of 1.5565.	In future, it is recommended to gain several environmental and Photo Voltaic data through a Physical system and it aids in increasing the prediction accuracy of this model.
(Vennila et al., 2022)	A fusion approach that combines ML and statistical techniques is introduced. Along with it, an ensemble of ML models is employed to surge the accuracy of the model.	The academic work Introduces a system for forecasting solar energy production shortly.	From the study findings, it is disclosed that this suggested hybrid model performs better than a distinct model which employs only ML techniques	The suggested technique can enhance the accuracy and performance and additional metrics utilizing various DL mechanisms
(Yuan, Gao, Xie, Li, & Jiang, 2023)	This work employs the Sparrow Search Algorithm (SSA) to augment the model parameters of the DBN model. Also, it utilizes LSTM along with SSA and DBN to predict the Complete Empirical Mode Decomposition with	This work emphasizes resolving the issue of high instability and fluctuation of PV power. Hence, this study introduces the power prediction technique	The outcomes display that the introduced merged forecasting approach has greater forecasting accuracy.	In future, this suggested model must be tested under various weather circumstances to deliver excellent PV power prediction
	Adaptive Noise decomposed data.			

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The above table 2 describes the several AI approaches and hybrid approaches and their outcomes in the Prediction of solar energy. The outcomes of Table 2 demonstrate that the statistical and Artificial Intelligence and hybrid techniques are employed in forecasting Photo voltaic solar energy.

9. DISCUSSION

From the comparative analysis, it is revealed that the ANN-based solar generation prediction approach utilizes environment and weather-based input parameters like pressure, cloud index, temperature, wind speed relative humidity and so on. Furthermore, AI is the auspicious approach which also seems to be preferable for long-term Photo Voltaic prediction and it must be learned and suggested as the probable standard and unified tool for long- term, real-time and short-term Photo Voltaic forecasting. In present times, intelligent algorithms are utilized in the forecasting of solar energy. Among those, the most significant ones are SVM and ANN (Bae, Jang, & Sung, 2016). Similarly, this study also discloses that Artificial Intelligence optimizers like Genetic Algorithms, Particle Swarm Optimization and Differential Evolution algorithms from the measurable statistical standards measurements are employed for solar energy forecasting. It can be witnessed that the entire prediction techniques involved in the investigation have Root Mean Square Error indices. According to (Liu, Fang, Zhang, & Yang, 2015), it is revealed that the SVM and ANN are distinctive ML techniques yet, they endure few limitations. Likewise, it is found by this review that the Deep learning techniques are found to be promising in the Photo Voltaic energy forecasting.

On the other hand, it is revealed that forecasting solar energy generation is a multifaceted procedure that involves several factors like weather circumstances. From this investigation, it is also revealed that ensemble approaches are smeared on existing ML algorithms to surge the accuracy and resolve the overfitting issue. Several instances of hybrid AI techniques are discovered in this study in the forecasting of solar energy. Also, it is found from this review that several previous academic works compare the various ML classifiers' performance in the prediction of solar energy. Moreover, the forecasting outcomes not only rely on the algorithm engaged but, also on the data amount, the metric, the location and the solving technique. Correspondingly, table 2 reveals that every existing study suggests a distinct algorithm for the forecasting of solar energy. From that analysis, this present study infers that guidelines for investigators must be created for the prediction of solar energy. This would aid them in the decision- making process. Similarly, this inquiry recommends the ensemble algorithms for solar energy production forecasting due to their accuracy ratio. The outcomes of this review infer to be cautious in the process of parameter optimization for enhancing the accuracy rate of solar power prediction.

10. CONCLUSION

Solar energy prediction is a significant step for excellent planning and energy distribution which improves the solar energy's quality. However, this forecasting is an extremely difficult task due to various factors such as weather conditions, solar energy plant characteristics and so on. Hence, the present review intends to provide an overview of solar energy forecasting. This review reveals that there are three types of techniques for solar energy prediction such as physical, statistical and artificial intelligence techniques. On the other hand, it is found that manual and physical methods of solar energy prediction are vulnerable to errors. As a result, this study emphasizes the Artificial Intelligence approaches in the forecasting of solar energy. The outcomes of this investigation disclose that the ML methods have been utilized in RE prediction for several decades. Also, currently, Deep learning emerged as an effective technique in the prediction of solar energy. ANN and CNN is a sub-section of AI which is found to be prevalent in the forecasting of solar energy. The study deduces that ensemble learning increases the accuracy of solar energy prediction. Additionally, the results of the review infer that Hybrid-AI techniques which merge ML, DL and ensemble methods outperform the traditional ML methods employed for forecasting solar energy. The outcomes of the review conclude that the hybrid models combining various approaches outperform the standard machine learning approach. In future, it is suggested to review various advanced, intelligence and optimization algorithms in the prediction of solar energy.

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SIMULATION AND ANALYSIS OF GRID TIED INVERTER FOR RENEWABLE ENERGY SOURCES

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ABSTRACT
The electrical energy exaction is accrue in present days, these energy produces from the various sources like nuclear power plant, thermal power plant etc. but these are the sources are to be unrenewable sources and high running cost also. In this project we reduce the operative cost by role of various renewable energy sources which are available in circumferential. These RES acquire the electrical energy can be stored in electrical batteries otherwise it can be consign to electrical grid. Nevertheless, this energy is not consigning to the grid straightaway because of useableness and efficiency. Consequently, grid tied inverter which is transferred electrical energy to the grid. The role of grid tied inverter and inverter input and output brake mechanism of import. On the other hand, the inverter output voltages must be contemporizing with grid voltages. So, the phase angle and amplitude of the grid voltages must be obtained accurately and fast. To perform a suitable grid contemporize the phase locked loops (PLL) are widely used. In this method, a three-phase space vector pulse width modulation (SVPWM) brake grid tied inverter is simulated in MATLAB/Simulink and analysis the voltage and current waveform. All simulation results support that the output voltages of the grid tied voltage source inverter are sympathetic with the grid and grid contemporized is successfully perform.

Keywords: Renewable Energy Source, Grid Tied Inverter, PI Controller, SVPWM, PLL, Reference Current Controlle.

1. INTRODUCTION

Electrical energy produced from the RES is preferred to consign to electric grid instead of storing in batteries. But, the produced energy is not transmitted to the grid straightaway because of useableness and efficiency. Many stipulations must be provided to transmit the energy to the grid. The RES are produced the electricity in the DC form. These stipulations are sinusoidal-shaped waveform, continuity of electrical energy, fixed-frequency, being balanced of the produced voltages, to be within specific limits of current harmonics. In this compliments, three-phase inverter is used at high powers to consign electrical energy to the grid. Indeed, brake of the inverter, known as grid tied inverter, is very important [1] in literature survey, number of methods is proposed for brake the grid tied inverter that can be purposed as current source inverter (CSI) or voltage source inverter (VSI). Even though CSI has gain such as blocking reverse voltage and showing high impedance to short circuits, VSI are purpose for easier brake and less conduction losses [1],[5]. The methods purposed in inverter brake are hysteresis current brake (HCC), sinusoidal pulse width modulation (SPWM), and space vector pulse width modulation (SVPWM). The HCC method has a good dynamic response; nevertheless current harmonics and switching frequency are uncertain. The SPWM method is simple minded to implement, ultimately it requires carrier and reference signals, has higher switching losses and cannot apply DC-link voltage effectively. The latest SVPWM method that has a fixed switching frequency, lower switching losses, low harmonic content, higher DC-link voltage utilization, and proper structure for digital brake is widely used to brake the grid tied VSI. In grid tied inverter, output voltages of the inverter must be contemprized with grid voltages. To carry out the grid contemprization, the cognition of the phase angle and amplitude of the grid voltages must be determined accurately and fast. So, grid tied inverter contemprization purpose a liberal role in these systems. To achieve a proper contemporization, phase locked loops (PLL) are generally purpose to contemporize the inverter and the grid. Moreover different PLL algorithms provide satisfactory response to several troubling effects such as harmonics, imbalances, frequency fluctuation, and phase bound in the grid voltages. The main goal of this study is to simulate and analysis a three-phase grid tied inverter brake by SVPWM method for RES. This paper is design the Simulink model and analysis purpose of study is remark, overview of the system is presented, brake of the grid tied inverter system is described, simulation model for three phase inverter also controlling of inverter system, load(Inductive load), grid, and measuring the VI measurement block and experimental results. Also analysis the inverter and grid voltage and current waveform lastly conclusion & future scopes are to be done. [1][4].

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1.1 METHODOLOGY

Fig. 1 shows, the overview of grid tied inverter block scheme. In this figure the various block are indicated line dc input supply like wind turbine pv etc.,3 ph inverter, filter, the PLL is used as the grid contemporization, the grid voltage and currents are to be measured by the VI measurement then they are transferred to controller for the control of the inverter. Then, appropriate control signals are obtained by the controller with actual and reference signals Finally, the filtered contemporized inverter output voltages are transmitted to the grid by connecting the LC filter.

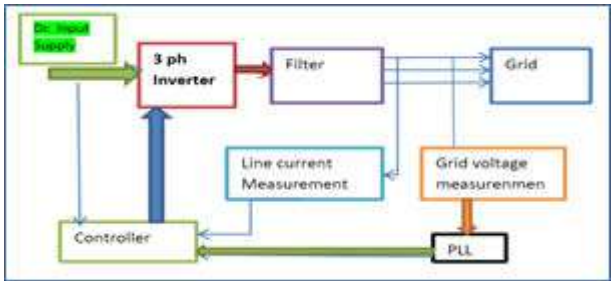

Fig.1: Grid tied inverter

2. MATLAB SIMULINK MODEL OF GRID TIED INVERTER

Fig. 2 shows the Simulink model of grid tied inverter. Firstly we defined the grid tied inverter, the grid tied inerter is the grid inverter convert direct current into the alternating current suitable for the injecting into an electric power grid, generally 240 V RMS of 50Hz or 120 V RMS of 60Hz.The PI controller is controlled the inverter output voltage. In model (Fig. 2) detect the reference g is the output signals of PWM generator. The inverter direct current is converted into the three phase alternating current. The PI controller output of voyabc & ilabc also the active and reactive power is filtering by using the first order filter that is in model use the LC filters. The inverter filter output power transferred to the grid. The inverter output voltage and current is measured by VI measurement.

Fig. 2 shows the MATLAB Simulink model of grid tied inverter. The generated DC supply given to the three phase inverter, for controlling the inverter operation the controller is connected across it, the active and reactive power can be filter out by using the filter. In between inverter and grid the VI measurement is connected for measurement of voltage and current. The inductive loads are connected to across it. The numbers of block diagram are shows in the Fig. 2. the simulation of grid tied inverter for various RES are design the model by using inverter, grid and various load. The contemporize inverter output and grid input is the main aim of our project, so the comparing & matching the voltage, current, frequency to the grid and inverter voltage.

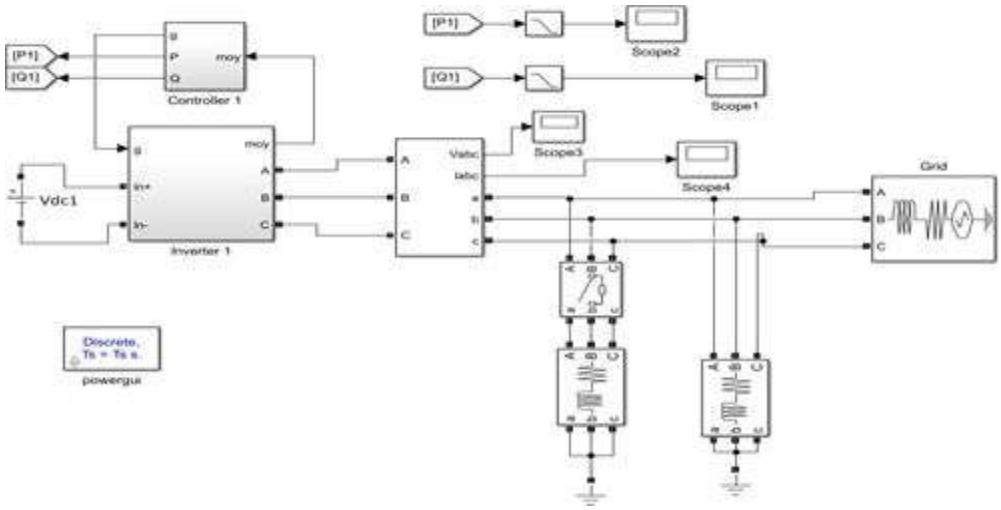

Fig.2: MATLAB Simulink model of grid tied inverter

The inverter error signals are calculate by using the PI controller.Standard inverter contemporize with the grid for the phase system. The three main quantities are to studies

(1)Phase sequence

(2)Frequency

(3)Voltage

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These three quantities are to be same for the contemporize the grid tied inverter. Controlling to these quantities the PI controller is design.

PLL is design for the phase sequence and the constant angular frequency. The simulation designing of PLL is shown in Fig. 3.

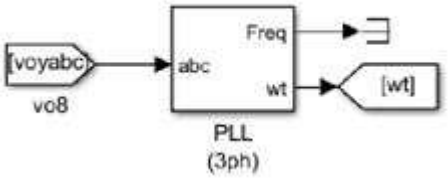

Fig.3: PLL Simulink

PLL is very important that the obtained phase angle of inverter is locked fast to the phase angle of the grid and it gives a good filtering characteristic in terms of the dy- namic performance of the system. The PI controller are generally use the blocking of phase sequence and angular frequency the PLL is generally use. dq-PLL is most preferable in the PI controller. Fig. 3 shows the PLL, the voltage (voyabc) is take from the grid voltage, it compare with the standard grid values and block the parameters. The angular frequency form the grid is the use in the abc-dq conversion for the constant frequency of the inverter output. Then for the third value of the system is to be contemporized the inverter and grid is the system voltage. Firstly we take the grid voltage (voyabc) for calculating the reference current for the dq reference frame as shown in Fig. 4.

The grid voltage (voyd) give the reference calculator for the dq reference frame the current is ild & ilq.

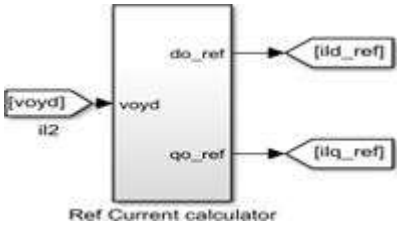

Fig.4: Reference c/n calculator

PI controller requires abc to dq refrence transfer it is used for the minimum error signal between actual current quantities sense before the filter & reference signal generated by voltage sense after the filter. For next the abc-dq conversion is carried out for the voltage and current to the actual values for the dq. Voltage (voyabc) is converted the dq actual voltage is voyd & voyq sameway the currents are ild & ilq. The system parameters used in simulation are given in Table 1.

Table 1: Simulation Parameters

S.N.	Parameters	Value
1	Three phase peak voltage	330V
2	Grid voltage	230V
3	DC supply	650V
4	Supply frequency fs	50HZ
5	Filter Inductance Lf	3mH
6	Inductor internal resistance rf	0.05Ω
7	Filter capacitance	30μF
8	Capacitor resistance	0.5Ω
9	Load 1	R=30Ω, L=75mH
10	Load 2	R=10.29Ω, L=25.86mH

Now, the current controller compare the actual and reference values of the current. Suppose the inverter is gives the 10 A current and actual current of grid is 12A at the time PI controller is measures the error signal. The inverter current that is actual ild is compare with the reference current ild is subtracted to each other and gives the error signal which entered in the PI controller. For 3 ph system the PI controller is used for synchronous frame. The PI controller advanced for these system, there will br no remaining control error after a set point change or a process disturbance. The disadvantage of PI controller is that there will be steady state error for 3ph system. The error signal is entered in PI controller , the PI controller need a feed forward path with the reference current. Same way the inverter current ilq and the reference current ilq is subtracted and gives the error signal,

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which error signal is entered in the PI controller the PI controller feed forward path is need to compare it with the reference value of ild.

PI controller output voltage is same way to compare the reference voltages (voyd & voyq) and inverter voltage. These voltage error signal gives to the SPWM and compare with the grid voltage.The SPWM is generate the its own carrier signal waveform. Its compare with the grid waveform and gives to the IGBT. If error is maximum in the SPWM the IGBT pulse wave is minimum. Its work as opposite to each other if the error signal waveform is minimum the output waveform of IGBT is maximum. Inverter voltage and current are multiplied then gives the apparent power (VA) that is real and reactive power which is used in the further system. In these way the PI controller is used to inverter operation for the grid. The simulation results are discussed in the results and the performance analysis.

3. RESULTS & PERFORMANCE ANALYSIS

The simulation MATLAB results about the work that has been done. The MATLAB simulation modules are useful for the actual design of the proposed work. MATLAB software is used due to its extensive scope of application in research and analysis zone. MATLAB software is used to simulate whole system. This software allows assembling

the circuit, running the simulation, analysing the results, and managing the data in a completely integrated graphical environment. This dissertation is focus on the synchronization of the inverter with grid using dq-PLL method. . It gives the results about the voltage and current characteristics of the inverter and grid. It describes about the voltage magnitude of inverter and grid. It also gives the values of active and reactive power.Fig. 5 shows the inverter output waveform for the current iabc for the sampling time Ts=0.6 sec.

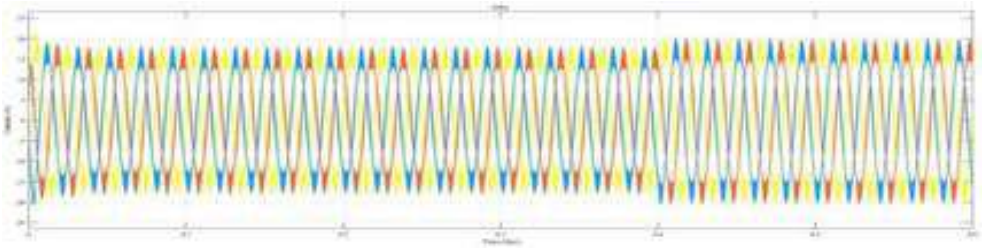

Fig.5. Inverter output non filter Current (ilabc)

The voltage from the inverter shows in the Fig. 6. The 3 ph. voltage is non-sinusoidal in nature. It is voltage before the filter Viabc.

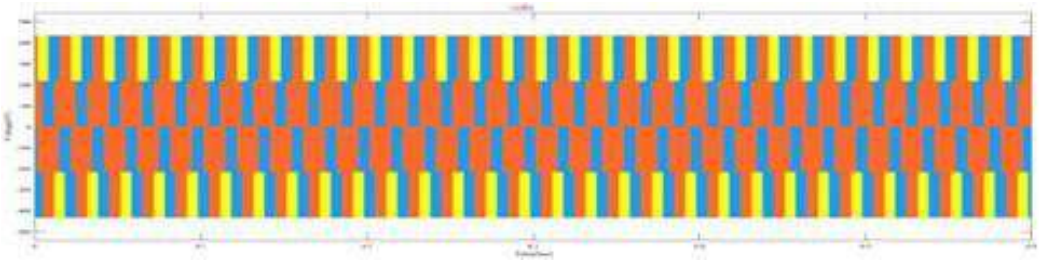

Fig.6. Inverter output non filter voltage (Viabc)

In Fig. 7, three-phase filtered output voltages and currents are shown. As shown in this figure, it is observed that the phase voltages and currents are balanced at the inverter output.

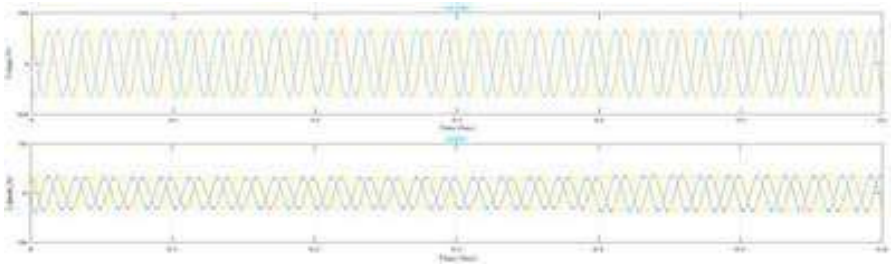

Fig.7. Inverter output filter voltage & current

Fig. 8 shows the voltage and current of selected phase. The bus bars select only one voltage behalf of three phases. In Fig. 8 select phase “a”, then as current is very less so in Simulink model we are multiplying it with 10 as a gain-

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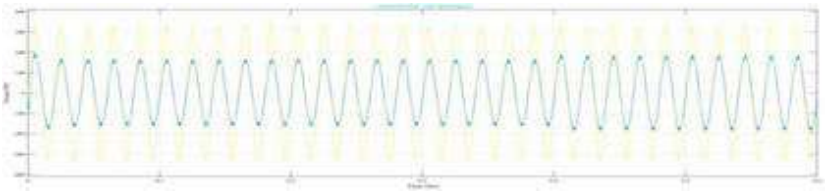

Fig.8. Voltage & current of selected phase

Fig. 9 shows the inverter current reference waveform. PI controller gives the error signals of the direct and quadrature axis. The errors in PI controller are the inverter actual current with d-axis and reference current with d-axis. Same way it calculate the error in actual current with q-axis and reference current in q-axis along with the feed forward path. Same way it gives the error voltages

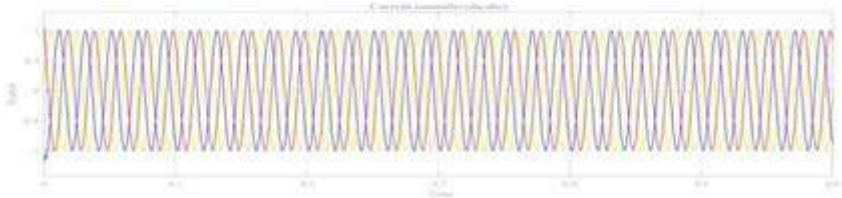

Fig.9. dq to abc current controller (dq reference and actual)

The PI controller sends the voltage error signal in the PWM generator. These carrier signals are send to the IGBT. If error signal is maximum the IGBT pulse wave is min and the error signal is minimum the IGBT pulse wave is max. Error signals are eliminate in PWM, Fig. 10 shows the PWM signals.

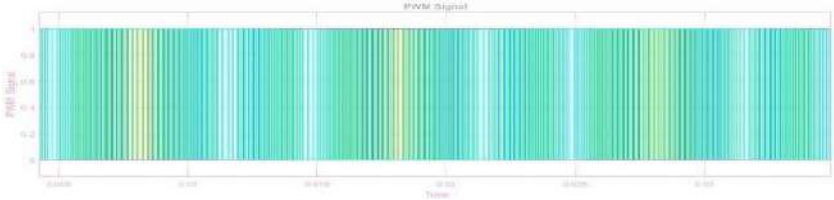

Fig.10. PWM generator output

The Fig. 11 & Fig. 12 shows active & reactive output power of the inverter. These output power is taking along with the without filtering.

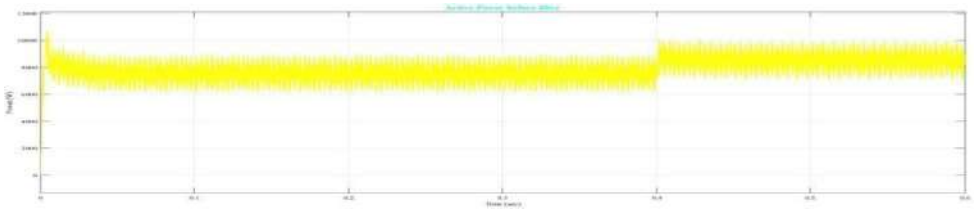

Fig.11. Active power before filter

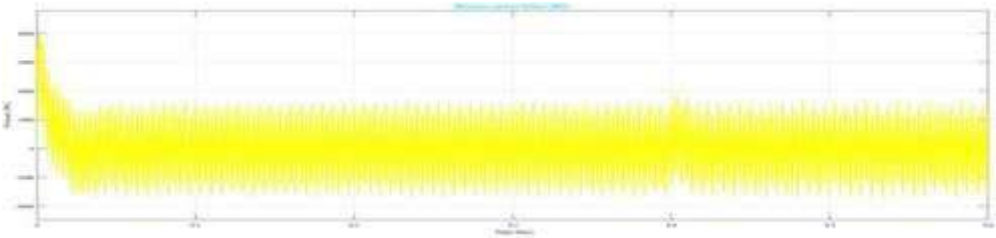

Fig.12. Reactive Power before filter

Fig. 13 & Fig. 14 shows the active & reactive power of inverter after the first order filter is connected

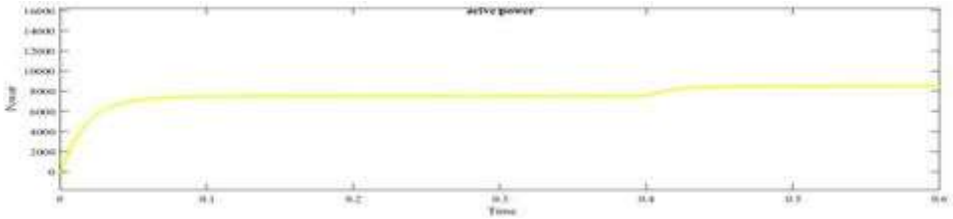

Fig.13. Active powers after filter

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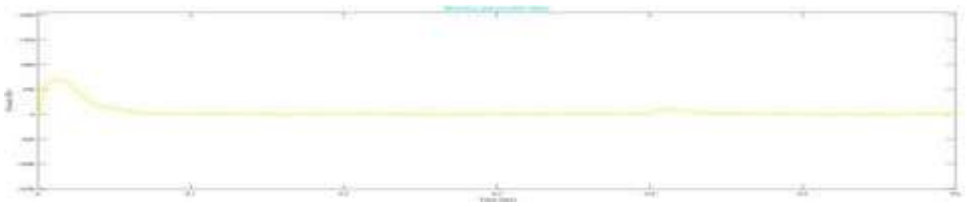

Fig.14. Reactive powers after filter

The Fig. 15 shows the inverter output voltage and grid voltage are contemporized with each other for the three phases. The output volt-age waveform of 3ph system is shows that the grid tied inerter is success-fully achieved

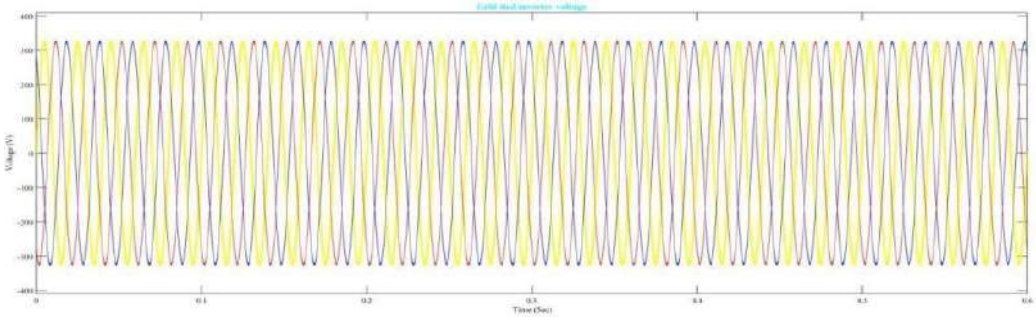

Fig.15. Contemporized grid tied inverter voltage

The Fig. 16 shows the current of the both grid and RES are contemporized with each other, the current is minimum at the condition we are multiplying it by the gain value. This current waveform is for the three phase system is successfully achieved for the grid tied inverter.

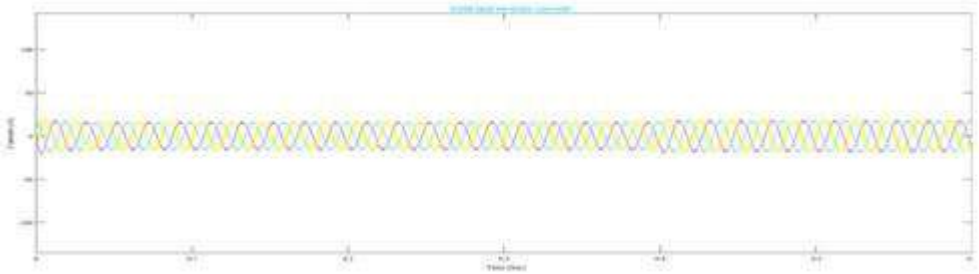

Fig.16. Contemporized grid tied inverter current

4. CONCLUSION

This method represents a simulated model of three phase grid tied inverter and closed loop current control scheme for the same. The overall simulation of system is simulated in MATLAB through PLL based PWM technique by using DC supply. The proposed system is capable for synchronizing with grid with little distortion as per grid requirement. It can be easily observed from the waveforms that there is scope for further research in improving the quality of the power. After the compensation, the grid voltage and current are in phase with inverter voltage and current. The SPWM technique is very useful in improving the power quality. The THD is well below the limit 5%. The performance of the shunt active power filter is analyzed using the SPWM technique for minimizing the harmonics, compensating the reactive power and improving the power factor in the power system. This technique can be used to control the VSC of custom power devices. The proposed switching technique uses a sinusoidal reference signal and an inverted sine wave as the carrier signal. The SPWM technique generates lower voltage THD and low switching losses in comparison with the conventional PWM technique. All simulation results and analysis confirmed that the output voltages of the SPWM controlled grid tied inverter are balanced with the grid and grid synchronization is successfully achieved. The low dynamic designed dq-PLL and adaptive PLL prove to overcome all the test conditions. These make them suitable for grid connected applications, such as wind turbines, PV or fuel cell systems.

4.1 FUTURE SCOPE

(1) Grid working is a great need of design the control system that will control the design of inverter power.

(2) It makes the system smart by coordinate with the IT system.

(3) It is helpful for nature and human.

(4) The natural sources are to be useful for making these systems.

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(5) Further research in improving the quality of the power.

(6) It also reduces the pollution and running cost of metering.

(7) Improve the power quality by using the LC filters.

(8) Grid must Synchronized with inverter by using dq-PLL method.

(9) Grid connected inverter system is great need of designing the control system by using ANN for controlling the inverter power.

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A REVIEW : FAULT CLASSIFICATION ON EHV TRANSMISSION LINE

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ABSTRACT
This Paper represents the prime aim of power system is to provide uninterrupted power supply to consumers but the performance of power system is frequently affected by transmission line faults. This fault may occur due to aging of equipment's etc. Which finally lead to disturbance in power flow. In order to maintain the continuity of supply and to improve the efficiency of power system the transmission line fault should be diagnosed and treated accurately.

The purpose of this work is to develop the method which can be used for accurate fault classification. As once the fault condition is detected and classified according to its category then it is feasible to decide the protection system to be used. Mat Lab Simulink can be used to design the EHV transmission line and faults.

Keywords: Fault, Fault classification, EHV Transmission line, MATLAB Simulink.

I. INTRODUCTION

Here, the most fundamental task in the assurance of the power system is to protect against undiscovered deficiencies through transmission lines. Unusual variables including climate, human error, smoke from fires, hardware failures (such as pivoting machines and transformers), and so forth can result in faults in overhead wires. These problems result in interference with electrical currents, damage to hardware, and even the death of humans, animals with wings, and other creatures. These problems put the power supply's congruency at risk. Fault is nothing more than an anomalous state. When an aberrant state arises in a power transmission system, the system quantities (voltage, current, phase angle, etc.) surpass their threshold values; this is referred to as a fault.

Two categories of faults exist in overhead transmission systems: shunt (short circuit) faults and series (open conductor) faults. It is simple to identify series errors by looking at the voltage of each phase. An open conductor fault has occurred if the voltage values increase. One open conductor fault and two open conductor faults are the two categories into which these faults fall. These are extremely uncommon faults It is simple to identify short circuit faults by monitoring the current in each phase. A short circuit fault has occurred if the current levels increase. There are two categories of short circuit faults: symmetrical faults and asymmetrical faults. Line to line (LG), line to line (LL), and double line to ground (LLG) are examples of asymmetrical faults; triple line (LLL) and triple line to ground (LLLG) are examples of symmetrical faults. Figure 1 depicts the fault classification in the overhead transmission system; phase A, phase B, phase C, and ground are denoted by the letters A–C and G, respectively. The most frequent fault is the LG fault, which is less serious than other failures. The next faults in terms of occurrence and severity are the 3- phase (LLL and LLLG) faults, LL faults, and LLG faults. If a 3-phase fault occurs, the entire system will collapse. Therefore, in order to prevent significant damages, the protection strategy must quickly identify the defect, classify its kind, and pinpoint its location. Numerous approaches have been developed to date, each with pros and cons of their own. For users, choosing a fault categorization system is therefore a major effort.

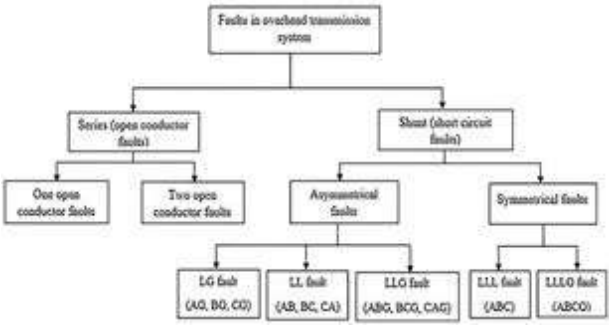

Fig: 1 Classification of faults

Thus, a review of all of the suggested efficient and effective fault classification techniques is necessary. In this review article, an attempt has also been made to relate the fault classification methods on the basis of their techniques, simulation tools used in that corresponding approach.

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2. ***Survey on fault classification methods*** Classification is a general procedure related with categorization, the procedure in which thoughts and items are perceived and separated. Classification permits us to see connections between things that may not be clear when taking a gander at them in general. Classifying things likewise makes it less demanding for us to make subjective judgments about the value of various things. Classification required mainly for business, science, mathematics, media, associations, financial aspects, industries, security arrangement, etc. In power system, overhead lines are most effortless to analyze since the issue is normally self-evident.

The exactness about its fault recognition and classification are the most vital elements for protection of overhead line. The association of new generating stations to fulfill this quick increment sought after requires growing transmission and distribution facilities. The subsequent lower dependability limits make it imperative to clear the transmission faults quick utilizing fast protection strategies. This has produced another enthusiasm for the transient based protection techniques. Due to so many techniques developed for fault classification, the user may get confusion to select the appropriate technique. To understand easily this review divided the widely used fault classification techniques into 3 types as follows:

(A) Prominent techniques

(B) Hybrid techniques

(C) Modern techniques

The Fig. 2 shows the tree diagram of the existing fault classification methods in fault analysis.

2.1. Prominent techniques

Prominent techniques arewell- known techniques, commonly used for fault classification in transmission lines. These techniques are classified into 3 types. They are

A.1 Wavelet approach

A.2 Artificial neural network approach

A.3 Fuzzy logic approach

The explanation of each technique is given below. The Fig. 3 shows the single line diagram of typical power system considered for the simulation.

2.1.1. Wavelet Approach

Wavelets are a numerical tool for signal preparing. The fundamental thought in wavelet transform (WT) is to choose a reasonable wavelet function as “mother wavelet” and afterward execute examination utilizing moved and enlarged adaptations of this wavelet. Wavelet can be picked with exceptionally attractive recurrence and time attributes when contrasted with Fourier procedures. The Fourier extension has just frequency determination and no time determination. This implies it decides every one of the frequencies present in the signal however it doesn’t tell at what time they introduce. To conquer this issue WT is proposed. WT gives time and frequency data all the while. WT can split signals into different frequency bands with the help of multi resolution analysis (MRA). It can be used in detecting faults and to estimate the phasors of the current and voltage signals, which are important for the protection of transmission lines.

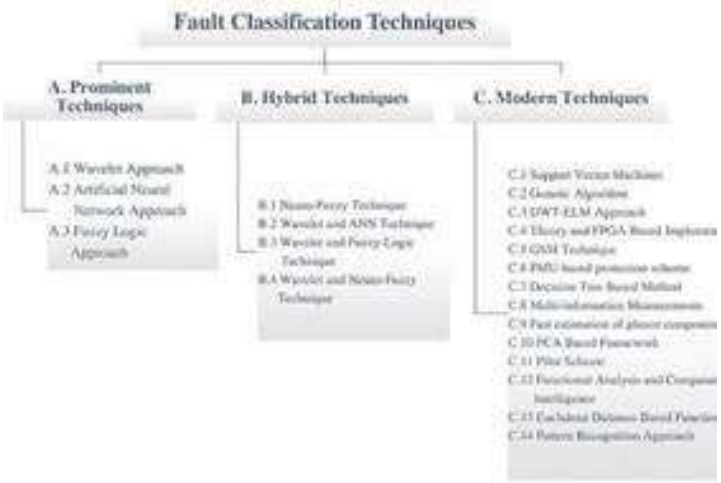

Fig2: Tree Diagram of fault classification Techniques

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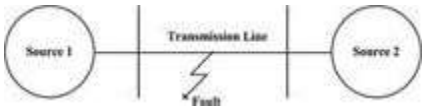

Fig3: Power System Model

WT can split signals into different frequency bands with the help of multi resolution analysis (MRA). MRA is used for fault analysis in the protection of overhead lines. The Fig. 4 shows the decomposition of a signal 'S'. In this figure, A and D indicates approximation coefficients and detail coefficients respectively. The energy of the signal, maximum detail coefficient and the ratio of energy change of each phase currents are calculated from the transients produced by each phase due to faults using discrete wavelet transform (DWT) and thus detecting and classifying transmission system faults.

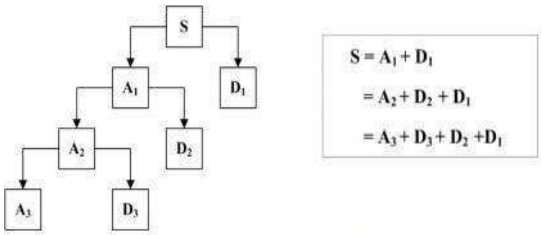

Fig. 4. Three-level decomposition of a signal 'S'.

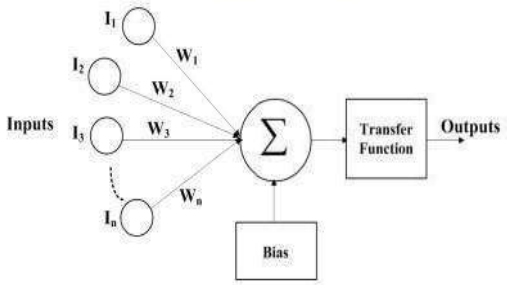

Fig.4: Artificial Neuron Model

2.1.2. Artificial neural network approach.

Artificial neural network (ANN) show qualities, for example, design affiliation or mapping capacities, adaptation to internal failure, strength, speculation and fast data preparing. Neural systems can be learned by illustrations. They can in this manner be prepared with known case of an issue to obtain information about it. Once suitably prepared, the system can be put to powerful use in understanding "untrained" or "unknown" case of the problem. The essential structure of simulated neuron model appears in Fig. 4.

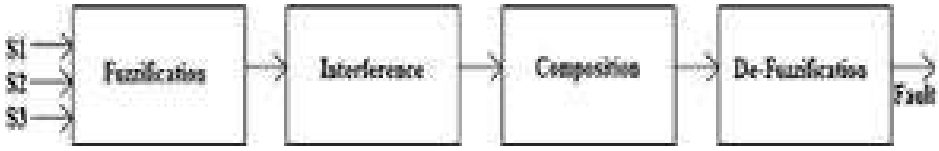

Fig 5: Fuzzy system

In present days, the need of high phase order transmission system increases due to the consumption of power increasing continuously. Six phase transmission lines will be able to transmit extra power for same phase to phase voltage with the same right of way economically. It is a big challenging task to protect six phase transmission lines.

2.1.3. Fuzzy Logic Approach.

The utilization of fuzzy logic has gotten a great deal of consideration as of late on account of its adequacy in diminishing the requirement for complex scientific models in critical thinking. Fuzzy logic utilizes linguistic terms, which manage the easy- going relationship amongst input and output variables. Hence, fuzzy logic technique makes it simpler to control and to take care of numerous issues, especially where the numerical model is not unequivocally known, or is hard to settle. Fuzzy logic gives not just a capable representation for estimation of instabilities additionally an imperative representation for vague ideas expressed in natural language. It is a scientific hypothesis, which incorporates the piece of information of ambiguity while portraying an importance or idea. Fuzziness is fundamentally one method for portraying uncertainty. Such ideas are valuable in issue order. The general procedure performed in a fuzzy logic methodology appears in Fig. 6 where S1, S2, and S3 are three inputs to the fuzzy classifier, used to characterize fault type.

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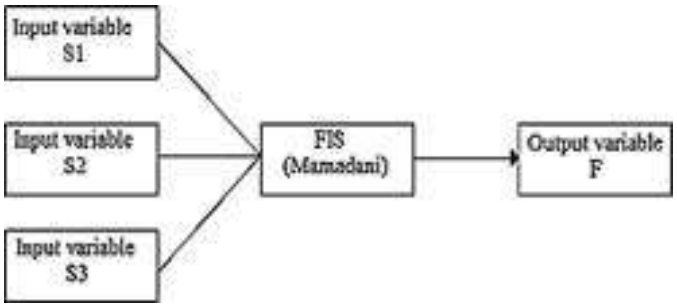

Fig 6: Fuzzy Interference system

2.2. Hybrid techniques

Hybrid techniques discuss the integration of the three techniques, namely wavelet approach, ANN approach, and fuzzy logic approach. Hybridization has been to overcome the drawbacks in one approach during its application, with the strengths of the other by appropriately integrating them. These are the combination of one or two prominent techniques. These techniques are classified into 4 types. They are

B.1 Neuro-fuzzy technique.

B.2 Wavelet and ANN technique

B.3 Wavelet and fuzzy-logic technique

B.4 Wavelet and neuro-fuzzy technique

2.2.1. Neuro-Fuzzy Technique

This is one of the most researched forms of hybrid systems and has resulted in a stupendous quantity of publications and research results. Neural systems that perceive designs and adjust to adapt to evolving situations, fuzzy inference systems that join human learning and perform approaches, together with certain subordinate—free enhancement strategies, brings about another procedure called neuro and fuzzy or Adaptive neuro fuzzy inference system (ANFIS). Fault classification achieved by using only the current signals, with fuzzy- neuro methods was presented by Keerthipala et al. (2000), the symmetrical components and three line currents were utilized to identify fault types. Elbaset and Hiyama

(2009) has presented an application of ANFIS for automated fault analysis in transmission lines using only data at one end. This application of ANFIS aimed at high- speed processing which can offer real-time identification of faults. This ANFIS was proposed not only to detect all shunt faults but also to classify the nature of faults for distance protection system. This method can correctly detect the faulty phases in a transmission line

2.2.2. Wavelet and ANN Technique

Wavelet and ANN technique attempt to combine the best features of a wavelet approach and artificial neural network approach to give better results in fault classification. A different fault classification method using current signals for thyristor- controlled series compensated transmission systems by integrating both the DWT and ANN algorithm together achieved, this technique has been presented by Cheong and Agganval (2004). This modular approach employs firstly a fault-classifying network based on simple standard back propagation (SBP) learning algorithm and secondly a network for discriminating the fault location based on Self-Organizing Maps (SOM) network

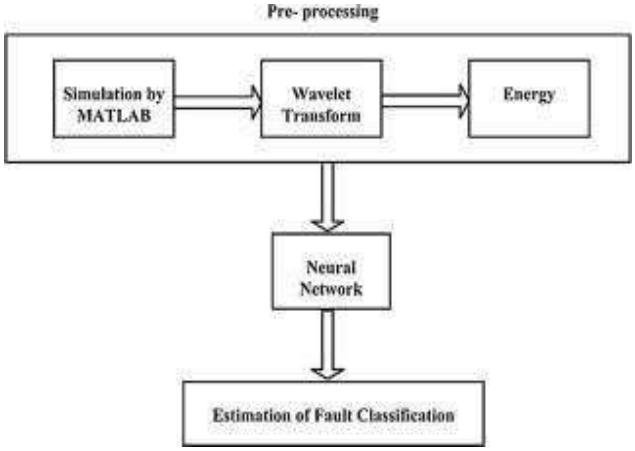

Fig 7: Fault classification technique using WT and ANN technique

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2.2.3. Wavelet and fuzzy-logic technique

In this technique, wavelet transform is used for decomposition of the output signals of simulated power system network. It decomposes the output signals to required level and detail coefficients at that required level used as input to the fuzzy logic tool box. Fuzzy logic tool box based on the rules used in that particular fuzzy inference system gives fault type as output.

2.2.4. Wavelet and neuro-fuzzy technique

Jung et al. (2007) developed a fault location strategy for transmission systems that combines both wavelet and neuro-fuzzy based methods. Tag Eldin (2010b) devised a method for locating defects in a series compensated gearbox system utilising WT and ANFIS. This method uses simply wavelet MRA Coefficients for fault identification and classification. In this study, the three phase currents at each transmission line closures are coupled to wavelet transformations. For fault analysis, the wavelet coefficients' spike directions and magnitudes are used. In order to evaluate the implementation of the suggested issue area

calculation and the validity of the calculation to identify and classify faults is tried, a wide range of faults with different beginning points, distinctive locations, and distinctive fault resistances in both sections of the series compensated transmission line are simulated. Additionally, the validity of distinguishing between external and internal flaws is tested. This scheme's main advantage is that it can react to rapidly changing information. Its main disadvantage is that it takes a long time to train feed forward networks using backpropagation algorithms, especially when the power network's dimension is large. In comparison to other ways, the scheme's complexity is higher.

II. CONCLUSIONS

In order to better understand the early approaches and combinations of various approaches that were previously employed for the protection of power transmission systems, the study presents a categorization of the fault classification techniques that are currently accessible in prominent and hybrid ways. For the first time, the approaches in this study have been categorized according to the fault classification methodology, which includes notable, hybrid, and current methodologies. The sophisticated techniques for fault classification and will provide a succinct overview of recently created fault classification approaches by different scholars.

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GRID INTEGRATION BENEFITS AND CHALLENGES OFELECTRIC VEHICLES: A REVIEW

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ABSTRACT
Vehicle to Grid (V2G) technologyis a game changer when it comes to integrating vehicles (EVs) into the power grid. It allows for a two way energy exchange, where EVs cannot only draw electricity from the grid but also contribute energy back, into it. As there are x`x`many distributed sources connected to grid EVs are also considered as distributed energy source. The V2G concept can enhance the stability, reliability and efficiency of thegrid. This paper reviews the benefits and challenges of grid integrated Electric Vehicles.

Keywords: Vehicle-to-Grid (V2G), Grid-to- Vehicle (G2V), Distributed Generation (DG), grid operator, ancillary services, emissions

I. INTRODUCTION
During the last few decades, the environmental impact of the petroleum-based transportation infrastructure, along with the peak oil, has led to renewed interest in an electric transportation infrastructure. Electric vehicles are becoming increasingly importantas not only do they reduce noise and pollution,but also they can be used to reduce the dependence of transport on oil – providing that the power is generated from fuels other than oil. Electric vehicles can also be used to reduce carbon emissions. Production of zero release of carbon dioxide requires that the energy for electric vehicles is produced from non-fossil-fuel sources such as nuclear and alternative energy [1].

Vehicle-to-grid (V2G) is a fast emerging component in the electric distribution networkin which plug-in electric vehicles interact or communicate with the power system toprovide demand response services by either injecting electricity to the electric network or absorbing electricity from the aforementionednetwork [2].

As the world transitions towards cleaner and more sustainable energy solutions, V2G stands out as a pivotal technology that not only promotes the widespread adoption of electric vehicles but also addresses challenges associated with renewable energy integration and grid management. This introduction explores the key principles, benefits, challenges, and potential applications of Vehicle-to-Grid technology, shedding light on its role in shaping the future of smart and sustainable energy systems.

This paper is organized as follows. In section II types of Electric Vehicles are explained. Section III describes the concept of V2G technology. In section IV benefits of V2G technology has reviewed. Section V has reviewed the challenges. Section VI is the conclusion section of this review paper.

II. TYPES OF ELECTRIC VEHICLES

A. Battery Electric Vehicles
The concept of the battery electric vehicle (EV)is essentially simple. The vehicle consists of an electric battery for energy storage, an electric motor and a controller. The battery is normally recharged from mains electricity via a plug and a battery charging unit that can be either carried on board or fitted at the charging point. The controller will normally control thepower supplied to the motor, and hence the vehicle speed, in forward and reverse [1].

B. The IC Engine/Electric Hybrid Vehicle
A hybrid vehicle has two or more power sources, which gives a very large number of variants. The most common types of hybrid vehicles combine an IC engine with a battery and an electric motor and generator. There aretwo basic arrangements for hybrid vehicles: the series hybrid and the parallel hybrid. In theseries hybrid design the vehicle is driven by one or more electric motors supplied directly either from the battery or from the IC-engine- driven generator unit – or from both. In the parallel hybrid the vehicle can be driven either by the engine working directly through a transmission system, or by one or more electric motors working via the transmission or coupled directly to the wheels – or both bythe electric motor and the IC engine at once [1].

C. Plug-in Hybrid Electric Vehicles (PHEVs)
PHEVs have both an electric motor and an internal combustion engine. They can operate in an all-electric mode for a certain range before the internal combustion engine kicks in.PHEVs can be charged through a power outlet or charging station.

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D. Fuelled EVs

The basic principle of EVs using fuel is muchthe same as with the battery EV, but with a fuel cell or metal air battery replacing the rechargeable electric battery. FCEVs convert fuel into energy through an electrochemical reaction with hydrogen and oxygen. This produces electricity which powers an electric motor [1].

III. THE CONCEPT OF V2G

In a traditional setup, electricity flows from the grid to the vehicle to charge its battery. V2G technology enables the reverse flow,allowing electric vehicles to return electricityto the grid when they are not in use.

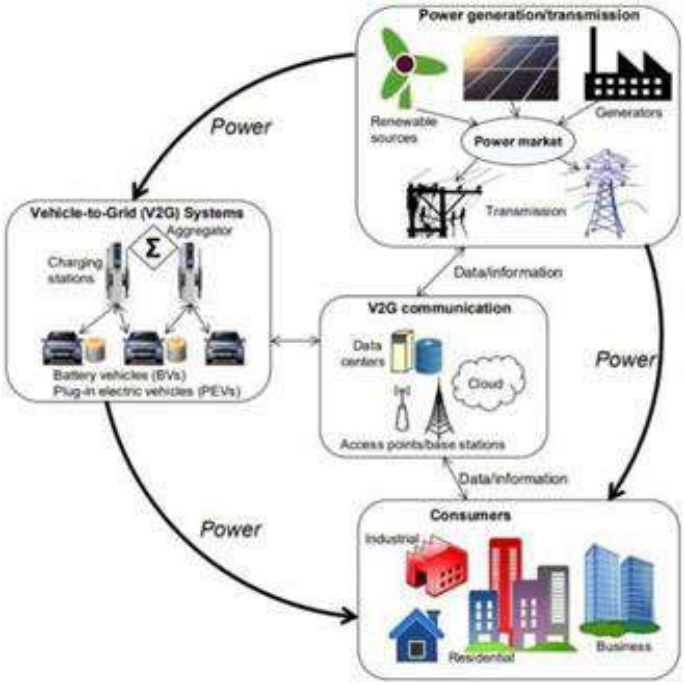

Fig.1 Vehicle to basic grid framework Fig.1 shows the V2G technology concept. TheEV can be of any type from the above types of EVs. Battery EVs can charge during low demand times and discharge when power is needed. Fuel cell EVs generate power fromliquid or gaseous fuel. Plug-in hybrid EVs canfunction in either mode [3]. This bidirectional flow of energy is facilitated through the vehicle's on-board energy storage system,typically a lithium-ion battery.

IV. BENEFITS OF VEHICLE TO GRID TECHNOLOGY

Usually personal vehicles in the worldtravel on the road only 3 to 4 hours in a day, for rest of the time they are parked at workplace or home garages. [3], [4], [5]. In many cases, these vehicles can support V2G capabilities. Vehicle-to-Grid (V2G) technology offers several benefits, primarily in the context of electric vehicles (EVs) and the broader smart grid infrastructure.

Vehicle-to-Grid (V2G) technology enables electric vehicles (EVs) to not only draw powerfrom the grid but also to return excess power back to the grid. This bidirectional flow of energy open up opportunities for various ancillary services that can help enhance the stability and reliability of the electrical grid.

1. Frequency Regulation

Frequency regulation is used to balancesupply and demand for active power. Frequency regulation is achieved mainly by cycling large generators [6]. This is costly. Fast charging and discharging rates of PEV batteries makes V2G a promising alternative for frequency regulation [3]. The frequency ofthe electrical grid must be kept within a specific range for optimal operation. Fluctuations in demand or supply can impact grid frequency. EVs connected to the grid canrespond to signals from the grid operator to either provide power to the grid or absorb excess power to help regulate and stabilize thefrequency.

2. Voltage Regulation

Voltage regulation is used to balance supply and demand for reactive power. Electric vehicles can provide voltage support by adjusting their charging or discharging rates based on grid voltage conditions. A voltage control can be embedded in the battery charger. When the grid voltage becomes too low, vehicle charging can stop; when it becomes high, charging can start [7].

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3. Peak Shaving and Load Balancing
EVs can be used to reduce peak demand onthe grid by charging during off-peak hours and discharging during peak demand periods. This helps in avoiding the need for additional power plants to meet short-term peak demand, thereby improving the overallefficiency of the grid.

V2G systems can assist in balancing loads across the grid by redistributing energy from vehicles with excess power to those in need. This can help prevent localized grid congestion and optimize the use of available resources. K. Mets, et al., [8] described local and global smart-charging control strategies. They showed that smart chargingcan reduce peak load and level the load curve.

4. Revenue Generation for EV Owners
EV owners can generate revenue by offering their electric vehicles as a resource toprovide grid services. Grid operators pay for services such as frequency regulation, voltagesupport, and grid balancing.

By participating in V2G programs and allowing the grid to draw power from their EVs during peak demand periods, owners can avoid higher electricity prices associated withpeak times. This can result in cost savings for the EV owner.

The work in [9] compares the different charging strategies, i.e., unmanaged, smart charging, and bidirectional charging, in a solar-connected German household. The study shows that smart, bidirectional charging of EVs reduces households' electricity costs. In a different aspect, all over the globe, governments are framing policies involving incentives for EV owners taking part in V2G operations.

5. Grid Support During Renewable Energy Variability
V2G systems can help mitigate the variability of renewable energy sources, such as wind and solar. EVs can absorb excess energy when renewable generation is high and provide power to the grid during periods of low renewable generation. V2G control scheme providing a distributed spinning reserve for the unexpected intermittency of the renewable sources [10].

V. CHALLENGES TO VEHICLE TO GRID TECHNOLOGY

After discussing various benefits of V2G technology there are some limitations or challenges of this system on existing distribution network.

1. Burden on Utility Grid
Improper scheduling of V2G and G2V power insertion alters the electrical parameters such as voltage drops, current, line losses and system harmonics. The magnitude of the burden largely depends on the number of EVs, their tolerable power handling capability, charging and discharging cycle, time of usage, and the discharge pattern. A surge in voltagelevel could burden the grid's protectiveswitchgear equipment and connected loads. In addition, using EV battery energies during theoff-peak hour may badly hamper the power distribution operation since the current grid system seldom could fulfill the demand from 20–30% of EV loading [11].

2. Impacts on Grid Power Quality
The presence of non-linear components in the charging infrastructure and fast charging introduce harmonic content in the grid voltage. This also leads to voltage instability, power loss, transformer over-loading, and degradation of reliability indices. Furthermore, in places where EVs are charged from already existing connections, this causes voltage instability in the host establishments [12, 13, and 14].

3. Battery Degradation
In V2G technology battery has to undergo many charging-discharging cycles. This raises concerns about the long-term reliability and lifespan of electric vehicle batteries. The cost of battery degradation is difficult to estimate, because technologies are still developing. Moreover, recycling outdated batteries and managing old and low-capacity batteries is also an economic burden. During gear changing and controlling, the on-board batteryplays a crucial part [15]. Thus, the batteryneeds proper monitoring. The battery chargerneeds to have the most sophisticated control algorithms to maintain the most economical operation, which becomes difficult with random EV integration into the grid.

4. Power Electronics—Charging Infrastructure
Power Electronics has an important role to connect EVs into grid. The bidirectional chargers are required in V2G system. With a bidirectional charge connector, during the V2G power transfer, it is essential to use a power electronics inverter of 1-phase and 3- phase for 1-phase and 3-phase connectors,respectively. The power

electronics involved in bidirectional power transfer can generate heat. Effective cooling systems are needed to manage temperature and ensure the reliabilityand efficiency of the charging infrastructure.

5. Investment Costs and Energy Losses

The initial investment includes the cost of deploying bi-directional charging infrastructure capable of supporting V2G.This infrastructure includes chargers, communication systems, and any necessary grid upgrades. The type of chargers, theirpower capacity, and the level of smart gridintegration can influence costs.

The bidirectional flow of electricity betweenthe grid and electric vehicles involves energy conversions, which may result in efficiency losses. These losses occur during the conversion of AC to DC for charging and DCto AC for discharging. The efficiency of power electronics in the charging infrastructure influences these losses.

VI. CONCLUSION

This paper reviewed various aspects of V2Gtechnology, including its benefits and challenges. This study starts with someoverviews of the present distributed generation sources along with the grid integration of Electric Vehicle to supply power demand. V2G technology holds a lot ofpromise in terms of green energy, lowemissions, frequency and voltage regulation, energy efficiency, peak shaving and load balancing and revenue generation for EV owners. However, successful grid integration of EVs has a lots of limitations battery life, charging infrastructure, communication infrastructure, impact on grid power quality, high investment, etc. are the major factors affecting the execution of V2G. As the technology matures and more V2G projects will get executed, so that solutions will be developed to address these challenges, unlocking the full potential of V2G for a moreresilient and sustainable energy future.

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REVIEW ON DETECTION AND CLASSIFICATION OF POWER QUALITY VOLTAGE EVENTS

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ABSTRACT
The detection and classification of power quality voltage events are crucial in ensuring the reliability and stability of electrical power systems. This research paper investigates various methodologies and techniques employed in the accurate detection and classification of power quality voltage events. The paper provides an overview of different types of voltage events, including sags, swells, interruptions, harmonics, and flickers, which can significantly impact the performance of electrical equipment. Several signal processing algorithms, machine learning models, and intelligent systems are reviewed for their effectiveness in detecting and categorizing these voltage events. Additionally, the paper explores the importance of feature extraction and selection techniques in enhancing the performance of detection and classification algorithms. Furthermore, the challenges associated with real-time implementation, data acquisition, and noise reduction in practical systems is discussed. The paper highlights the need for robust, adaptive methodologies capable of handling diverse operating conditions and varying loadscenarios.

Keywords: Voltage Events, Power quality

I. INTRODUCTION
In modern society, the reliable and efficient supply of electricity is indispensable for various sectors, ranging from industrial operations to everyday household activities.[1] However, the quality of power supplied by electrical grids is susceptible to disturbances, often resulting in voltage events that can disrupt the smooth functioning of electrical equipment.[2] Power quality issues encompass a spectrum of anomalies, including voltage sags, swells, interruptions, harmonics, and flickers, among others, each capable of causing detrimental effects on connected devices and systems.[3].

The detection and classification of these voltage events are paramount in ensuring the stability and resilience of electrical power systems. Over the years, research and development efforts have been directed towards devising robust methodologies and advanced techniques aimed at accurately identifying and categorizing these power quality disturbances [4]. Understanding and effectively addressing these issues are critical not only for maintaining the operational integrity of electrical networks but also for preventing potential economic losses and ensuring user safety [5].

This research paper presents an in-depth exploration of the methodologies, technologies, and algorithms utilized in the detection and classification of power quality voltage events [6]. By comprehensively surveying the existing literature and methodologies, this paper aims to provide a consolidated overview of the current state-of-the-art techniques employed in this domain [7]. The significance of accurate detection and classification of power quality events lies in their potential impact on the performance and longevity of electrical equipment [8].

Voltage sags, characterized by short-duration reductions in voltage levels, can lead to malfunctions or shutdowns of sensitive equipment, while voltage swells, the opposite, can cause excessive stress and damage. Interruptions, albeit brief, can result in system instability and data loss. Moreover, harmonic distortions and flickers can affect the efficiency and lifespan of electrical machinery, thus necessitating their precise identification andclassification [9-11].

The methodologies explored in this paper encompass a wide array of signal processing algorithms, machine learning models, and intelligent systems tailored for detecting and categorizing various voltage events. Additionally, the importance of feature extraction and selection techniques in enhancing the performance and accuracyof these detection and classification algorithms is highlighted [12].

Despite advancements in research, challenges persist in real-time implementation, data acquisition, and noise reduction in practical systems. The dynamic nature of power systems, coupled with varying load conditions and environmental factors, poses significant challenges in developing adaptable and robust detection systems capable of accurately identifying and classifying voltage events across diverse operational scenarios [13-15].

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In summary, this paper aims to provide a comprehensive overview of the existing methodologies, challenges, and future directions in the field of detecting and classifying power quality voltage events. By addressing these issues, the research endeavors to contribute to the enhancement of power system reliability, operational efficiency,andoverallperformance.

II. OBSERVATION

Observation	Description
Various VoltageEvents	The paper extensively covers different types of voltage events such as sags, swells, interruptions, harmonics, and flickers, detailing their characteristics and impact on electrical systems.
MethodologiesExplored	Signal processing algorithms, machine learning models, and intelligent systems are reviewed for their efficacy in detecting and categorizing power quality disturbances.
Importance of Feature Extraction	Emphasizes the significance of feature extraction and selection techniques in refining detection and classification algorithms, enhancing accuracy and performance.
Challenges in Practical Implementation	Identifies challenges in real-time implementation, data acquisition, and noise reduction, highlighting the need for adaptable systems capable of handling diverse operating conditions.
Impact on Electrical Equipment	Stresses the criticality of accurate detection as voltage events can lead to malfunctions, shutdowns, stress, and reduced lifespan of electrical machinery and connected devices.
Contribution to Power System Reliability	Aims to contribute to the improvement of power system reliability, operational efficiency, andoverall performance by addressing challenges and enhancing detection methodologies.

2. CLASSIFICATION ACCURACY OF MACHINE LEARNING MODELS

In the classification phase, machine learning modelswere trained and tested using extracted features from voltage signals to categorize different power quality disturbances. Results revealed that support vector machines (SVM) demonstrated superior performance in accurately classifying interruptions and harmonics compared to neural networks and decision trees. The discussion emphasizes the robustness of SVM in handling non-linear data distributions inherent inpower quality disturbances.

3. IMPACT OF FEATURE SELECTION TECHNIQUES

Further analysis focused on the significance of feature extraction and selection techniques in refining the accuracy of classification algorithms. Feature selection methods like principal component analysis (PCA) and mutual information-based feature selection demonstrated notable improvements in classification accuracy by reducing feature redundancy and enhancing the discriminative power of selected features.

4. CHALLENGES IN REAL-WORLD IMPLEMENTATION

Real-world implementation challenges, such as noise interference and data acquisition from diverse sources, were examined. Discussions highlighted the limitations faced in practical scenarios, where varying environmental conditions and transient disturbances can complicate accurate detection and classification. Strategies for noise reduction and adaptive algorithms were proposed to address these challenges.

III. RESULT AND DISCUSSION

5. Impact on Electrical Equipment and System Reliability

Findings emphasized the critical impact of power quality disturbances on electrical equipment. Voltage sags were identified as one of the most detrimental events, often causing equipment malfunction or shutdown. Discussions centered on the necessity of proactive measures to mitigate these disturbances, emphasizing their influence on system reliability and equipment lifespan.

1. Performance Comparison of Detection Algorithms

The study involved the application of various signal processing algorithms, including wavelet transforms and Fourier analysis, for the detection of power quality voltage events. Through simulation and comparative analysis, it was observed that the wavelet transform method exhibited higher accuracy in detecting transient disturbances such as voltage sags and swells compared to Fourier analysis. The discussion highlights the ability of wavelet-based techniques to localize and identify the timing and magnitude of voltage variations more effectively

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6. Future Directions and Recommendations

The discussion concluded by outlining potential future directions, suggesting the integration of advanced machine learning techniques, sensor technologies, and hybrid systems for more accurate and adaptabledetection frameworks. Recommendations for real-time monitoring systems capable of handling diverse operating conditions were proposed to enhance power system reliability.

IV. CONCLUSION

In the realm of modern electrical power systems, ensuring the reliability and stability of power quality is paramount. This research paper has delved into the intricate domain of detecting and classifying power quality voltage events, which significantly influencethe performance and longevity of electrical equipment.

Through an extensive review of methodologies and techniques, it has become evident that a diverse array of signal processing algorithms and machine learning models play a pivotal role in identifying and categorizing voltage events. The exploration of methodologies such as wavelet transforms, Fourier analysis, and machine learning techniques hasshowcased their potential in accurate event detection and classification.

A critical highlight of this research has been the emphasis placed on feature extraction and selectiontechniques. The extraction of relevant features fromvoltage signals has emerged as a fundamental aspect, enabling precise identification and classification of different power quality disturbances. However, practical implementation poses substantial challenges. Real-time implementation, noise reduction, and adaptability to varying operating conditions remain key hurdles. Addressing these challenges is essential for the successful deployment of robust detection systems in real-world electrical networks. The profound impact of voltage events on electrical equipment cannot be overstated. From causing malfunctions and shutdowns to reducing efficiency and lifespan, these disturbances demand proactive detection and mitigation strategies.

This research aims to contribute to the improvement of power system reliability and performance. By shedding light on existing methodologies, challenges, and future directions, it lays the groundwork for further advancements in the field. The future may witness the integration of advanced machine learning techniques, smart sensor technologies, and hybrid systems, fostering more accurate and adaptable detection frameworks.In essence, the accurate detection and classification of power quality voltage events are pivotal for maintaining the stability, resilience, and efficiency of electrical power systems. This research endeavors to propel advancements in this domain, ultimately contributing to the enhancement of power system reliability and performance in the face of evolving challenges.

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REVIEW ON FAULT DETECTION IN POWER DISTRIBUTION SYSTEM USING FEATURE EXTRACTION TECHNIQUES

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ABSTRACT
Fault detection in power distribution systems is paramount for ensuring uninterrupted and reliable electricity supply. This research paper explores the application of feature extraction techniques for the effective detectionof faults within these systems. By employing various signal processing and data analysismethods, such as wavelet transforms, Fourier analysis, and machine learning algorithms, this study aims to extract meaningful features from power distribution system data. These features serve as indicators of potential faults, enabling swift and accurate identification and localization of anomalies. The paper discusses the implementation and evaluation of different feature extraction methodologies, highlighting their efficacy in detecting and classifying faultsin power distribution networks. The outcomes and insights derived from this research contribute to the enhancement of fault detection mechanisms, ultimately improving the reliability and efficiency of power distribution systems.

Keywords: Fault detection, Distribution system

I. INTRODUCTION
The reliable and uninterrupted supply of electricityis crucial for sustaining modern societies. Power distribution systems form the backbone of this infrastructure, responsible for delivering electricity from generating stations to end-users. [1,2] However, these systems are prone to various faults and disturbances, which can lead to power outages,equipment damage, and financial losses. Detecting and resolving faults promptly is paramount to ensure the reliability and stability of power distribution networks [3-5].

This research paper delves into the realm of fault detection within power distribution systems, focusing on the utilization of feature extraction techniques as a means to enhance fault detection capabilities. Traditional methods of fault detection often rely on complex algorithms and extensive data analysis, which can be time-consuming and may lack precision. Therefore, the exploration of feature extraction techniques presents a promising avenue to streamlineand improve fault detection processes [6-9]

The primary objective of this study is to investigate and implement various feature extraction methodologies tailored specifically for analyzing power distribution system data[10]. By leveraging signal processing techniques like wavelet transforms, Fourier analysis, and machine learning algorithms, the research aims to extract relevant features from the complex data obtained from these systems. These extracted features serve as critical indicators or signatures of potential faults within the network [11,12].

The significance of feature extraction lies in its ability to distill large volumes of raw data into concise and meaningful characteristics that highlight deviations or irregularities indicative of faults [13]. These features provide valuable insights into the operational status of the power distribution system, enabling swift and accurate identification and localization of faults. Consequently, this proactive approach can facilitate quicker responses and remedial actions, minimizing downtime and mitigating potential damages caused by faults [14,15].

Through this paper, we explore and evaluate the effectiveness of different feature extraction techniques in detecting and classifying faults within power distribution networks. The findings derived from this research not only contribute to advancing fault detection methodologies but also hold substantial implications for improving the reliability, efficiency, and resilience of power distribution systems. Ultimately, the goal is to propose enhanced fault detection mechanisms that can be integrated into existing systems to ensure more robust and reliable electricity supply for communities and industries [16,17].

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II. OBSERVATION

Feature Extraction Technique	Key Observations
Wavelet Transform Analysis	- Effective in capturing transient faults for early detection. Demonstrates adaptability across diverse fault scenarios.
Fourier Analysis	- Identifies periodic fault patterns aiding in classification. Limited in detecting non-periodic faults; requires combined methods for comprehensive detection.
Machine Learning Algorithms	- Achieves high accuracy in fault identification and classification. Computational complexity needs addressing for real-time implementation.
Overall Implications	- Integration of multiple techniques enhances fault detection resilience. Potential implications for proactive maintenance and system resilience against diverse faults.
Limitations and Future Directions	- Hybrid approaches needed to address individual technique limitations. Opportunities for advancements in feature extraction and machine learning for adaptive fault detection systems.

This observation table succinctly outlines the keyfindings and discussions related to each feature

- Implemented machine learning algorithms toclassify fault patterns based on extracted features.
- Achieved high accuracy rates in faultidentification and classification

Effectiveness of Feature Extraction Techniques:

1. **Wavelet Transform Insights:**

- Wavelet analysis proved instrumental in capturing transient faults, crucial for preemptive fault detection.
- Discussion on the adaptability of wavelet features in diverse fault scenarios and their potential in real-time fault detection systems.

2. **Fourier Analysis Contribution:**

- Fourier analysis provided insights into periodic fault patterns, aiding in fault classification and trend identification.
- Consideration of limitations in detecting non- periodic faults and the importance of combined methodologies for comprehensive fault detection.

3. **Machine Learning Applications:**

- Discussion on the robustness of machine learningalgorithms in fault classification, emphasizing their role in automating fault detection processes.
- Consideration of computational complexities andmodel optimization for real-time implementation in power distribution systems.

Overall Implications:

- Integration of these feature extraction techniques offers amulti-faceted approach to fault detection, enhancing the system's resilience against diverse fault types. Extraction technique employed for fault detection

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Discussion on the potential implications for predictive in power distribution systems.

III. RESULT AND DISCUSSION

1. Wavelet Transform Analysis: Results and Discussions:

- Utilized wavelet transforms to extract frequency-domain features from power distribution system data.
- Identified transient fault signatures within the data, enabling early fault detection.

2. Fourier Analysis:

- Employed Fourier analysis to capture periodic patterns in the system data.
- Detected recurring fault-related anomalies, aiding in classification and localization.

3. Machine Learning Algorithms:

- Maintenance strategies, enabling proactive interventions to prevent system failures.

IV. CONCLUSION

In this study, we delved into the application of feature extraction techniques for fault detection in power distribution systems. The employment of wavelet transforms, Fourier analysis, and machine learningalgorithms unveiled valuable insights into fault identification and classification. This synthesis encapsulates the key findings, implications, and future directions gleaned from the research, underscoring the significance of feature extraction techniques in bolstering fault detection within power distribution systems and paving the way for further advancements in the field.

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THE STUDY FOCUSES ON THE SIMULATION AND ANALYSIS OF FAULTS IN HIGH VOLTAGE (HVDC) POWER TRANSMISSION.

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ABSTRACT
In this paper, first we have discussed the basic structure and principle of High Voltage Direct Current Power Transmission System and types of faults occur on it. We used MATLAB Simulink to simulate the transient processes of this system when the short circuit line to ground (LG) fault occurs on HVDC Transmission line. We observed effect of using Solid and Resistive Grounding on fault current. It will be proven by simulation result that the model and the simulating method is valid, visual and time saving.

Index Terms: HVDC Transmission System, MATLAB Simulation

1. INTRODUCTION

1.1 Introduction to HVDC Transmission System

High Voltage Direct Current is known as HVDC. Long-distance electrical transmission via submerged cables or overhead transmission lines is accomplished with the help of the well-proven HVDC transmission line technology. In situations where conventional or traditional alternating current (AC) connections are not feasible, it is also utilized to link disparate power systems.

Power flow may be quickly and precisely managed in terms of both direction and power level with an HVDC system. This option is frequently used to raise the connected AC networks' effectiveness and performance. Direct current was the first electricity to be used for applications. Edison built the first Central Electric Station in New York in 1882, delivering power at 110 volts direct current. The notion of induction motor and transformer invention

In order to supplement or expand the HVDC transmission system, DC transmission has made a comeback in the shape of HVDC transmission today. Because line reactance causes instability as distance increases, HVDC transmission methods are more economically desirable than HVAC transmission systems. Because there is no frequency in HVDC systems, line reactance issues are not present.

Between the Swedish mainland and the island of Gotland, the first commercially utilized HVDC transmission connection in history was constructed in 1954 with a power rating of 20 MW and a transmission voltage of 100 kV. This was a monopolar, sea return, 100KV, 20MW cable system. Since then, advances in HVDC power transmission technology have been made on a constant basis. DC transmission is a useful or efficient method.

INTRODUCTION TO MATLAB SIMULATION:

- MATLAB is the easiest and most productive software environment for engineers and scientists.
- MATLAB Simulation plays an important role in power system studies, planning, design, and operations.
- Typical uses include: Data analysis, exploration, and visualization.

2. PRINCIPLE OF OPERATION

2.1 Principle of Operation of Hvdc System:

A dc transmission line connects the two converter stations that make up an HVDC system, one at each end. One converter, referred to as an inverter, is used in rectifier mode to convert AC into DC. The system's ac supply is available at both ends. Transformers and thyristor valves are the two primary pieces of equipment in a converter station. To guarantee smooth direct current (dc) into ac at the receiving end, chokes and

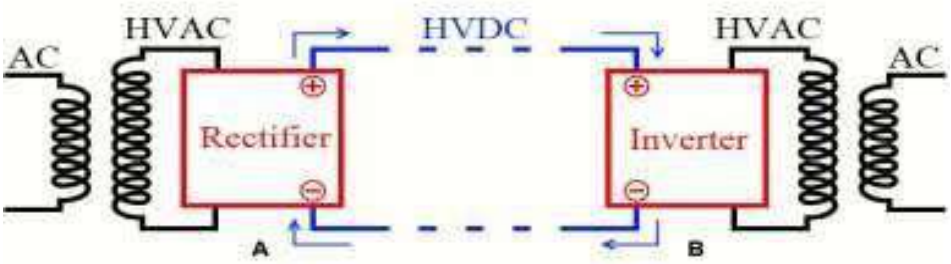

Fig.2.1 Basic Structure of HVDC Transmission System

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Figure 2.1 shows a single line diagram showing the two converter stations, A and B, in an HVDC transmission system. The converter station at sending end A supplies converter station B. The thyristors' values scale up the voltage to an appropriate level. Thus, high voltage direct current is present at the commencement of the transmission line. This rectified current travels over the transmission line to the receiving current-end conversion station B, where a thyristor valve transforms it into three phases of alternating current. A step-down transformer then steps down the current to a low voltage for additional distribution.

While the converter at the receiving end functions as an inverter, the converter at the sending end serves as a rectifier. The converter's thyristor valves' firing angle can be adjusted to control the magnitude of the DC output voltage.

The firing angle in a rectifier is $0°<\alpha<90°$, while in an inverter, it is $90°<\alpha<180°$. ASS The converter's dc output voltage is determined by the cosine of the firing angle. Therefore, when the firing angle is less than 90°, the converter voltage turns negative. As a result, the converter starts to function as an inverter [5].

In actuality, a three-phase bridge converter is used at both ends of an HVDC converter station (sending as well as receiving end). By controlling the firing angle, converters and HVDC links with bidirectional power flow can be operated in both directions. Operates in both rectifier and inversion mode by varying α.

2.2 Components of HVDC Transmission System:

A. Converter

The HVDC system we have simulated is based on Six pulse Converter:

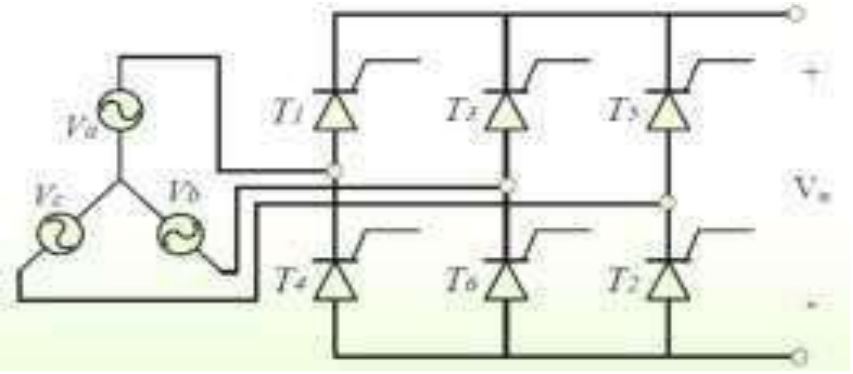

Fig. 2.2 Internal structure of six pulse HVDC converter

The circuit's working principle is that, as long as the gate signal is applied to the SCRs at that precise moment, the pair of SCRs connected between the lines with the highest line-to-line voltage will conduct. T4 and T5 are initially conducting, and Vcb is the highest line-to-line voltage between $0\leq t \leq \pi/3$. When T6 is fired at a delay angle of α, Vcb is achieved at load. The converters go by the names current source converters or line commutated converters.

One thyristor from the +ve limb and one from the -ve limb are activated every 60º.

B. Smoothing reactors

- With an inductance of up to 1 H in series with each pole, these are high reactors. They reduce DC line harmonics in voltages and currents.
- They stop inverter commutation failures.
- They stop light loads' current from being discontinuous.

C. Harmonic filters

- Harmonics in current and voltage are produced by converters. These harmonics have the potential to interfere with telecommunications systems, overheat capacitors, and cause nearby generators to trip. These harmonics are reduced by the application of harmonic filters. *Reactive power supplies* in a steady state, the reactive power used by the converter accounts for roughly half of the active power transferred; in a transient state, this figure may be substantially higher. a result, reactive power is supplied close to the converter. A shunt capacitor provides this reactive power for a robust AC power system.

D. Electrodes

- Electrodes are conductors that provide connection to the earth for neutral. They have large surface to minimize current densities andsurface voltage gradients.

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E. DC lines

- They may be overhead lines or cables.
- DC lines are very similar to AC lines.

F. AC Circuit Breakers

- They used to clear faults in the transformer and for taking the DC link out of service.
- They are not used for clearing DC faults.
- DC faults are cleared by converter control more rapidly.

2.3HVDC Line Faults

Lightning strikes, and external mechanical stress are the main causes of faults on DC transmission lines. Line to Ground and Line to Line faults are frequent fault types in HVDC transmission systems. These are permanent defects that require a time-consuming repair. The converter needs to be turned off right away if cable faults in the DC transmission line are discovered. These errors are probably temporary, for which fault restoration was necessary following fault clearance. HVDC transmission systems can experience a variety of faults; however, in this paper, we will solely address the Line to Ground (LG) fault, which primarily affects six pulse HVDC systems [2].

Failure of the insulation between the DC conductor and ground is the cause of the DC Line to Ground fault. The DC Line to Ground fault in the overhead HVDC transmission system is a transient issue brought on by pollution and lightning strikes. The most common fault in subterranean HVDC transmission systems is the DC line to ground fault. Figure 6 illustrates the analogous DC Line to ground fault circuit. In addition to the neutral-ground link of the transformer and the mid-point of the DC-link capacitor, this fault will generate a ground point [4].

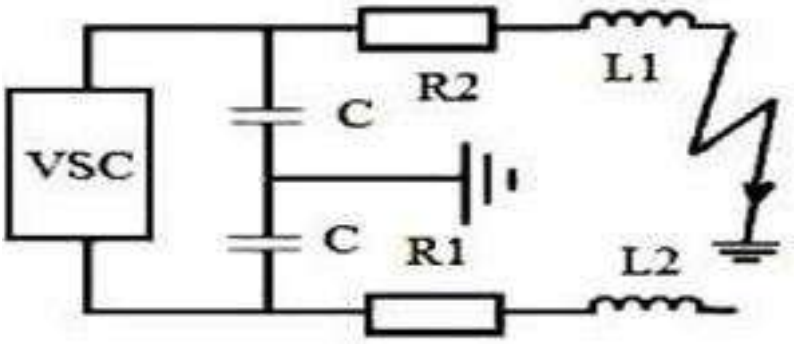

Fig.2.3: An equivalent circuit of DC Line to Ground FaultThis fault can be divided to three stages are as follows:

a) DC Side Capacitor Discharge Stage

When a DC Line to Ground faults occurs, a discharge circuit is formed among the fault pole capacitor and fault impedance through the fault line. After the fault occurs, the system experiences the DC side capacitor discharge stage [3].

b) Grid-Side Current Feeding Stage

When DC Line to Ground faults occurs; the DC side capacitor discharging due to this the DC voltage drops constantly. When the DCvoltage drops to below any grid phase voltage, then the system will experience the grid side current feeding stage [3].

c) Voltage Recovery Stage

The fault pole capacitor voltage drops and non-fault pole capacitor voltage rising with the capacitor discharging. The DC voltage graduallyrestores, so the system enters the voltage recovery stage [3].

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3. METHODOLOGY

1 Simulation Diagram

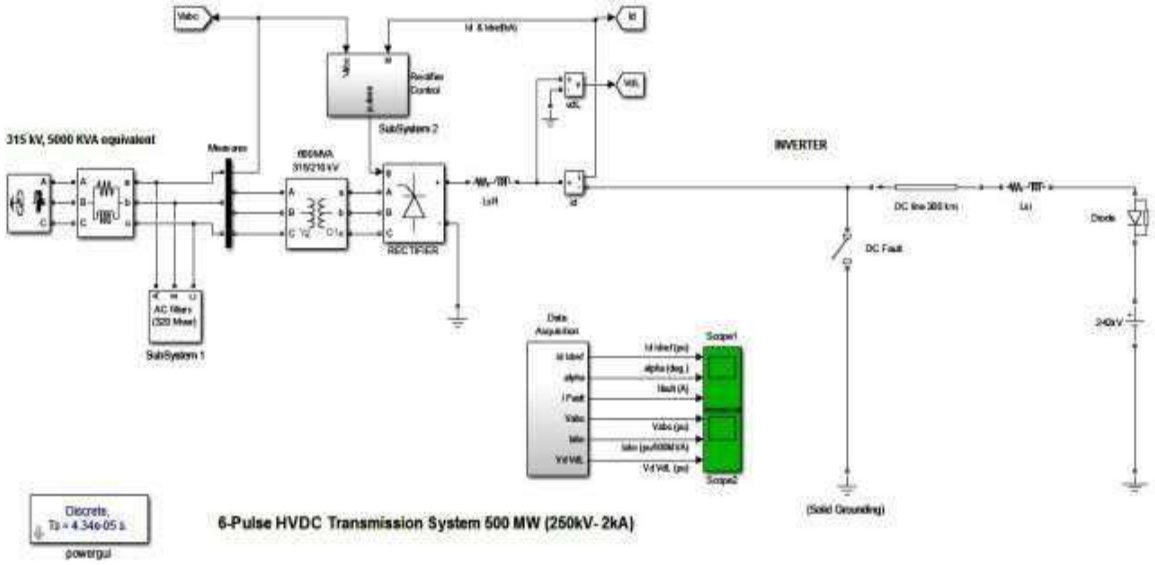

Fig. 3.1 Simulation diagram

3.2DESCRIPTION OF EACH BLOCK IN SIMULATION DIAGRAM:

1. The Three-Phase Source block

A balanced three-phase voltage source with an internal R-L impedance is implemented by the Three-Phase Source block. A neutral connection, which can be made accessible or internally grounded, joins the three voltage sources in Y. By inputting R and L values, you can directly specify the source's internal resistance and inductance, or you can specify the source's inductive short-circuit level and X/R ratio to indirectly specify the same. *Three-Phase Parallel RLC*

The Three-Phase Parallel RLC Branch block implements three balanced branches consisting each of a resistor, an inductor, a capacitor, ora parallel combination of these.

2. Subsystem-1 AC Filters

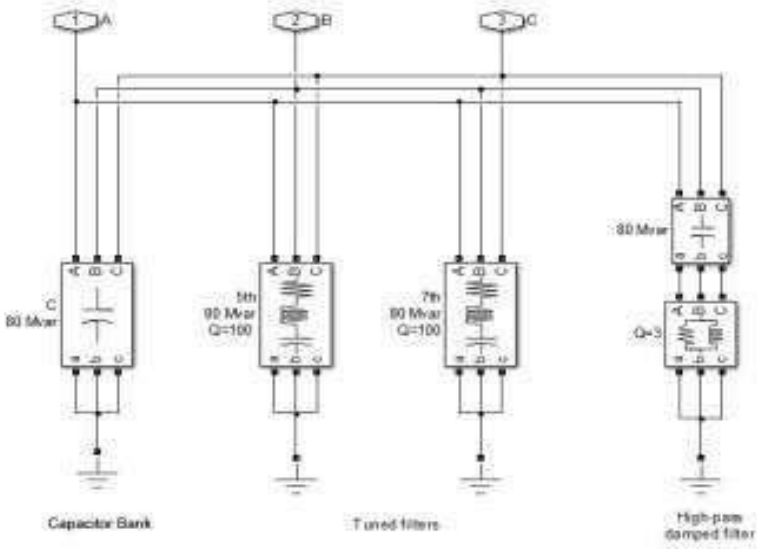

Fig. 3.2.1 AC Filters internal Structure

The AC filter consists of Capacitor Bank, Tuned filter and High Pass Filter each performing their own function as explained bellow*:*

Capacitor Bank

A Capacitor Bank is a group of several capacitors of the same rating that are connected in series or parallel with each other to store electrical energy. The resulting bank is then used to counteract or correct a power factor lag or phase shift in an alternating current (AC) powersupply

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Tuned Filter
The ac/dc filters are always needed in HVDC converter stations to suppress harmonic currents/voltages. HVDC converter stations usually require ac/dc filters, the main purpose of which is to mitigate current/voltage distortion in the connected networks. In addition, the ac side filters significantly compensate the network demanded reactive power.

High Pass filter
A high - pass filter (HPF) is an electronic filter that passes signals with a frequency higher than a certain cutoff frequency and attenuates signals with frequencies lower than the cutoff frequency. The amount of attenuation for each frequency depends on the filter design. Resulting bank is then used to counteract or correct a power factor lag or phase shift in an alternating current (AC) power supply

3. Measurement mask link
The block can output the voltages and currents in per unit values or in volts and amperes.

4. Three Phase Transformer Two windings
This block implements a three-phase transformer by using three single-phase transformers.

The two windings of the transformer can be connected in any way as follows:

Y, Y with accessible neutral, Grounded Y, Delta (D1), delta lagging Y by 30 degree, Delta (D11) or delta leading Y by 30 degrees.

5. Rectifier block (Universal Bridge)
The Universal Bridge block implements a universal three-phase power converter that consists of up to six power switches connected in a bridge configuration. (Working Principle of 6 pulse thyristor is explained in HVDC components details)

6. Series RLC Branch block (Smoothening Reactor)
The Series RLC Branch block implements a single resistor, inductor, or capacitor, or a series combination of these.

7. Current Measurement block
The Current Measurement block is used to measure the instantaneous current flowing in any electrical block or connection line. TheSimulink output provides a Simulink signal that can be used by other Simulink blocks.

8. Voltage Measurement block
The Voltage Measurement block measures the instantaneous voltage between two electric nodes. The output provides a Simulink signalthat can be used by other Simulink blocks.

9. SubSystem-2 Model of Control Strategy

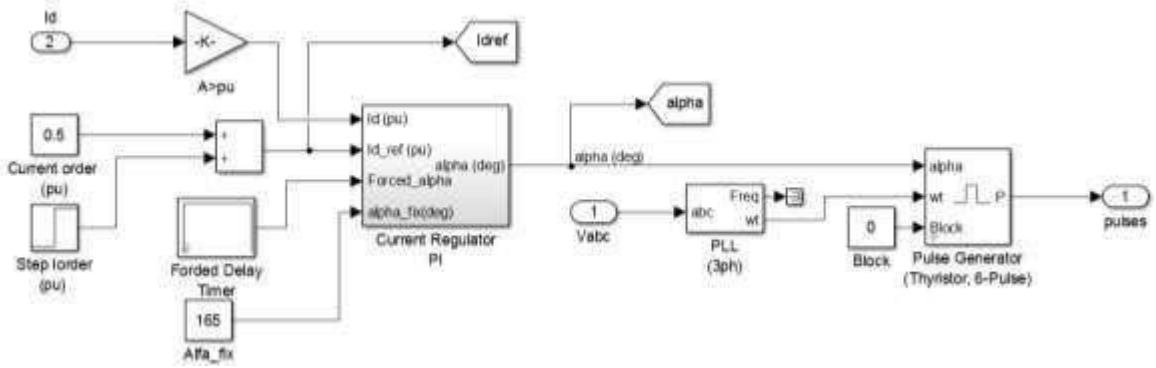

Fig.3.2.2 Model of Converter Station Control Strategy

To control α, we use the pulse generator's constant DC Current control mode to trigger pulses. We simulate the transient process when the rectifier side's DC circuit is grounded using the Model of Control Strategy [1].

10.DC LINE 300 KM
An N-phase distributed parameter line model with lumped losses is implemented by the Distributed Parameter Line block. The Electromagnetic Transient Program (EMTP) uses a traveling wave method called Bergeron, on which the model is based [1]. The lossless distributed LC line in this model is defined by two values (for a single-phase line): the wave propagation speed v=1/Glc and the surge impedance Zc=Gl/c, where l and c represent the per-unit length capacitance and inductance, respectively..

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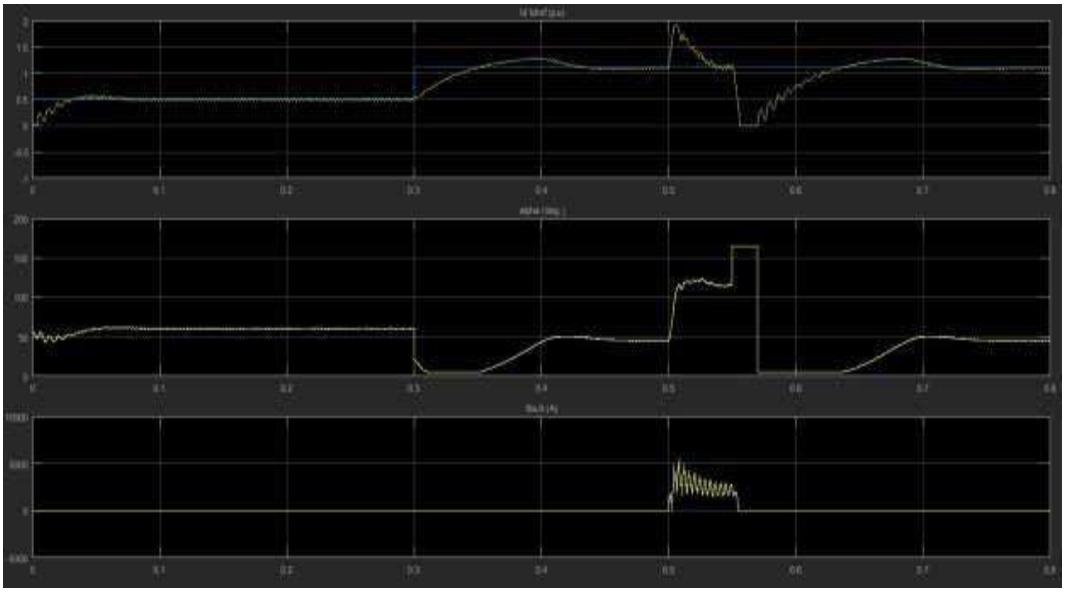
11. Data Acquisition Block
This block is used to link various input signals to the Scope to see graphical outputs.

3.3 Simulation
The system is discretized (sample time 1/360/64 = 43.4 us). Setting, the sample time in to zero, will change to continuous integration for the power system. The system is programmed to start and reach a steady state. Then, a step is applied on the reference current to observe the dynamic response of the regulator. Finally a DC fault is applied on the line.

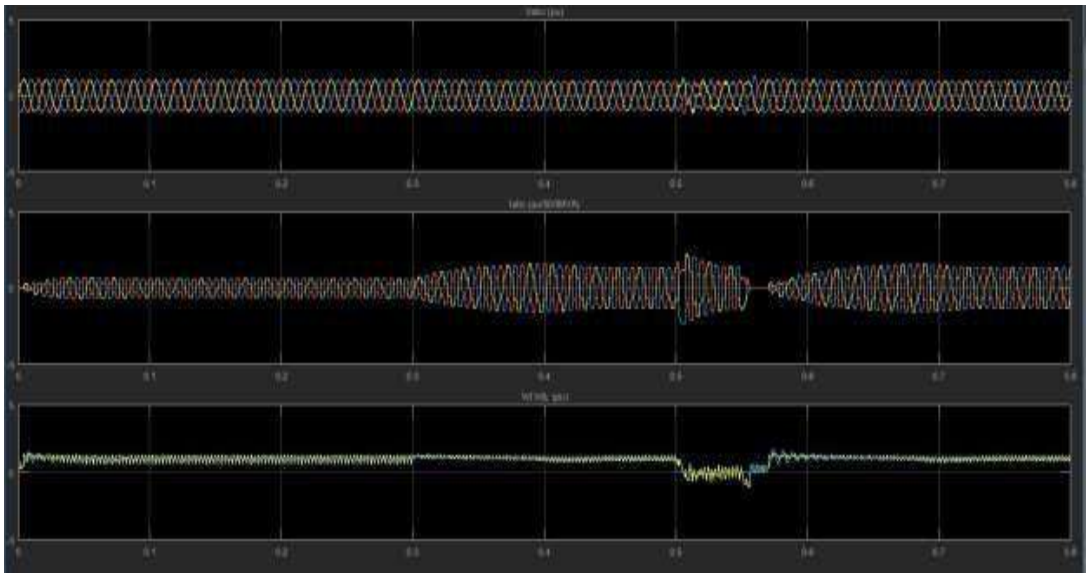
4 SIMULATION RESULTS

- Results are taken for two different grounding conditions that is solid and resistive grounding. And effects of each condition arediscussed in Analysis section.
- At Scope1: Trace1 Shows the reference current (magenta) and the measured Id current (yellow), Trace2 Shows the firing angle alpha (in degree) at converter station, Trace3 Shows the Fault current Ifault (in Amperes)
- At Scope2: Trace1 Shows the AC side Voltage Vabc (pu), Trace2 Shows AC Source side current Iabc (pu), Trace3 shows DC linecurrent Vd (pu).

4.1 SIMULATION RESULTS AT SCOPE1 FOR LINE TO GROUND (LG) FAULT WITH SOLID GROUNDING.



4.2 SIMULATION RESULTS AT SCOPE2 FOR LINE TO GROUND (LG) FAULT WITH SOLID GROUNDING.



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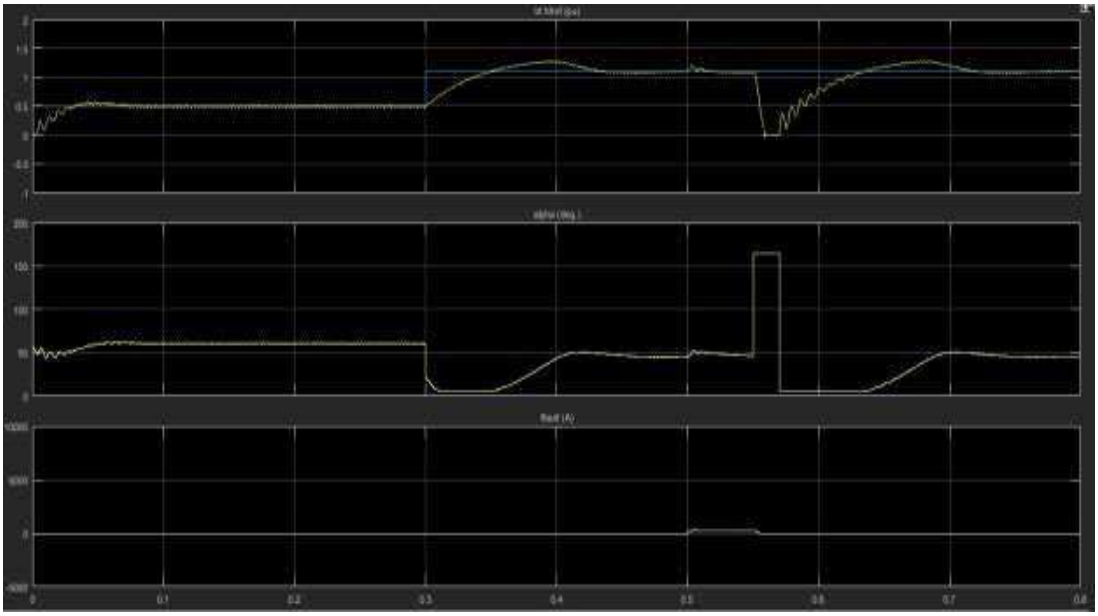
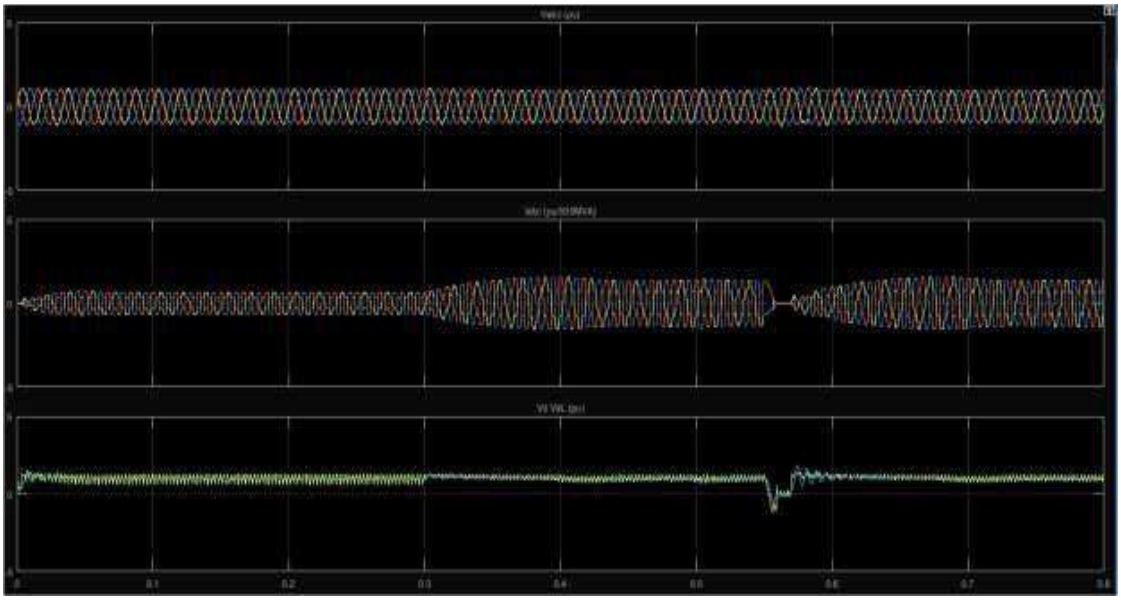
4.3 SIMULATION RESULTS AT SCOPE1 FOR LINE TO GROUND (LG) FAULT WITH RESISTIVE GROUNDING.



4.4 SIMULATION RESULTS AT SCOPE2 FOR LINE TO GROUND (LG) FAULT WITH RESISTIVE GROUNDING.



5 ANALYSIS

Sr. No.	Time Point	Observation (For Solid Grounding Condition)
1	0 < t < 0.3 s	Trace 1 shows the reference current (magenta) and the measured Id current (yellow). The reference current is set to 0.5 pu (1 kA). The DC current starts from zero and reaches a steady-state in 0.1 s. Trace 2 shows the alpha firing angle required to obtain 0.5 pu of current (30 degrees).
2	0.3 < t < 0.5 s	At t = 0.3 s, the reference current is increased from 0.5 pu (1 kA) to the nominal current 1pu (2 kA). The current regulator responds in approximately 0.1 s (6 cycles).The alpha angle decreases from 30 degrees to 15 degrees.
3	0.5 < t < 0.55 s	At t = 0.5 s, a DC fault is applied on the line. The fault current (trace 3) increases to 5 kA and the Id current increases to 2 pu (4 kA) in 10 ms. Then, the fast regulator action lowers the current back to its reference value of 1 pu.

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4	**0.55 < t <0.57 s**	At t = 0.55 s, the alpha angle is forced by the protection system (not simulated) to reach 165 degrees when the Forced alpha input of the current regulator goes high(1). The rectifier thus passes in inverter mode and sends the energy stored in the line back to the 345 kV network. As a result, the arc current producing the fault rapidly decreases. The fault is cleared at t = 0.555 s when the fault current zero crossing is reached.
5	**0.57 < t < 0.8 s**	At t = 0.57 s, the regulator is released and it starts to regulate the DC current again. The steady-state 1 pu current is reached at t = 0.75 s.

Sr. No.	Time Point	Observation (For Resistive Grounding Condition)
1	**0 < t < 0.3 s**	Trace 1 shows the reference current (magenta) and the measured Id current (yellow). The reference current is set to 0.5 pu (1 kA). The DC current starts from zero and reaches asteady-state in 0.1 s. Trace 2 shows the alpha firing angle required to obtain 0.5 pu of current (30 degrees).
2	**0.3 < t < 0.5 s**	At t = 0.3 s, the reference current is increased from 0.5 pu (1 kA) to the nominal current 1pu (2 kA). The current regulator responds in approximately 0.1 s (6 cycles). The alpha angle decreases from 30 degrees to 15 degrees.
3	**0.5 < t < 0.55 s**	At t = 0.5 s, a DC fault is applied on the line. The fault current (trace 3) increases to 5 kA and the Id current increases to 2 pu (4 kA) in 10 ms. Then, the fast regulator actionlowers the current back to its reference value of 1 pu.
4	**0.55 < t <0.57 s**	Here we used Resistive Type of Grounding (Grounding Resistance = 1KΩ) to limit the fault current So we can see that fault current does not rising. At t = 0.55 s, protection system 165 degrees when the Forced alpha input of the current regulator goes high (1). The rectifier thus passes in inverter mode and sends the energy stored in the line back to the 345 kV network. As a result, the arc current producing the fault rapidly decreases. Thefault is cleared at t = 0.555 s when the fault current zero crossing is reached.
5	**0.57 < t < 0.8 s**	At t = 0.57 s, the regulator is released and it starts to regulate the DC current again. The steady-state 1 pu current is reached at t = 0.75 s.

6 ADVANTAGES

MATLAB Simulation has following advantages against classical physical model:

1. Simulink results are Valid, Visual and Time saving.
2. Greater flexibility, parameters can be changed anytime to desired value.
3. MATLAB performs all mathematical operations at higher speed, so it makes a design to be produced at very short time.
4. High accurate and reliable results are obtained because it also helps to reduce the probability of error.
5. Easy documentation.

7 LIMITATIONS

1. Operations are performed by considering ideal values of parameters, but in case of practical situation or physical modeling, results mayvary.
2. Cost of MATLAB Software is high.

8 CONCLUSION

The HVDC transmission grid is now a crucial component of the power transmission network. Therefore, the HVDC system's temporary steady-state simulation is crucial for power system planning, studies, and operation. This paper uses Simulink in MATLAB to conduct software-based studies of transient disturbances. The steady state and LG fault conditions for both solid and resistive grounding conditions have also had their current-voltage (C-V) characteristics simulated. Resistive grounding has been shown to be a useful tool for limiting

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fault current. The analytical outcomes of this suggested model can be a helpful tool for designing and optimizing systems.

9 FUTURE SCOPE

Future research will test the system using DC faults at the multi terminal network and examine a range of potential fault criteria. This would pave the path for figuring out the numerical specifications for the HVDC system's protection logic.

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EMERGING TRENDS AND ADVANCEMENT INELECTRIC VEHICLE

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ABSTRACT
Nowadays the use of electrical vehicles (EV) has increased. Because of that the fuel energy consumption has been decreased. EV are the best alternative with respect to bad environmental effects and change in climate. In this paper different areas are covered related to EVsuch as types of EV which are mainly classified into three categories plug-in-hybrid electricvehicles (PHEVs), hybrid electric vehicles (HEVs), Battery electrical vehicles (BEVs). Analyze different functionalities in EV and discuss about the latest developments and upcoming challenges in EV technology. We conclude with the recent progress in areas of battery efficiency, battery storage size, affordability, sustainability can be resolved.

Keywords: Latest developments in EVs, Hybrid EVs, Plug-in-hybrid EVs, Battery EVs, EVS innovations.

I. INTRODUCTION
The automobile industries are playing an important role in enhancing the human lifestyle. In the case of using conventional vehicles it affects on the environment due to decreasing amount of fossil fuels and reducing the greenhouse gases (GHG) [1]. Because of that the researcher are paying attention on utilization of renewable energy in more number. Renewable energy system is the best alternative to the conventional form of energy. Many automotive industries are doing new innovations in the sector of EV technology. The development has been done in many cities all over the world [2]. Recently in EV technology, mainly working on battery charging-discharging time, lifespan of the battery, reducing battery size, increasing vehicle speed. The concept of rechargeable batteries in EV give the huge progress in few years [3]. Number of batteries has been studied such as lead acid, nimh, lithium ion batteries and tested for EV.[4]. After testing lithium ion was the most suitable battery for EV. This battery has high efficiency, high energy density and the life of the battery is more then any other battery [5]. One more advancement is that is charging of the battery with the help of renewable energy system, because of this charging cost of the battery has reduced [6]. In the recent years research has been made to fulfil the various challenges whichare coming in in EV technology. The working of EV on charging of battery using renewable generation and charging through the gird is the nextstep to advancement.

Categories in Electrical Vehicles

Table 1: Categories in EV

Vehicles Category	Utilize Conventional Engine	Manner in which toCharge Battery
HEV	YES	On internal board
PHEV	YES	On internal board or External loading
BEV	No	External loading

Recently in manufacturing of EV, three principle electric categories come from the start that is preparation phase to end which is production phase.

1. Hybrid Electric Vehicles (HEVs) :
Hybrid electric vehicles (HEVs) that combines a conventional internal combustion engine (ICE)system with an electric propulsion system. As there is the electric propulsion system combine, the fuel economy is much better than the conventional. The configuration of the HEV is given in fig. 1 [8].

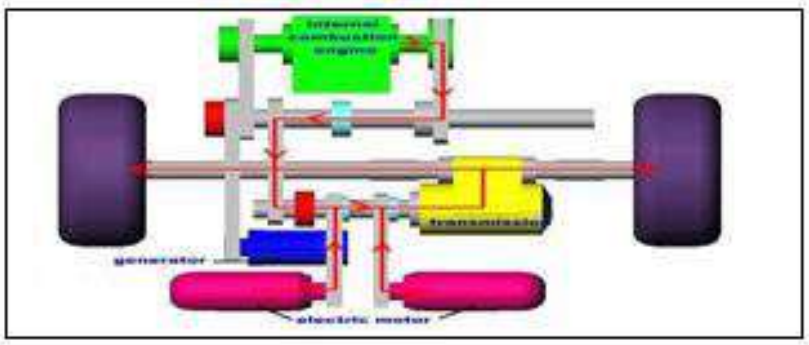

Figure.1: diagram mechanism of a hev

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2. Battery electric vehicle (BEVs):

Battery electric vehicle (BEVs) are pure electric vehicles, that exclusively use chemical energy stored in rechargeable battery packs. In this vehicle main parts are electric motor, battery pack and power controller which is shown in fig. 2 [9].

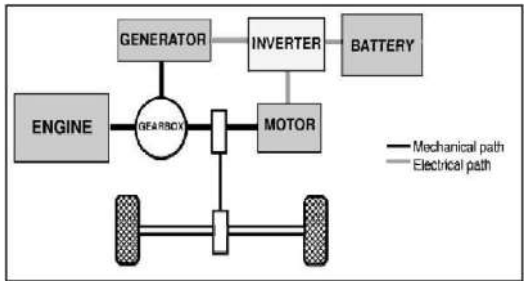

Figure 2: Diagram mechanism of BEV

A. Plug-in-Hybrid Electric Vehicle

A plug-in-hybrid electric Vehicle(PHEVs) is thehybrid type electric vehicle in which battery can be recharged by plugging it into an external source of electric power, as well as by its on- board engine and generator. In that it is consistof double motorization, ICE and battery pack shown in fig. 3[10].

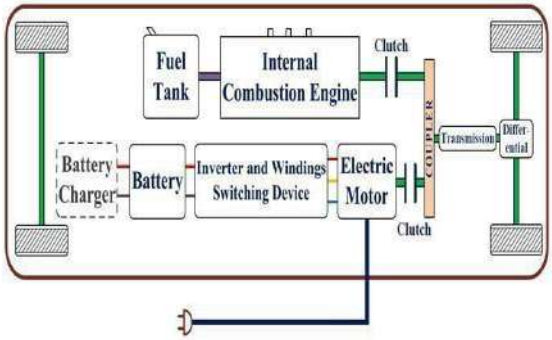

Fig.3: Diagram mechanism of BEV

Anaiysis of Different Functionality in EVS

As shown below table 2 is the analysis and comparison of technical specifications of different EVS. And table 3 shows the fuel economization [11-12]**.**

Table 2: Analysis and Comparison of Technical Basic Functionalities

Vehicles Category	Operation mode	Batterytype	Maximumdriving distance(km)	Maximumspeed (km/h)
HEV	Charging assisting	NiMH	900-1200 (hybrid)	170
PHEV	Charging assisting	NiMH	20-60 (electric)	160
PHEV	Mixed mode	Li-ion	900 (hybrid)	160
BEV	Charging depleting	Li-ion	120-400	80-200

Table 3: Analysis and Comparison of Fuel Consumption and Co2 Emissions

Vehicles Category	Electricity consumption (kwh/km)	Well-to-wheel fuel economy (1/100km)	CO2 emission (gCO2/km)
HEV	NA	4.7	109
PHEV	0.225	5.68	132
BEV	0.175	3.77	88

Recent Technical Advancement in EVS Technology:

A. BATTERY ADVANCEMENT:

An EV battery is a battery used to power the electric motor. These batteries are mainly lithium ion batteries. These batteries are designed for high ampere-hour capacity. It takes 7 hours to charge for the 300 miles range,

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because of that user get disappointed by using EVs. Moreover to use EV, recently someprogress has been done to increase charging time. Now 90 miles of range EV takes 30 minutes to charge with the help of fast DC charger. Fig. 4. Shows cost targets of different manufacturers upto the year 2022 [13].

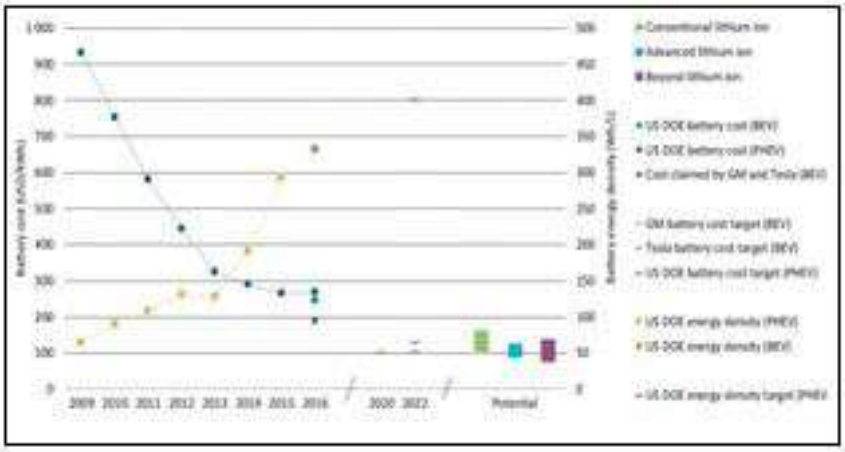

Fig. 4: Peaks reached of battery cost and energydensity

A. ADVANCE BATTERY RECHARGINGMETHODS: VEHICLE TO GRID (V2G)

The topic of V2G is certainly not far away from the EVs, V2G technology presented as a system that offers an ability of controllable, duplex electrical energy between the EV and the electrical network. On average, a vast majority of vehicles remain parked a long period per day on the same reserved space; the V2G corresponds to the idea, of using the batteries of EVs during these long parking areas, to store the energy produced, at times when the demand is lower than the electricity produced and reinject it into the network, when the demand is higher than the quantities produced . The developments and uses of this system could help regulate electricity flows and integrate RESs into the grid, by increasing the reserve capacity of the national grid operator and by eventually eliminating power plants, used during peak electricity consumption that produces highly carbonaceous electricity

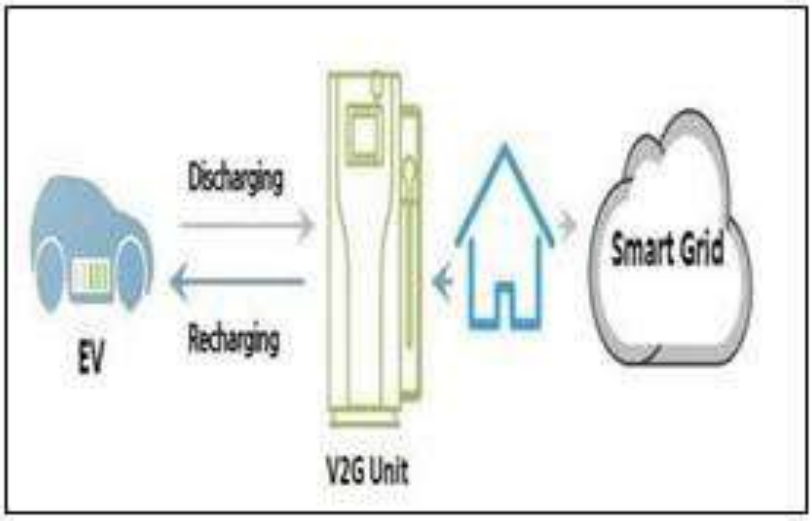

Fig. 5: V2G Technology

ENERGY STORAGE WITH HYDROGEN:

This option is required to charge the EVs directly from RESs to the vehicle, indirectly with hydrogen integrated energy storage system based on hydrogen storage. Hydrogen is one of the most abundant elements of the planet and has the highest energy per mass of any fuel. For the reason that hydrogen produced on a large scale to play a significant part in the energy transition. Solar energy / H**2** hybrid systems are innovative solution to the issue of storage RESs

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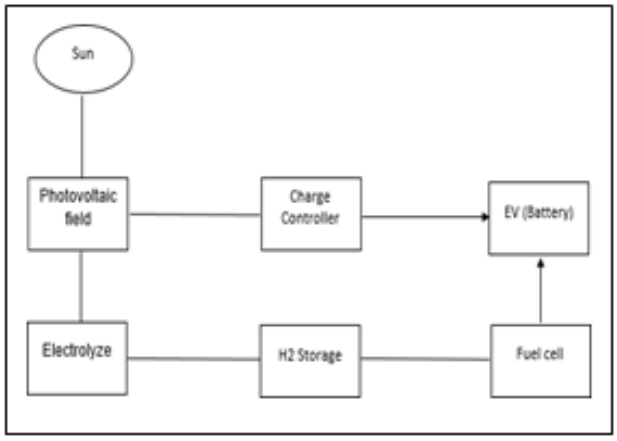

Fig.6: Solar hydrogen production and storage process

II.CONCLUSION

In this paper all the areas regarding EV technology has been studied and concluded that EVs has advanced technology with fuel economy, CO2 emission factor and the latest technical development such as battery enhancement, V2G, energy storage with hydrogen. There are three basic categories that are HEVs, BEVs, PHEVs in detail. There was the analysis and comparison between main three basic types of EVs in which HEVs are the better option because it offers higher driving distance compared to other two it is due to the existence of internal combustion engine.

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COMPARATIVE STUDY OF DIFFERENT TYPES OF SLAB FOR SAME STRUCTURAL CONDITION

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ABSTRACT
In today's construction, the classic slab is generally supported by a beam., The weight is transferred from beam to column with a small slab thickness and a large beam depth. Because of the flat slab, architects may build partition walls everywhere they're needed. It's popular since it aids weight loss, promotes rapid growth, and is affordable. Similarly, the traditional slab has provided advantages such as increased stiffness, Since its introduction, it has had a better weight bearing capability, as well as being safe and cost effective. Grid slabs are required if the span is greater, and grid beams are provided to lower the span. Grid slabs are ideal for longer spans with heavy loads because they remove voids, which would otherwise produce dead load. Grid slabs are less expensive and more vibration resistant. The study's goal is to figure out which of the three slab types is the most cost-effective: standard slab, flat slab with drop, and grid slab. a G+5 Storey displacement, shear force, bending moment, and storey drift in a residential multi-story structure with flat slab, standard slab, and gird slab were investigated in this study. The performance and behaviour of all structures in India's seismic zone III were investigated with the help of dead load, live load, and seismic load. The findings of shear force, bending moment, story displacement, and story drift demonstrate that the total result values make flat slab a suitable construction when compared to conventional and grid slabs.

Keywords: Flat slab, conventional slab, Grid Slab, Seismic analysis, Etabs.

1. INTRODUCTION

The floor and roof of a structure are made up by slabs, which are plate components that transmit weights mostly through flexure. For multi-story parking garages, incline slabs can be used as ramps. A stair may be thought of as a slanted slab. A slab can be embellished with the flanges of a Tor L-beam, as well as beams or walls.

1.1 Flat Slab:

It stands directly on a pillar of support without the need of beams, providing strength in all directions. The load from a flat slab is immediately transferred to the column, and we increase the column's shear capacity by adding additional slab thickness above the column, which is known as a drop panel. It is commonly used in commercial or residential structures' basements to reduce story height while lowering the overall height of the structure.

Types of flat slab:

a) A flat slab with a drop panel on one side.

b) Column head on a flat slab.

c) Column head and drop panel on a flat slab.

d) No drop panel or column head on a flat slab.

1.2 Slab with a Flat Design:-

According to IS456:2000, two approximation methods are utilised to create flat slabs.

i. DDM (Direct Design Method).

ii. EMF (Equivalent Frame Method).

1.3 Grid Slab:-

Beams placed to make up a grid or coffered floor system. Waffle slabs are often more substantial than ribbed slabs. Grid slabs are widely used in big locations, such as auditoriums and retail displays, for architectural purposes. Architectural lighting can be hidden in the ceiling.

1.4 Objectives:-

- Structure zone III evaluation over various spans.
- An examination of various slab types for a variety of parameters such as dead loads, base shear, and story drift.
- Examine the slab's story deflection, shear force, and bending moment, as well as the slab's story drift.
- To compare the results and determine the best slab type.

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1.5 Research Gap:-

- When comparing flat slabs, grid slabs, and ordinary slabs, several researches discovered that, Flat slabs were found to be good for some parameters, whereas grid slabs were found to be better for longer spans and standard slabs were found to be acceptable for lateral stiffness.
- The goal of this research is to determine the outcomes for not only the slab spans, but also the overall structure.

2. METHODOLOGY:-

- To study various vertical loads/ lateral loads applied on building of G+5 storied.
- Analyse the building for seismic zone III
- Analyse the models with Conventional slab
- Analyse the models with Flat Slab
- Analyse the model with Grid Slab
- Comparing the model with the model of different Spanning distance.
- Analyse and Comparative study of various parameters on slab such as SFD, BMD, Story Drift, Story Shear, Story Displacement, etc.
- Validation of the result obtained from the model.

3. LOAD CONSIDERATION:-

(i). IS-875(PART1):1987 specifies the dead load.

a. Wall Load =0.23x20kN/m3 (Brick Density) x (3m-0.45) (Storey Height)=11.73kN/m

b. 3kN/m load on parapet wall

c. 125 kN/m2 Slab load = 0.125m x 25 kN/m3

d. 1.5 kN/m2 finished floor

(ii) IS-875(PART1):1987 specifies the live load.

3 kN/m2 live load on the floor

(iii) Earthquake Load: In accordance with IS1893:2016.

a. Earthquake Zone III (Z=0.16) (Seismic Definition)

b. Factor of response decrease = 5

c. Factor of Importance – 1.2 (Residential building)

d. Site Factor-2 (Rock and Soil) (Medium Soil Building)

e. Type of Structure – 1 Damping – 5% (0.05)

Table 1: Parameter for construction

Sr. No.	SPECIFICATION	SLAB SYSTEMS OF MANY TYPES		
		Conventional Slab	Flat Slab	Grid Slab
1.	Sizes of the Plan	18mx10m	18mx10m	18mx10m
2.	X-Direction Length	18m	18m	18m
3.	Y-Direction Length	10m	10m	10m
4.	Height of a Storey	3m	3m	3m
5.	Number of Storeys	5	5	5
6.	Thickness of the slab	125mm	150mm	100mm
7.	Dimensions of the Beam	230mm x 450mm	--	230mm x 450mm
8.	Dimensions of the Column	230mm x 450mm	230mm x 500mm	230mm x 650mm
10.	Grid Beam Dimensions		--	200mm x 200mm
11.	Depth of the drop	--	400mm	--
12.	Grade of Concrete	M20	M20	M20
13.	Grade of Steel	Fe415	Fe415	Fe415

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4 MODELLING OF BUILDING:-

This model is created using ETABS Software and is based on an AutoCAD design.

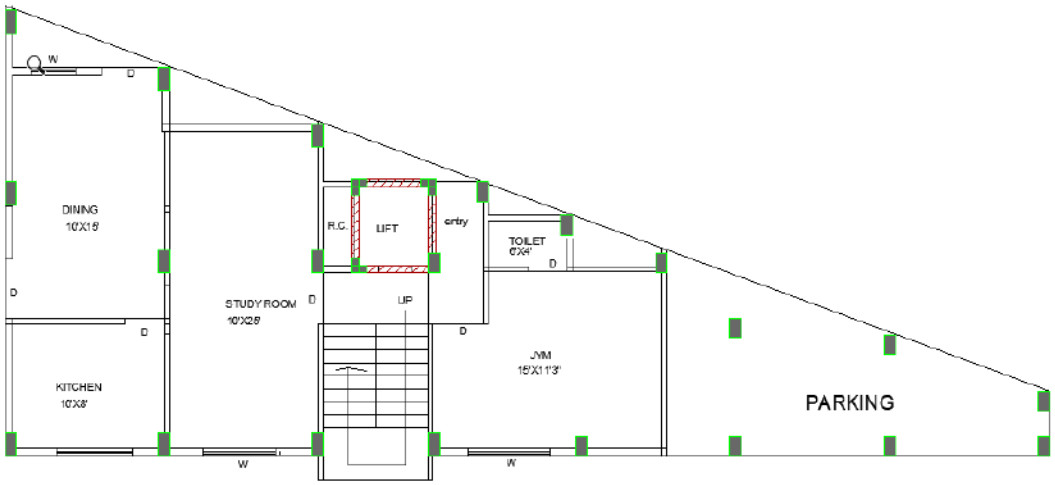

Figure 1.Plan of Building at Ground Floor

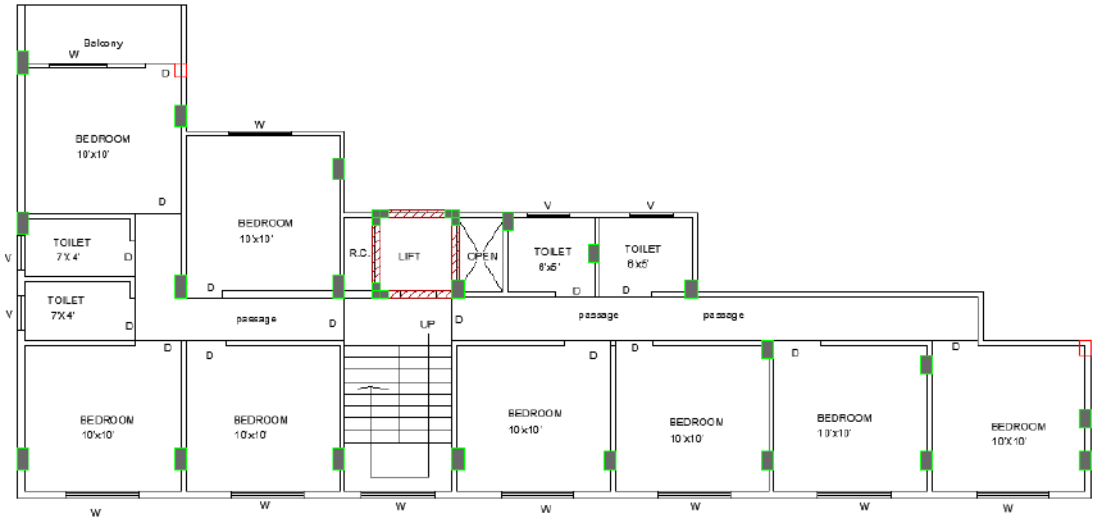

Figure 2. Plan of Building at Typical Floors (1st, 2nd, 3rd, 4th,& 5th)

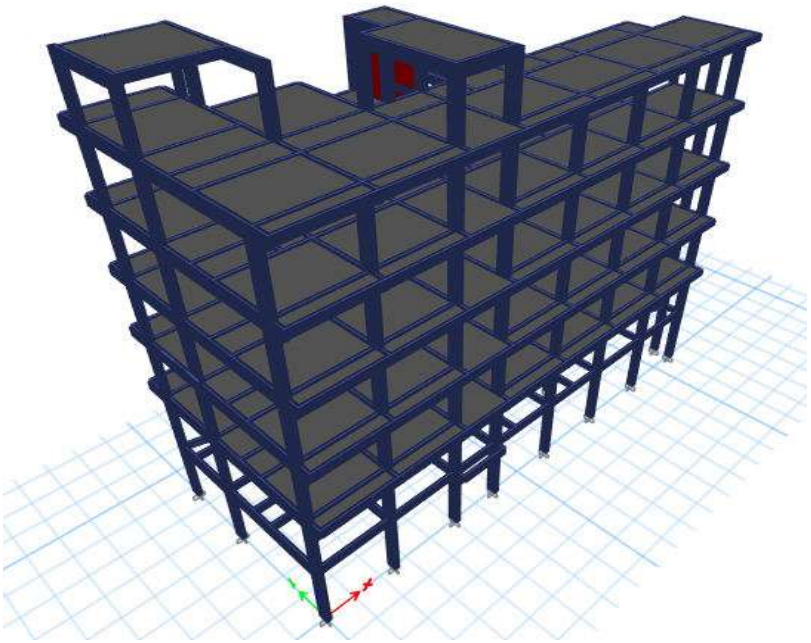

Figure 3. 3D model of building on Etabs

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5. RESULT:-

1. Bending Moment

Table 2:- Comparison of Bending Moment Result

Parameters	Two Way Slab	FLAT SLAB	GRID SLAB
Bending Moment (kN-m)	23.18	46.28	34.63

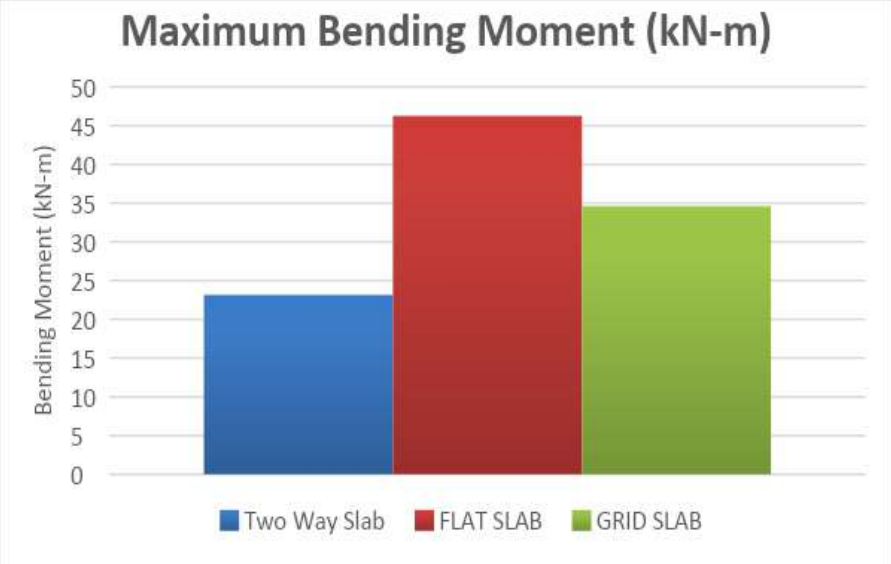

Figure 4: Graph for Bending Moment

2. Shear Force

Table 3:- Comparison Of Shear Force Result

Parameters	Two Way Slab	FLAT SLAB	GRID SLAB
Shear Force (kN)	28	126	25.64

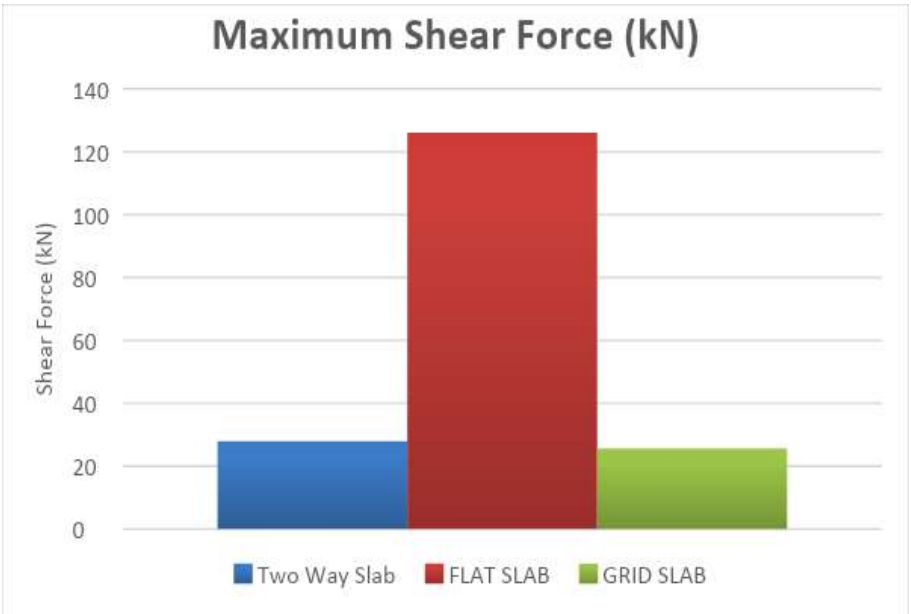

Figure 5: Graph for Shear Force

3. Base Shear

Table 4: Comparison Of Base Shear Result

Parameters	Two Way Slab	FLAT SLAB	GRID SLAB
Base Shear (kN)	268.932	198.963	220.69

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Figure 6: Graph for Base Shear

4. Storey Drift

Table 5: Comparison of Storey Drift Result

Storeys	Two way slab	Flat slab	Grid slab
Storey5	0.000434	0.000413	0.00054
Storey4	0.000699	0.000651	0.000779
Storey3	0.000863	0.0008	0.000934
Storey2	0.0009	0.000818	0.000904
Storey1	0.000601	0.000507	0.000485
Ground	0	0	0

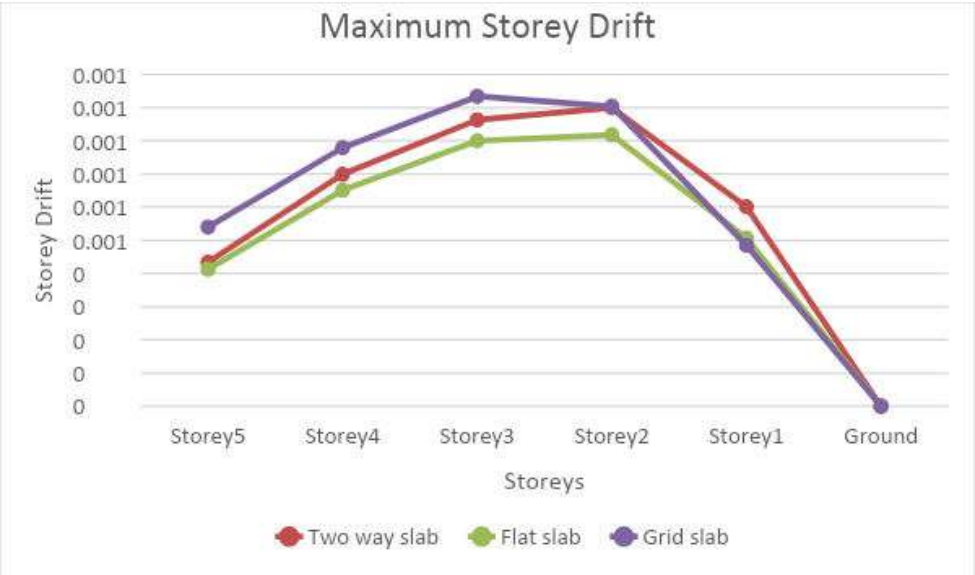

Figure 7: Graph for Storey Drift

5. Storey Displacement

Table 6. Storey Displacement Result Comparison

Storeys	**Two way slab (mm)**	**Flat slab (mm)**	**Grid slab(mm)**
Storey5	13.979	12.758	14.54563
Storey4	12.246	11.105	12.38584
Storey3	9.451	8.502	9.26785
Storey2	5.999	5.3	5.535863
Storey1	2.405	2.027	1.940095
Ground	0	0	0

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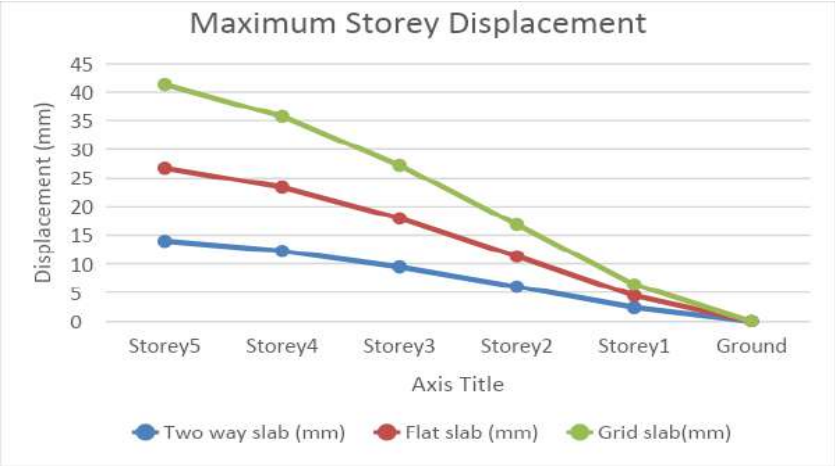

Figure 8: Storey Displacement Graph

6. CONCLUSION

- The findings of the analysis led to the following conclusions.
- Flat slab constructions are substantially heavier than regular slab structures..
- When compared to grid slabs and two-way slabs, flat slabs have higher bending moment and shear force.
- Flat slab designs, on the contrary, improve the visual appeal viewpoint while providing the designer with huge work in the form Placing flexural reinforcement is simple, and casting concrete is simple, and open there is enough room for water and air lines, among other benefits. between the slab and the wall and a possibly ceiling with fur, saving of one story height in multi-story constructions, and so forth.
- As a result, the Flat slab is more cost-effective than the traditional and Grid slabs. In comparison to traditional slab structures and The best structures are grid slab and flat slab structures choice for high-rise construction.

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DURABILITY STUDIES ON CONCRETE USING SUGARCANE BAGASSE ASH

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ABSTRACT
Sugarcane bagasse is a fibrous by-product of the sugar refining process. This by-product causes a high level of environmental pollution, necessitating the use of urgent waste disposal methods. The present study focuses on the use of Sugarcane Bagasse Ash in a concrete production as a substitute material for fine aggregate. The use of fine aggregate in concrete is increasing day by day. Sugarcane Bagasse ash contains a high amorphous silica and aluminium content. In the present analysis, agricultural waste product Sugar Cane Bagasse Ash (SBCA) is used as an alternative binding material. The aim of this project is to investigate the effects of partially replacing fine aggregate with sugarcane bagasse ash in concrete that has been exposed to various curing environments. The bagasse ash used for the research work is collected from Mahatma Sugar Factory, Wardha and used in concrete as a fine aggregate replacement in the ratio of 0 %, 5%, 10%, 15% & 20% by a weight. The influence of a fine aggregate replacement by bagasse ash on durability of concrete to Acid attack and Sulphate attack is determined in this paper. The concrete specimens were cured for 28 days in a solution of 3% sulphuric acid and hydrochloric acid. In this paper, we primarily focus on evaluating variation in compressive strength and weight reduction in five different M30 Grade mixes.

Index Terms: Durability, Hydrochloric acid (HCL), Sugarcane Bagasse Ash, Sulphuric acid (H2SO4), Weight loss

I. INTRODUCTION
For a long time, concrete was thought to be a very durable material that required little to no maintenance. This statement is correct except when it is exposed to extremely hostile conditions**.** Some concrete buildings are constructed in highly contaminated urban and industrial areas, hostile marine environments, toxic subsurface water in coastal areas, and a variety of other hostile environments where other building materials are found to be non-durable. Concrete is not completely resistant to acid and sulphates. Depending on the form and concentration of acid, most acid solutions can disintegrate Portland cement concrete slowly or quickly. Ca(OH)2 is the most fragile element of the cement hydrate, but C-S-H gel is also vulnerable. The use of pozzolanic admixtures to enhance the properties of concrete has been demonstrated by renowned researchers. Pozzolanic products have also been shown to improve the resistance of concrete to acid attack in studies.

Globally, programs are being developed to regulate and control the monitoring of by-products, residuals and an industrial waste in an order to protect the atmosphere from pollution. Burning them in a regulated atmosphere and using the ashes (waste) for more polite methods would be a successful solution to the issue of recycling an agro-industrial excess. The use of a waste such as cement and fine aggregate substitute materials will reduce the cost of the manufacture of concrete and mitigate the negative environmental impact of the disposal of such waste. Many researchers have recognized one such possible application in the agricultural waste known as sugarcane Bagasse from the sugar industry, which when burned produces sugarcane Bagasse ash (SCBA). Sugarcane is an essential agricultural plant that grows well in hot climates. India has a total sugar production capability of over 30 million tonnes per year. Sensitive amorphous silica is produced due to the combustion process when bagasse is burnt in the boiler of the cogeneration plant under controlled conditions and is present in the residual ashes known as a Sugarcane Bagasse Ash. Bagasse ash is a useful sand substitute material due to this amorphous silica content. If the concrete is exposed to acidic conditions it can degrade. It is one of the most significant durability problems that affects the maintenance costs and life cycle performance of all concrete structures since sulphuric acid, hydrochloric acid, and other acids may be contained in chemical waste, ground water, and other locations. Acid rains, one of the main components of which is sulphuric acid, can cause concrete structures in industrial zones to deteriorate. Hence to study the effect of sugarcane bagasse ash on acid and sulphate resistance we used sugarcane bagasse ash as a substitute for 0%, 5%, 10%, 15% and 20% by weight of fine aggregate to increase consistency and lower construction costs. A study on acid and sulphate resistance of concrete using HCl and H_2SO_4 solutions respectively is observed. Concrete of grade M30 for a curing time of 28 days of the concrete specimens in 3% HCl and H_2SO_4 solutions were the component factors considered in this analysis. The effect of HCl and H2SO4 is measured by the loss in weight and loss in strength compared to the previously determined conventional concrete.

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II. LITERATURE REVIEW

"An Experimental Study on Concrete with Sugarcane Bagasse Ash as a Partial Replacement of Cement under Sulphate Attack Using Mgso4 Solution", (December 2014) by Mohananganga Raju Puppala, M K M V Ratnam

In this project objective is to study the influence of partial replacement of Portland cement with sugarcane bagasse ash in concrete subjected to different curing environments. Experimental investigation on acid resistance of concrete in mgso4 solution. The variable factors considered in this study were concrete grade of M35 & curing periods of 7days, 28days, 60days, 90days, 180days of the concrete specimens in 1%, 2%, 3%, 4%, and 5% MgSO4 solution. Bagasse ash has been chemically & physically characterized & partially replaced in the ratio of 0%, 5%, 10%, 15%, and 20% by weight [1].

"Study on Bagasse Ash as Partial Replacement of Cement in Concrete", (January 2017) by Lathamaheswari, R., Kalaiyarasan, V and Mohankumar, G

This paper presents the attempt made in making concrete with partially replacing cement by 2.5, 5.0, 7.5,10 and 12.5 % of bagasse ash. Mix design is made for conventional M20 grade, conventional and ash based concrete prepared, the workability, strength and durability characteristics are determined through proper testing and the results are compared. The optimum level of cement replacement with bagasse ash is observed to be 7.5 percent [2].

"EFFECT ON M30 SCBA CONCRETE IN ACIDIC ENVIRONMENT", (December 2019) by P. V.

RamBabu, V. Jahnavi Deepthi, G. V. Ramarao

In this experiment the impact of partial replacement of SCBA in ordinary Portland cement cured in various acidic environments is studied. Bagasse ash has been replaced by 0%, 5%, 10%, 15% and 20% by weight of cement. The concrete specimens were cured for 28, 60 and 90 days in water and in concentrations of 1%, 3 % and 5% sulphuric acid and hydrochloric acid solutions. The tests conducted are compressive strength. The ideal percentage of SCBA replacement is around 10%. The presence of SCBA in concrete developed resistivity towards Acidic attacks [3].

"Study on Concrete with Sugarcane Bagasse Ash as a Partial Replacement of Cement using HCL Solution", (June 2016) by S. NAGA BHARGAVI, Y. ANAND BABU

This investigation is focused on the partial replacements of Portland cement by Sugarcane Bagasse Ash in concrete. . In this paper the influence of partial cement replacement with Sugarcane Bagasse ash in concrete subjected to different curing environments has been studied by Experimental investigation on acid resistance of concrete in HCL solution. The variable factors considered in this study were concrete grade of M35 & curing periods of 7days, 28 days, 60 days, 90days, and 180 days of the concrete specimens. The parameter investigated was the time in days to cause strength deterioration factor of fully immersed concrete specimens in 1%, 2%, 3%, 4%, 5% HCL solution. Bagasse ash has been chemically & physically characterized & partially replaced in the ratio of 0%, 5%, 10%, 15%, and 20%. Fresh concrete tests like compaction factor test and hardened concrete tests like compressive strength at the age of 7days, 28 days, 90, 180 days was obtained [4].

"To Study the Properties of Concrete using Bagasse Ash on M-25 Grade of Concrete", (July 2018) by Amit and Sahil Goel

In this paper M25 grade of concrete was prepared to study the durability of concrete in terms of resistance of concrete specimens under the exposure of chloride and sulphate attack at exposure time of 7, 28 and 62 days after 28 days of water curing. The concrete specimens containing of bagasse ash as a partial replacement of cement subjected to chloride and sulphate attack had better resistance in comparison to the control mix [5].

III. MATERIALS

The materials used in the study are

Cement

The cement is used as a material which binds. The cement used is Portland-Pozzolana cement in this research is available from Birla Cement Company and complies with IS 1489 (Part 1): 1991.

Table 1: Physical Properties of Cement

Sr. No.	Property of cement	Value
1	Fineness	313 m^2/kg
2	Specific gravity	3.14
3	Initial setting time	55 mins
4	Final setting time	320 mins

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Fine Aggregate
Aggregates were purchased from licensed suppliers in compliance with IS 383 - 1970 standards and were chemically inactive (inert), spotless and robust. The fine aggregate has been checked according to the limitations stated in IS: 383-1970. In this research, the specific gravity of sand is 2.64 and the sand corresponds to zone II as per the Indian standards

Coarse Aggregate
Machine-crushed coarse aggregates shall be one of black trap or similar black tough stone and shall be stiff, robust, thick, durable, and spotless or obtained from consultant licensed quarries. In this analysis, crushed aggregate is used in angular form with a maximum size of 20 mm and confirms to IS: 2386- 1969. The specific gravity is 2.70.

Sugarcane Bagasse Ash (SCBA)
Approximately 50 % of cellulose, 25 % of hemicellulose and 25 % of lignin make up the Sugarcane Bagasse Ash. Each ton of sugarcane produces about 26 % of bagasse 0.620 % of residual ash. The chemical composition of the waste after incineration is dominated by Silicon Dioxide (SiO2). The ash is used on farms as a fertilizer in the Sugarcane Baggage Ash harvests, despite being a substance of an extreme degradation and that contains little nutrients.

Table 2: Properties of sugarcane bagasse ash

Property	Value
Fineness modulus	1.78
Specific gravity	1.44

Table 3: Chemical properties of sugarcane bagasse ash

Compound	Mass (%)
SiO_2	64.55
Al_2O_3	7.97
Fe_2O_3	4.53
CaO	6.4
K_2O	3.77
MgO	3.13
SO_3	0.86
Loss of Ignition	3.29

Water
Good potable water available in the site is used for the construction purpose which conforming to the requirements of water for concreting and curing as per IS: 456-2000.

IV. METHODOLOGY

IS 456:2000 was followed while creating the mix design. The fresh concrete was mixed by a hand until the consistency was achieved before mixing; the materials were spread in layers at the bottom of the pan, the rough aggregate first, followed by the cement and finally the fine aggregate. The components of the mixtures were mixed dry for 1.00 minute in order to homogenize the mixture; water was then added and mixed for another 3.00 minutes. The concrete was cast into the moulds in three layers, and each layer received

36.00 blows, using 16.00 mm diameter bar, to remove any air. The requisite number of cubes were cast for each mix. Sacking was used to protect the moulds for 24 hours at room temperature. After at least 24 hours, the specimens were de-moulded and poured into the curing tank. The cubes were removed from water, surface dried and weighed after 28 days and then immersed in 3% hydrochloric acid solution and 3% sulphuric acid solution for 28 days. After 28 days cubes were taken out from solution, surface dried and weighed. The acid attack test was carried out according to ASTM C 267-97 for a total of 28 days. For the acid resistance test, hydrochloric acid of 3% concentration was used, and sulphuric acid of 3% concentration was used for the sulphate resistance test. Concrete specimens of size 150 mm were immersed in a solution of dilute HCl and H_2SO_4. Once every two weeks, the solution was replaced. Concrete specimens were subjected to two separate examinations. The compressive strength of concrete was checked to see if it changed as a result of acid and sulphate attack. After 28 days of immersion in dilute hydrochloric and sulphuric acid, the concrete specimens were tested for compressive strength. The specimens were also checked to see loss in weight.

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V. RESULTS & DISCUSSION

After 28 days, specimens immersed in 3% hydrochloric acid and 3% sulphuric acid solution were removed form curing tank and tested for weight loss and compressive strength loss. After treating specimens with hydrochloric acid and sulphuric acid for 28 days of M30 grade concrete for replacement of natural sand by SCBA in proportions of 0%, 5%, 10%, 15%, and 20% by weight, the decrease in the compressive strength and loss in weight of the concrete are as follows:

Acid Attack

The effect of bagasse ash on the weight and strength of concrete specimens exposed to 3% hydrochloric acid solution for 28 days has been investigated. The difference in weight and strength was studied and compared with the control mix and normal water curing.

1) Weight Loss

The weight loss of bagasse ash concrete cube specimens exposed to hydrochloric acid solution for days has been investigated. The impact of bagasse ash on weight loss is shown in Table 4 and illustrated in fig. 1

Table 4: Weight Loss of Concrete Specimens Subjected to Acid Attack

Mix Designation	Weight before acid attack (gm)	Weight after acid attack (gm)	% Loss in Weight
M0	8192	7964	2.78
M5	8158	7988	2.08
M10	8141	7995	1.79
M15	8173	7991	2.23
M20	8169	7959	2.57

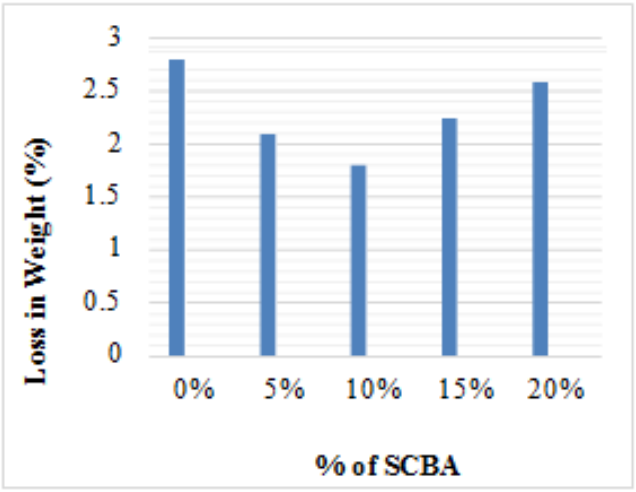

Fig. 1: Weight Loss of Concrete Specimens Subjected to Acid Attack

More amount of weight loss was observed in the control mix specimens and it was found decreasing up to 10% of SCBA content as sand replacement. It means that the control mix specimen have recorded maximum loss in weight that is 2.78% and the specimen with 10% SCBA have recorded the least loss in weight. The percentage loss in weight was 1.79% for the mix with 10% SCBA.

2) Compressive Strength Loss

Table 5 and fig. 2 shows the comparison of the compressive strength loss values of acid attacked specimens at 28 days.

Table 5: Compressive Strength Loss of Concrete Specimens Subjected to Acid Attack

	Compressive strength		
Mix Designation	Before acid attack (N/mm^2)	After acid attack (N/mm^2)	% Loss in C.S.
M0	31.6	30.03	4.96
M5	31.95	30.6	4.22
M10	33.82	32.66	3.43
M15	29.97	28.66	4.37
M20	28.89	27.53	4.70

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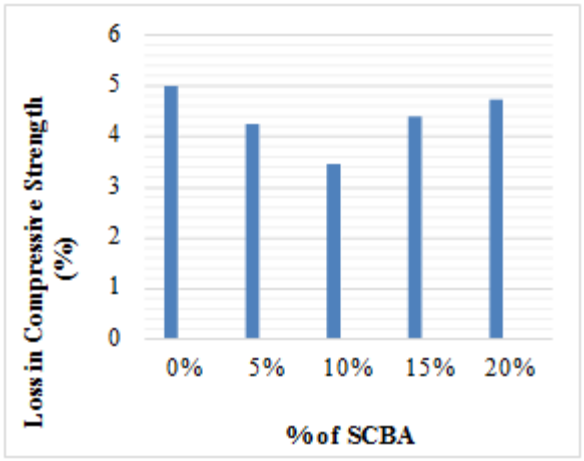

Fig. 2 Compressive Strength Loss of Concrete Specimens Subjected to Acid Attack

There was loss in compressive strength for the entire concrete specimens. In the case of concrete mixes with 0% SCBA more reduction in compressive strength was observed when exposed to hydrochloric acid solution. Also gradual reduction in the loss was observed with the increase in the percentage of SCBA in concrete up to 10%. The maximum loss in compressive strength (4.96%) was recorded for the control mix with 0% SCBA. The value was 3.43% for the mix with 10% SCBA. So the specimen with 10% SCBA have recorded the least loss in compressive strength.

Sulphate Attack

The effect of SCBA when used in concrete as a fine aggregate replacement in the ratio of 0 %, 5%, 10%, 15% & 20% by a weight on the weight and compressive strength of concrete specimens exposed to sulphuric acid (98% concentrated) solution with 3% concentration for 28 days has been studied. The difference in weight and strength was studied and compared with the control mix and normal water curing.

1) Weight Loss

The result of the weight loss of concrete specimens after the end of 28 days is illustrated in Table 6 and fig. 3

Table 6: Weight Loss of Concrete Specimens Subjected to Sulphate Attack

Mix Designation	Weight before sulphate attack (gm)	Weight after sulphate attack (gm)	% Loss in weight
M0	8145	7821	3.97
M5	8180	7900	3.42
M10	8163	7913	3.06
M15	8171	7870	3.68
M20	8128	7818	3.81

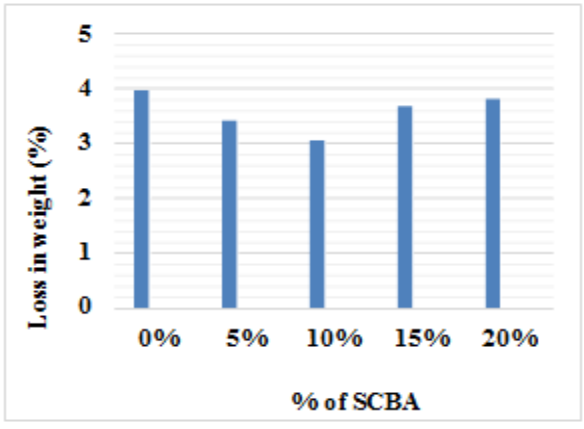

Fig. 3 Weight Loss of Concrete Specimens Subjected to Sulphate Attack

At the end of the immersion in a 3% sulphuric acid solution, the mixture that contained 10% SCBA showed lower weight loss (3.06%) than the other mixes and the mix with 5% SCBA had only lost 3.42% of its initial weight which is close to the weight loss of M10. Maximum amount of weight loss that is 3.97% was observed in the control mix specimens with 0% SCBA.

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2) Compressive Strength Loss

Table 7 and fig. 4 shows the comparison of the compressive strength loss values of sulphate attacked specimens at 28 days.

Table 7: Compressive Strength Loss of Concrete Specimens Subjected to Sulphate Attack

Mix Designation	Compressive Strength		% Loss in C.S.
	Before sulphate attack (N/mm^2)	After sulphate attack (N/mm^2)	
M0	31.6	29.87	4.96
M5	31.95	30.36	4.22
M10	33.82	32.45	3.43
M15	29.97	28.47	4.37
M20	28.89	27.38	4.70

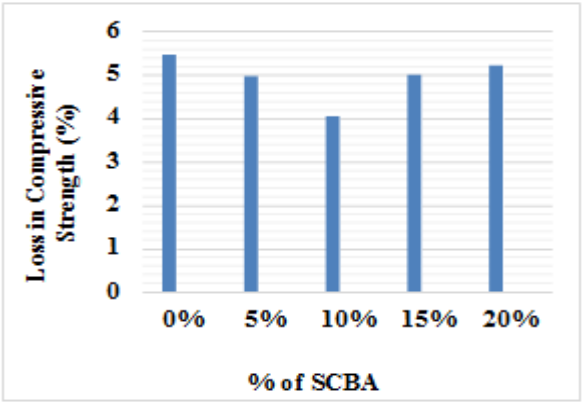

Fig. 4: Compressive Strength Loss of Concrete Specimens Subjected to Sulphate Attack

The initial compressive strength and strength loss of concrete specimens from different mixtures were measured to evaluate the performance of concrete specimens against sulphuric acid intrusion after 28 days of immersion. It can be seen from Table 7 that the concrete mixture with 10% SCBA showed minimum strength loss (4.05%) than the other mixes. The maximum loss in compressive strength (5.47%) was recorded for the control mix with 0% SCBA. So the specimen with 10% SCBA have recorded the least loss in compressive strength.

VI. CONCLUSION

In this study, SCBA supplanted concrete with 5%, 10%, 15%, 20% were readied and afterward were subjected to point by point appraisal on their durability properties. The conclusion from the above examination are as per the following.

- The compressive strengths of the concrete cubes immersed in acid solution were lower than their corresponding concrete cubes cured in water only. The compressive strengths of SCBA replaced concrete cubes exposed to hydrogen chloride acid of concentrations of 3 percentage solutions decreases for all percentages of replacements
- In case of acid resistance test, the weight loss is least at 10% replacement and for all replacement levels the weight loss is less compared to conventional concrete. In case of sulphate resistance test, the weight loss is least at 5 and 10% replacement level.
- The strength loss is least in both cases at 10% level of replacement. The incorporation of sugar cane bagasse ash of not more than 10% was able to improve the resistance of concrete towards acid and sulphate attack.
- At 20% replacement loss in strength is nearly equal to normal concrete.
- The presence of SCBA in concrete resulted in increased chemical resistance. It was clearly shown that SCBA is a pozzolanic material that has the potential to be used as partial sand replacement material and can contribute to the environmental sustainability.

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AMBIENT AIR QUALITY STATUS IN FIVE METROPOLITAN CITIES OF MAHARASHTRA BEFORE AND AFTER DIWALI: A CASE STUDY

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ABSTRACT
It has been observed that the problem of air pollution is worsening rapidly in the twenty-first century when compared to the previous century. This problem was prevalent in various Maharashtra metropolitan areas last year. This paper will examine the situation of ambient air quality in five Maharashtra metropolitan cities before and after Diwali, namely Pune, Nashik, Aurangabad, Nagpur and Mumbai.

Keywords: Air Quality Index, Ambient Air, Pollutants, Particulate matter.

I. INTRODUCTION

This Air is an important natural resource providing the basis of life on earth. The air in the atmosphere provides oxygen to plants and animals by virtue of which they are able to live. It is therefore important to have good quality air for various activities. However, this is becoming increasingly difficult in view of large scale pollution caused by the industrialization of society, intensification of agriculture, introduction of motorized vehicles and explosion of the population. These activities generate primary and secondary air pollutants which substantially change the composition of air. Therefore defined air pollution as the introduction of chemicals, particulate matter (PM) or biological materials that cause harm or discomfort to humans or other living organisms, or cause damage to the natural environment or built environment into the atmosphere [1]. Pollutants from human activities are detrimental to human health. Primary anthropogenic sources include combustion of fuels such as wood, coal, and the emissions from vehicle exhausts. Industry has been suggested to be the primary source of sulphur dioxide (SO_2) and benzene (C_6H_6) in a number of studies, whilst nitrogen dioxide (NO_2) is primarily from vehicle combustion emissions in a city environment [2]. Particulate matter with diameter ≤ 2.5 μm (PM2.5) and ≤ 10 μm (PM10) will encompass both sources. Benzene may also be viewed as a proxy for other industrial pollutants such as polycyclic aromatic hydrocarbons (PAHs), and other volatile organic compounds, for which ambient levels are not monitored on a national scale [3]. Air pollution is a major environmental risk factor for morbidity and mortality, leading to 4.2 million deaths every year globally, primarily from heart disease, stroke, chronic obstructive pulmonary disorder (COPD), lung cancer and acute respiratory infections [4]. Diwali, or Deepawali, is a festival of "rows of light", which is celebrated every year during October/November in India. Celebrating with the brightness and sparklers brings happiness, delight and festivity. Firecrackers are associated with worldwide festivities such as New Year's Eve celebrations [5]. The Lantern Festival in China, Bonfire Night in UK, Tihar in Nepal, Day of Ashura in Morocco, Sky fest in Ireland, Bastille day in France and Diwali in India [6]. Firecrackers consist of, chemical such as potassium nitrate (KNO_3), potassium chlorate ($KClO_3$), arsenic (Ar), sulphur (S), manganese (Mn), sodium oxalate ($Na_2C_2O_4$), aluminium (Al), iron dust powder ($Fe_2O_3.H_2O$), potassium perchlorate ($KClO_4$), strontium nitrate ($Sr(NO_3)_2$), barium nitrate ($Ba(NO_3)$) and charcoal [5]. Burning of firecrackers release pollutants, like sulphur dioxide (SO_2, 10%,), potassium nitrate (75%), charcoal (15%), carbon dioxide (CO_2), carbon monoxide (CO), suspended particles (including particles below 10 μm in diameter, i.e. PM_{10}) and several metals like aluminium, manganese and cadmium, etc., which accompanying with serious health risks [7]. In the Indian context, studies have also been reported on the air quality degradation for the firework activities during Diwali

Festival but studies are few. In Thiruvananthapuram, India a study about the effect of firework display during Deepawali on the mass concentration of atmospheric black carbon reveals over 3 times increase compared to normal days. Study has observed that there is 2 to 3 times increased in PM10 and TSPM concentrations in Hisar city (India) that leads to short-term variation in air quality during Diwali festival. Bursting crackers is turning to a competition and a status indicator. It is estimated that the annual U.S. carbon dioxide emissions from fireworks are 60,340 tons or the same emissions from 12,000 cars on the road for a year [8].

Firecrackers during Diwali emit a large amount of PM and poisonous gases in the air. They degrade the air quality which causes air pollution in the society leading to serious health hazards and disturbance in the ecosystem. The present aim of this paper is to study the status of ambient air pollution before and after Diwali by observing the concentrations of PM_{10}, trace gases (SO_2 and NO_2) in four metropolitan city of Maharashtra.

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II. DATA BASE AND METHODOLOGY

Data for this study were gathered from authorized Central Pollution Control Board (CPCB) website Maharashtra Pollution Control Board (MPCB) website. This website has a live tracking of pollution levels. For this type of investigation, this is dependable and accurate data. Average air pollution data before Diwali was taken from 2nd November 2023 to 9th November 2023 and average air pollution data after Diwali was taken from 10th November 2023 to 17th November 2023. Census and district Gazetteer Data has been used.

III. STUDY AREA

For this study Pune, Nashik, Aurangabad, Nagpur and Mumbai were selected. Specific location like

MIDC Chikalthana, More Chowk Waluj, Chembur, Mindspace-Malad West, Mahal, Ram Nagar, Gangapur Road and Savitribai Phule Pune University for Air quality data were taken in to account varying stages of development and are emerging cities. Mumbai is the largest metropolitan area. Pune is the ninth largest city in India and the leading metropolis. Nashik, Aurangabad and Nagpur are major million-person cities in the state respectively.

IV. RESULT AND DISCUSSION

The majority of Indian cities suffer from extremely high levels of urban air pollution, particularly in the form of suspended particulate matter, SO_2 and NO_2, Levels of all pollutants are increasing due to industrial processes, agricultural activities, building construction, and road traffic, as well as reductions in natural habitat and other natural sources [9]. This study shows how major pollutant level like Sulphur dioxide, Nitrogen oxide and particulate matters deteriorates air quality. The focus of this study is to compare air pollutants and there level in air before and after Diwali situation.

1. Sulphur Dioxide

Sulphur Dioxide is major pollutant. It reacts with other substances and form hazardous compound like Sulphuric acid, Sulphurous acid and sulphate particles. Major sources of SO_2 are fossil fuel like coal, oil and gas burning. Maximum SO_2 comes from anthropogenic activities and Motor vehicle emission is also one of the prime sources of Sulphur Di oxide. It results cough, Shortness of breathing. Most of the people exposed to SO_2 are resulted Asthma and respiratory Diseases. In 1953, Amdur and co-workers examined the responses of men breathing up to 8 ppm SO_2 in one of the first controlled studies of humans exposed to air pollutants. They observed that SO_2 caused a change in respiratory pattern and that the effect was concentration dependent. The tolerance level of inhalation was individually different [10].

2. Nitrogen Oxide

Likewise others Nitrogen dioxide is a result of road traffic and other fossil fuel combustion processes.NO_2 reduce immunity of lungs infection and bronchitis. The major health hazard that is associated with NO_2 are increased incidence of lower respiratory tract infections in children and increased airway responsiveness in asthma patients. Study done by Neas, L. M et al shows Long-term exposure to NO_2, typically in homes with gas burning appliances, appears to be associated with increased susceptibility to lower respiratory tract illness [11].

3. Particulate Matter

PM_{10} is defined as particulate matter with a diameter of 10 micrometres or less. It could be inhalable dust, mist, or smoke. If it is biological, it may cause bacterial or fungal infection in the human body. It's an allergy. When particles such as asbestos and chromates are repeatedly absorbed by the human body, they cause cancer.

National Air Quality Index

Vehicle pollution, industrial dust, lead, and carbon monoxide are prominent polluters in cities. The data used in this study was obtained from secondary sources on the CPCB website. IIT Kanpur created the National Air Quality Index (AQI), which was launched in Delhi in September 2014 as part of the Swachh Bharat Abhiyan. There are six AQI categories: Good, Satisfactory, Moderate, Poor, Very Poor, and Severe, as well as eight contaminants groups. The Central Pollution Control Board approved of this.

Table No 1: AQI Codes

Sr No	Remark	Colour Code	Possible Health Impact
01	Good		Minimal impact
02	Satisfactory		Breathing discomfort to sensitive people
03	Moderate		Breathing discomfort to people with lungs, heart diseases
04	Poor		Breathing Discomfort to people with prolonged exposure
05	Very Poor		Respiratory illness of prolonged exposure
06	Severe		Affect healthy people and serious impact on health

Source: Central Pollution Control Board

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Pollution Level before Diwali Period in Five Metro Cities:

Pollution level before Diwali among five major metro cities is as shown in following tables and figure. It is observed that at all the locations in Aurangabad, values of PM_{10}, NO_2, SO_2 are within the permissible limits. For Nagpur values of PM_{10} at all the locations are very high than the permissible limits. Values of NO_2 and SO_2 are within the permissible limits. Maximum value of PM_{10} was 201.93 µg/m^3 which is two times the limit given by CPCB. In Mumbai values of PM_{10} were observed higher than the permissible limits. Though NO_2 and SO_2 were within given limits permissible limits. Among all five metro cities values of gaseous pollutants are more in Mumbai. For Nashik and Pune also values of PM_{10} are more than the permissible limits. But NO_2 and SO_2 at both the locations are safe. It is observed from the graph that maximum value of particulate matter is at Nagpur followed by Nashik and Mumbai.

TableNo2: Pollution at Aurangabad before Diwali

Location	Aurangabad		
Pollutant	PM_{10}	NO_2	SO_2
Station 1	95.2325	21.4875	4.96375
Station 2	99.665	16.465	16.82125
Average	97.44875	18.97625	10.8925

Table No 3: Pollution at Nagpur before Diwali

Location	Nagpur		
Pollutant	PM_{10}	NO_2	SO_2
Station 1	201.93375	31.335	52.4175
Station 2	173.845	30.02875	22.68375
Average	187.889375	30.68188	37.55063

Table No 4: Pollution at Mumbai before Diwali

Location	Mumbai		
Pollutant	PM_{10}	NO_2	SO_2
Station 1	166.3325	47.74625	6.11125
Station 2	117.4713	28.0775	12.72375
Average	141.9019	37.91188	9.4175

Table No 5: Pollution at Pune before Diwali

Location	Pune		
Pollutant	PM_{10}	NO_2	SO_2
Station 1	139.2788	52.865	1.6625
Station 2	137.8913	18.40375	3.425
Average	138.585	35.63438	2.54375

Table No 6: Pollution at Nashik before Diwali

Location	Nashik		
Pollutant	PM_{10}	NO_2	SO_2
Station 1	143.2243	9.721429	2.982857
Station 2	158.3175	35.3225	7.3575
Average	150.7709	22.52196	5.170179

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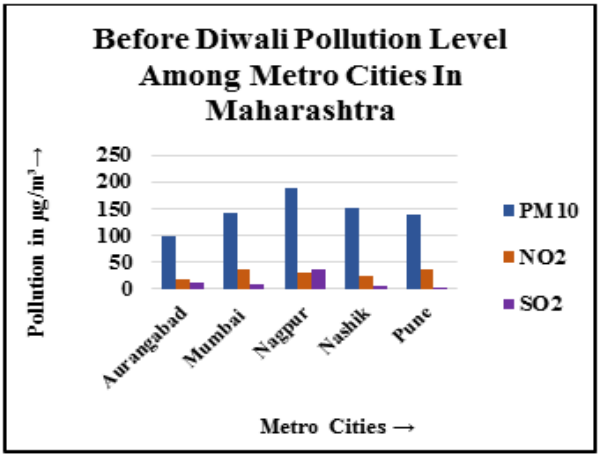
Figure No 1: Pollution before Diwali



Pollution Level after Diwali Period in Five Metro Cities:

Pollution level after Diwali among five major metro cities is as shown in following tables and graph. It has been observed that at all the locations values of PM_{10} is on higher side than permissible limit given by CPCB. It is alarming situation for all the metro cities in Maharashtra. In the Nagpur values of PM_{10} are two times more than the given limit. It has been also observed that there is rise in NO_2 and SO_2 also but they found within permissible limits. Maximum value of gaseous pollutant found at Mumbai. Maximum values of NO_2 was around 46 µg/m^3 and maximum value of SO_2 was observed to be around 20 µg/m^3. From the graph it is clear that maximum pollution of PM_{10} is at Nagpur. Nashik is at second position in terms of PM_{10} pollution and Mumbai is at third position. Pune and Aurangabad is at fourth and fifth position respectively.

TableNo7: Pollution at Aurangabad after Diwali

Location	Aurangabad		
Pollutant	PM_{10}	NO_2	SO_2
Station 1	162.0083333	18.64333333	5.535
Station 2	104.88125	23.08875	11.9675
Average	133.4447917	20.86604167	8.75125

Table No 8: Pollution at Nagpur after Diwali

Location	Nagpur		
Pollutant	PM_{10}	NO_2	SO_2
Station 1	226.62625	30.0375	32.6025
Station 2	189.4475	26.075	16.09875
Average	208.036875	28.05625	24.35063

Table No 9: Pollution at Mumbai after Diwali

Location	Mumbai		
Pollutant	PM_{10}	NO_2	SO_2
Station 1	178.59125	43.24875	4
Station 2	151.6025	45.60625	19.95
Average	165.096875	44.4275	11.975

Table No 10: Pollution at Pune after Diwali

Location	Pune		
Pollutant	PM_{10}	NO_2	SO_2
Station 1	124.72875	41.545	2.9225
Station 2	164.715	9.96125	1.24
Average	144.721875	25.753125	2.08125

Table No 11: Pollution at Nashik after Diwali

Location	Nashik		
Pollutant	PM_{10}	NO_2	SO_2
Station 1	158.16375	11.51375	3.1075
Station 2	213.3275	31.54375	7.58875
Average	185.745625	21.52875	5.348125

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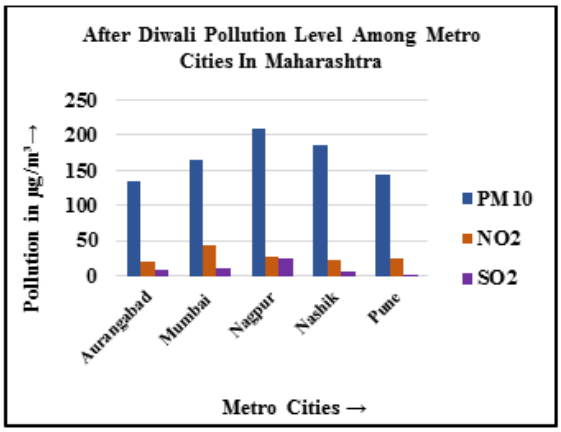
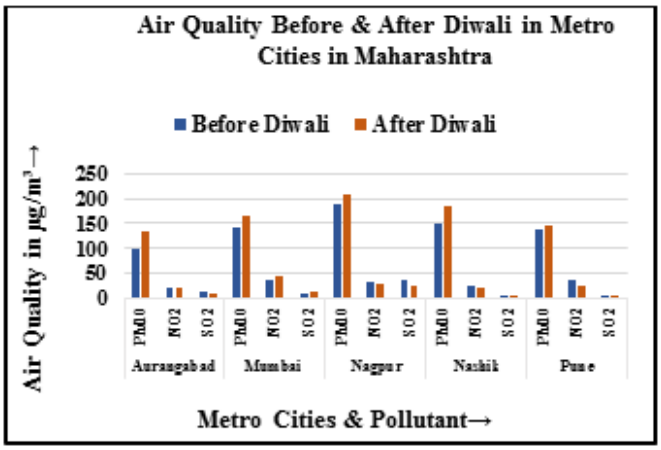
Figure No 2: Pollution after Diwali



Comparison of Pollution Level before and After Diwali Period in Five Metro Cities:
Pollution before and after Diwali is given in the following figure. It is clear from the graph that pollution of PM_{10} increases after Diwali. Maximum increased pollution of PM_{10} was observed at Nashik followed by Nagpur and Aurangabad. Already at all the locations except Aurangabd values of PM_{10} were more than the permissible limits after Diwali. It is concerned that these values may set as new bench mark for the new values in next Diwali.

Figure No 2: Pollution before and after Diwali



V. CONCLUSION

It is observed that there is rise in the pollution of particulate matter since last 10 years and we are putting new bench mark every year. Diwali is a festival of lights where entire nation enjoys fireworks and pollution increases. We treat this as new bench mark for next Diwali. According to our study, approximately rise in PM_{10} pollution is increase by 50 $\mu g/m^3$ in this year. Already all the cities have high value of PM_{10} pollution except Aurangabad before Diwali. And after Diwali all the locations are having PM_{10} pollution more than the permissible limit. If this continues it will be a threating situation for us and coming generation. It is also observed from the study that gaseous pollutants are also increasing but fortunately they are within the permissible limit for all metro cities. Finally it is concluded from the studies that individual and authorities should take care of the cities during Diwali with less use of fire crackers. Otherwise next generation will blame us for the worse conditions of the environment.

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REMOTE SENSING AND GIS BASED APPROACH FOR LULC CHANGE DETETCTION CASE STUDY OF VASHISHTHI RIVER WATERSHED

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ABSTRACT
Remote Sensing (RS) and Geographic Information System (GIS) are powerful approaches with extensive applications across various fields, including agriculture, urban planning and development, natural resource conservation, and disaster management, among others. The integration of RS and GIS facilitates a comprehensive understanding of Land Use Land Cover (LULC) change, its underlying factors, and its consequences. The Vashishthi River plays a crucial role as the primary source of irrigation and drinking water for the local communities. Moreover, it is renowned for its picturesque landscapes and holds great religious significance. The river flows through the prominent cities of Chiplun and Ratnagiri, covering an area of approximately 2,233 square kilometres. Nevertheless, the region encompassing the river, spanning approximately 2,163 square kilometers, is selected as study area. The selected land cover classes for LULC change detection include water bodies, built-up areas, barren land, and vegetation. However, the accuracy assessment, which gauges the reliability of the LULC maps for 2013 and 2020, reveals of 73.02% and 66.97%, respectively. This study holds practical value for future applications in the field of hydrological modelling.

Keywords: RS and GIS, LULC, Watershed, Accuracy Assessment

I. INTRODUCTION
LULC classification and change detection is accomplished through utilization of RS and GIS. In order to achieve sustainable natural resource management, it is imperative to comprehend and quantify landcover change processes [9]. [15]. Rapid resource depletion has altered the world's land surfaces and contributed to the ongoing advancement of human civilization and better living standards [2], [1].

The ability to identify changes on the Earth's surface at various scales is made possible by the availability of remotely sensed data and the ongoing advancements in its temporal, geographical, and spectral resolutions [10], [12]. The consequences of alterations in land use and land cover include diminished vegetation cover, which triggers a cascade of detrimental environmental effects. These consequences include changes in hydrological patterns, pollution of nearby natural ecosystems, degradation in their quality, biodiversity loss, climate change, and more [8], [5], [3]

Thus, in order to evaluate the effects of "from-to" transitions, planners must continuously monitor continuous changes. Assessment helps with policymaking and execution by facilitating the creation of alternative land use options. Furthermore, monitoring urban development provides substantial foresight by forecasting the size and location of future built-up regions [6], [7]. It is possible to classify LULC using supervised or unsupervised techniques.

An important stage in the processing of data from remote sensing is accuracy assessment or validation. It determines the generated data's informative value to the user [11]. Errors of commission, or the chance that a classified pixel will match the kind of land cover at its corresponding real-world location, are measured by the user's accuracy [4]. The degree to which actual land cover types may be accurately defined is determined by measuring errors of omission, or producer accuracy [14].

II. STUDY AREA
Over 2,233 square kilometres, including the river and its environs, are included in the Vashishthi River Watershed. It has an important function in maintaining the local communities since it flows through the well-known cities of Chiplun and Ratnagiri.

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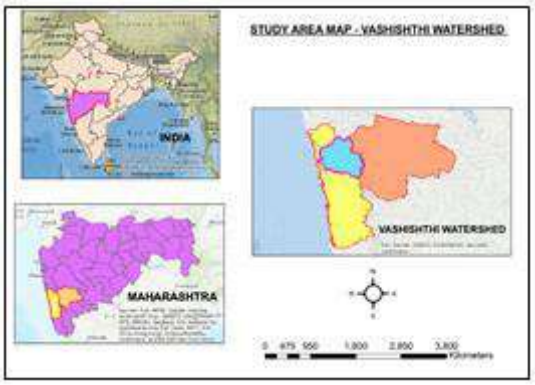

Fig 1: Study Area Map (Vashishthi Watershed)

The watershed is located at Latitude 17° 33' 05" N and Longitude 73° 26' 07" E. This watershed is distinguished by its varied landscapes, featuring agricultural lands, dense vegetation, urban zones, and water bodies. These attributes render it an ideal subject for the examination of LULC changes and their consequential effects.

III. DATABASE AND METHODOLOGY

LULC change detection is conducted utilizing RS and GIS methodologies. Landsat 8 satellite imagery and DEM datasets, accessible from United States Geological Survey (USGS) website, serve as the databases employed for geoprocessing in ArcMap.

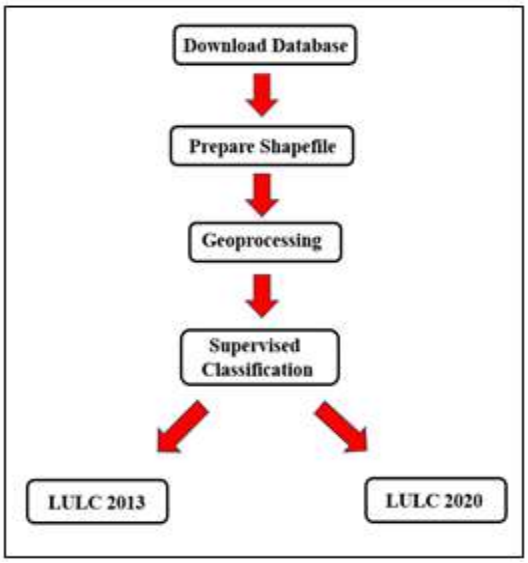

Fig. 2: Flowchart of Preparation of LULC Maps

The shapefile serves as a widely used vector file format across multiple GIS software. Different shapefiles can either be accessed or created specifically for a designated study area. Fig. 3 displays the DEM of the research region that was produced in order to make LULC maps. The creation of a shapefile typically necessitates a DEM, which is conveniently accessible through USGS.

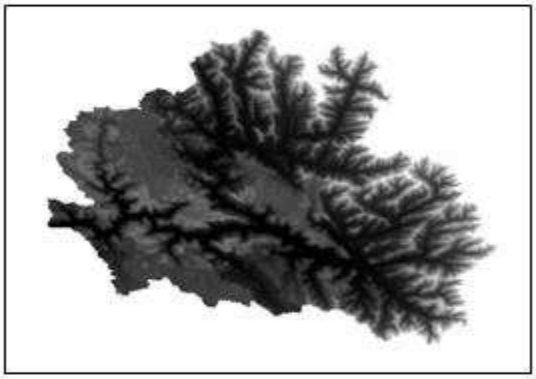

Fig. 3: DEM of Study Area

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Geoprocessing, present in GIS software, is utilized to exploit geographic data, involving operations like fill, flow direction, flow accumulation, watershed delineation, and others. This stage is essential in GIS to customize the model according to specific application requirements.

Image classification primarily utilizes two main methods: supervised and unsupervised classification. Due to its ability to produce more accurate and reliable results, supervised classification is the preferred method for LULC applications, as opposed to unsupervised classification.

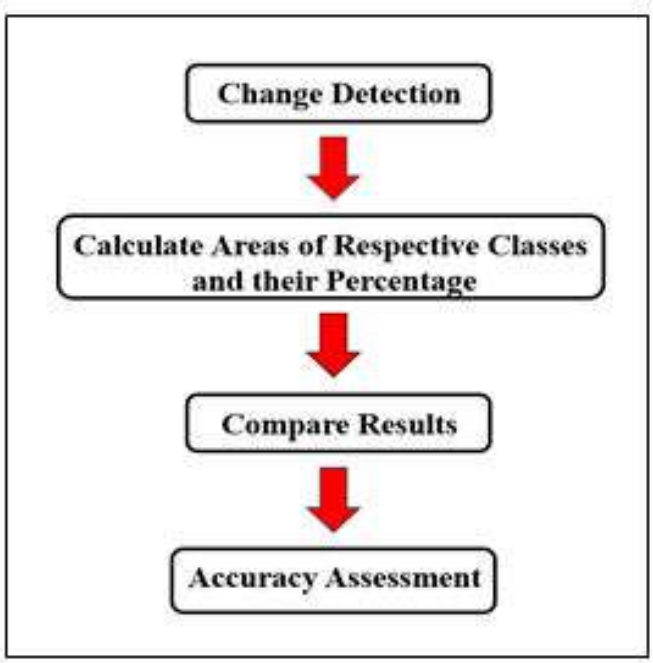

Fig. 4: Flowchart of LULC Change Detection and Accuracy Assessment

LULC change detection focuses on key classes such as water bodies, vegetation, barren land, and built-up areas. Detecting changes over time involves analysing the composition and modifications within classes. This process entails calculating variations in class structures and configurations to identify instances of change detection. The process involves comparing the percentage area changes for each class over time.

The accuracy assessment of classified results is conducted to ensure the reliability of the study. User accuracy is computed to assess the dependability of user-provided data and it is calculated by following formula:

User Accuracy =

$$\frac{(Correctly\ classified\ pixels\ in\ each\ class)}{(Total\ pixels\ in\ user\ category)} \times 100$$

Producer accuracy is determined to assess the reliability of reference data. (Google Earth Pro) and determined by following formula:

Producer Accuracy =

$$\frac{(Correctly\ classified\ pixels\ in\ each\ class)}{(Total\ pixels\ in\ producer\ category)} \times 100$$

Accuracy assessment is primarily conducted through two methods, namely the matrix error method and the kappa coefficient method. The kappa coefficient method is chosen for accuracy assessment because it provides precise results, especially in the context LULC change detection. The formula is as follows:

Kappa Coefficient = $\frac{(TS \times TCS) - \Sigma\ (Total\ User \times Total\ Producer)}{TS^2 - \Sigma\ (Total\ User \times Total\ Producer)} \times 100$

Where, TS = Total Samples

TCS = Total Classified Samples

Accuracy assessment comprises the ground truth validation, entailing the comparison between user values (dataset values) and producer values (ground truth) to evaluate and confirm the results.

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IV. RESULTS AND DISCUSSION

In Fig 5 and 6, changes in LULC classes over an 8-year period are depicted.

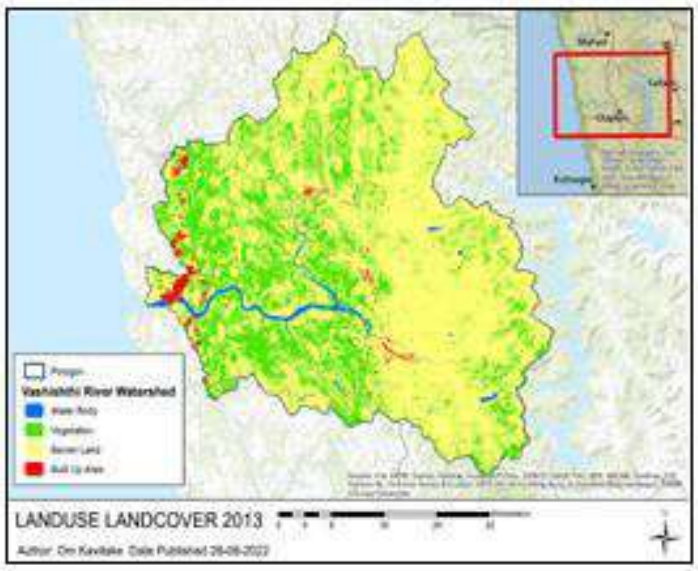
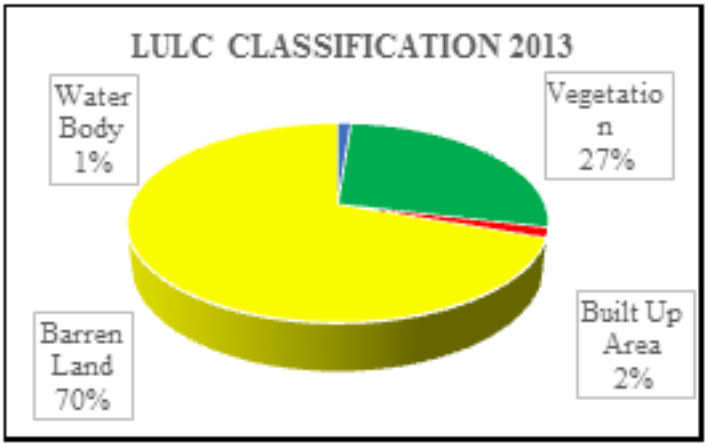


Fig. 5 LULC of Vashishthi Watershed (2013)



Graph 1: LULC Classification 2013

In the 2013 land use and land cover (LULC) classification graph, a predominant feature is the extensive coverage of barren land, accounting for approximately 70% of the total area. Vegetation follows closely behind, constituting 27% of the classified maps. Built-up areas make up a modest 2%, while water bodies account for 1% of the overall composition.

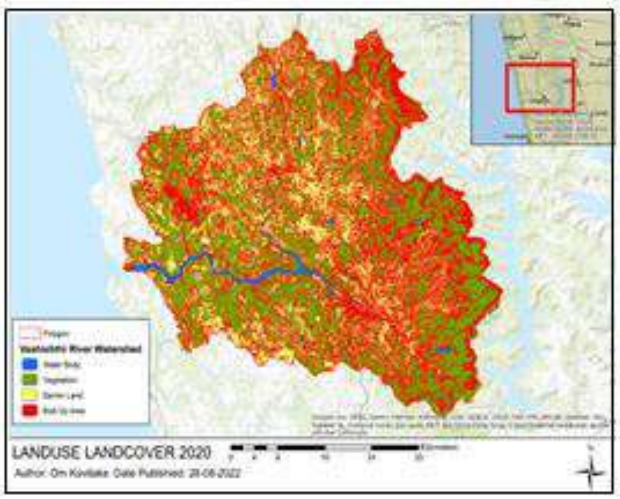


Fig.6 LULC of Vashishthi Watershed (2020)

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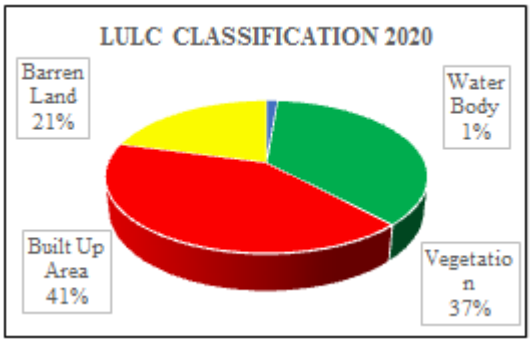

Graph 2: LULC Classification 2020

Graph 2 illustrates the Land Use and Land Cover (LULC) classification for the year 2020, showcasing a well-defined distribution of land categories. The predominant category is built-up areas, constituting approximately 41% of the total classified data. Following closely is vegetation, covering about 37% of the landscape, while barren land accounts for 21%. The smallest proportion is attributed to water bodies, making up approximately 1% of the classified data.

Table I: Lulc Change Detection

			2013		2020		Change Detection	
Object ID	Shape	Class Name	Area (Sq. Km)	Percentage (%)	Area (Sq. Km)	Percentage (%)	Area (Sq. Km)	Percentage (%)
1	Polygon	Water Body	25.97	1.2	29.02	1.34	3.05	0.14
2	Polygon	Vegetation	595.12	27.52	792.22	36.64	197.1	9.12
3	Polygon	Barren Land	1507.09	69.69	450.51	20.83	-1056.58	-48.36
4	Polygon	Built Up Area	34.29	1.59	890.64	41.19	856.35	39.6
Total			2162.47	100	2162.39	100		

Table II: User and Producer Samples Classification (2013)

	Water Body	Vegetation	Barren Land	Built Up Area	Total (User)
Water Body	13	0	0	0	13
Vegetation	1	11	0	0	12
Barren Land	0	3	7	0	10
Built Up Area	0	3	3	5	11
Total (Producer)	14	17	10	5	46

Table III: User and Producer Samples Classification (2020)

	Water Body	Vegetation	Barren Land	Built Up Area	Total (User)
Water Body	11	0	0	0	11
Vegetation	0	11	0	0	11
Barren Land	0	3	10	0	13
Built Up Area	1	6	2	4	13
Total (Producer)	12	20	12	4	48

Table I signifies that area under water bodies, vegetation, and built-up areas increased by 0.14%, 9.12%, and 39.6%, respectively. Additionally, there was a notable decrease of 48.36% in the area under barren land. Table II and III illustrate that the accuracy assessment for 2013, there were a total of 46 samples (TS), out of which 36 were correctly classified (TCS). Applying the kappa coefficient formula yielded an accuracy of 73.02%. Similarly, for 2020, there were 48 total samples, with 36 correctly classified, resulting in an accuracy of 66.97% using the same formula.

V. CONCLUSION

The findings of the accuracy assessment suggest positive trends in the growth of water bodies and vegetation, indicating an increase in water-holding capacity. This growth is likely to result in a reduction of runoff and discharge. The construction of weirs contributes to an augmentation in water body classes, while the increase in vegetation can be attributed, to a certain extent, to afforestation programs undertaken in the years 2017 and 2018. The recent surge in economic prosperity and a preference for a more luxurious lifestyle have resulted in real estate emerging as the most favoured investment option in coastal areas. Consequently, there has been a

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significant decline in barren land, and the escalation of construction activities has led to a substantial increase in built-up areas.

The reliability of the maps, falling within the acceptable range of 70 to 80%, enhances the credibility of the findings. These outcomes collectively highlight the significance of the study for future applications in hydrological modelling. Understanding the changing landcover, can contribute to more accurate and effective hydrological models. This information is crucial for sustainable water resource management and land-use planning, emphasizing the practical utility of the study's results in guiding further research and applications in the field.

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ANALYSIS AND DESIGN OF COMPOSITE BRIDGE AND THEIR DESIGN CRITERIA

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ABSTRACT
In the Gadchiroli district, I discovered remote villages like Krishnar Tola, Vasamundi, Marda, Jaller, Pushtolla, Laheri, and Allapalli facing severe transportation challenges, especially during the rainy seasons due to difficult terrain. The harsh conditions make it nearly impossible for heavy vehicles to access these areas. Recognizing this issue, the Indian government, in collaboration with the Public Works Department of Gadchiroli, initiated a transformative project known as the 'BAILY BRIDGE.' The BAILY BRIDGE project aimed to enhance transportation connectivity in challenging terrains by implementing composite bridge structures. Composite structures involve the integration of different components without compromising their individual engineering properties or structural behaviors. This innovative solution has proven particularly beneficial for villages such as Krishnar Tola and Vasamundi in Gadchiroli District. The implementation of composite bridges has provided viable transportation solutions, enabling smoother travel and accessibility to these remote areas. The government's strategic use of steel sections over concrete, bituminous roads over concrete, elastic bearings on bridges, and trusses in concrete showcases a collaborative approach, combining two or more structural components/materials while ensuring their safe load combinations.

Keywords: Dispersion edge, Tyre imprint/ impression, Overlap of dispersion, Deck Slab, Class 'A' Loading, IRC6, Impact Factor, stiffener.

I. INTRODUCTION
Composite construction involves the strategic combination of various materials such as timber, steel, concrete, and masonry to create robust building structures. One prevalent form of composite construction is the integration of steel and concrete, resulting in steel-concrete composite structures. Steel components possess notable tensile strength but are susceptible to buckling, while plain concrete elements endure high compressive forces but lack tensile strength. The incorporation of both materials in structures allows designers to leverage the strengths of each while mitigating their individual weaknesses.

The popularity of composite steel-concrete structures has grown significantly, particularly in tall buildings, where approximately 70% employ composite floor and column systems. The evolution of composite wall systems is also notable. Effective system design hinges on a comprehensive understanding of local and global buckling behavior.

While the principles of composite material design date back, advancements in the 1960s, facilitated by the advent of computers, marked a significant leap. Before computer processing capabilities allowed for extensive data analysis, composite material design relied on empirical methods like "netting" analysis and carpet plot techniques.

Recognizing the advantages of composite structures, the public works department is revising bridge design criteria to incorporate composite bridge standards. The inaugural bridge in Gadchiroli, situated in Potegaon on a village road, spans 55 meters without pair support. This research aims to analyze the seismic load conditions on this bridge according to IRC specifications and conduct a moving load analysis on the deck slab.

Bridges experience twelve main forces, including dead load, live load, water pressure, impact load, bouncy effect, thermal effects, wind load, seismic forces, longitudinal force, earth pressure, and centrifugal forces. This study specifically focuses on the deformation stresses induced by moving loads on the 55-meter span bridge without pair supports. Data collected from the construction process at the Potegaon site informs the analysis and assessment of the bridge's performance under various loads.

A. Experimental Data.
1) C/C of Bearing = 7.1m

2) Overall length of girder =55.6m

3) Type of super structure = 55.80 m

4) C/C of Girders = 11 m

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5) Outer to outer of superstructure=11.8 m

6) Projection of slab beyond =1.2 m

7) Clear carriageway = 7.5 m

8) Thickness of wearing coat = 0.065 m

9) Overall depth of Super structure=1.914 m

10) Depth of main plate girder =1.564 m

11) Number of bearing per span =5 Nos. at each end.

I. LEATERATURE REVIEW

Sr.No.	Research Papers Studied		
	Research Paper	**Author**	**Important Findings**
1	Soil Steel Composite Bridges Research Advantages and Application (2019)	Amir H. Wadi	Design professionals are consistently pushed by their counterparts to investigate the boundaries of design and explore various applications, especially in sloping terrains. The continual evolution of design methods demonstrates the industry's dedication to tackling emerging challenges and pushing construction practices forward to achieve improved performance and superior outcomes.
2	Optimal Design of Steel-Concrete Composite I-girder Bridges	Ali Kaveh, Mohammad Mahdi Motesadi Zarandi	This document focuses on the intricate optimization of steel-concrete composite I-girder bridges, a critical aspect in engineering owing to their substantial cost implications. By utilizing innovative meta-heuristic algorithms, namely Colliding Bodies Optimization (CBO), Enhanced CBO (ECBO), and Vibration Particle Comparative (VPS) analysis, our findings indicate that VPS demonstrates superior performance in comparison to CBO and ECBO during the evaluation process.
3	Application Of Composite Structures In Bridge Engineering. Problems Of Construction Progress And Strength Analysis (2014)	Kazimierz FLAGA Cracow Uninersity of Technology, Institute of Building Engineering, Poland	Over the course of several decades, the field of bridge engineering has witnessed the judicious utilization of steel-concrete composites, particularly in the construction of highway bridges. This emphasis on their use is rooted in the numerous advantages they offer, including considerations such as mass, damping properties, and overall longevity.
4	Analysis and Experiment Study of Continuous Beam Arch Composite Bridge (4-09-2014)	Jianrong Yang, Yu Bai, Xiaodong Yang and Yonghong Chen	3 dimension finite element analysis and full-scale testing are carried out on a newly-built continuous beam arch composite bridge. The 3D finite element model of the bridge is generated using a commercially available finite element package.
5	Study on Crack Resistance Steel Fiber reinforced self stressing Concrete in old bridge. (21-10-2008)	Boxin wang, Chengkui Huang	This research aims to enhance crack resistance in negative bending moments of old bridges using SFRSSC. Computer analysis on 5-span continuous T-beams reveals that SFRSSC's expansive action reduces internal forces in negative bending moments. Experimental results from 5 composite concrete specimens support these findings.

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A. Calculation

Consider section 1-1

The load dispersion of the Tyre imprint / impression Can be considered @ angle of 45° throughout the depth of slab and evaluate by using equation

B eff. = B1 +2 (D + w. c) = 20+2 (0.8 +0.060), B eff. @ 1 = 21.72 m, Thus, B eff. @ 2 = 21.72m

Thus position @ bearing is too small nearly equals to 0.04 it Can be Considered to be loaded

Thus,

B•eff. = Shoulder/ kerb/ Roadways + B. eff@ (1,2) = 1.20 + 21.72= 22.92m

B. Dispersion overlap

If (C/c distance between axial load) / 2 < B.eff. / There is an overlap of dispersion @the Deck Slab

Effective Width of Dispersion

Consider Section 2-2, The effective width of a dispersion of a single wheel as per IRC 21:2000, Pg. 52

W.eff.= $\alpha \cdot x \left(1 - \frac{x}{Leff}\right) + bw$

where,

x → Distance of the Centre of gravity of Concentrated load nearest Support

$Leff$ → Effective depth

α → Constant depending upon $\frac{L \text{ of Span}}{W \text{ of Span}}$

bw → Width of Concentrated load Area

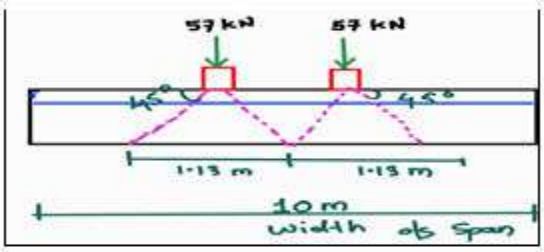
from IRC-21:2000 Pg. 53, Table 1

= 2.60, W.eff =5×21.72(1- 21.72) = 61.71,

Now, Bw = 0.5 +2(0.060) = 0.62m,

W.eff = 2.60x21.72 (1-21.72/55) + 0.62m

= 34.79m



check for the dispersion overlap

It (C/c distance between the axial load) / 2 < W•eff / 2# Dispersion @ bottom of the deck Slab

Here, W.eff. / 2 = 11.90 / 2 = 5.95 (C/c Axial load / 2 = 0-6) , W.eff. / 2 > 0.6

It means, there is Overlap Occurred

Same as, W.eff ① = W.eff ② = 34.79m

Check for the dispersion overload, It (C/c distance between the axial load) / 2 < W•eff /2 =55/2 > 34.79 / 2, 7.5 > 17.40 (The overlap is not occurs)

C. Impact Factor for Class 'A' Loading

as per IRC6, Pg.22 and Clague 211.2 impact factor is given by Equation

I.F.= 4.5 / 6+ L.eff = 4.5 / 6+55 = 0.073,

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Intensity of distributed load (1) Can be evaluated using following equation

I= I.F. x Axial Load/Area under Influence load

Live Load and Share force to obtain maximum Share force the wheels are adjusted in such a manner that the dispersion edge just touches the support,

B.eff ② and ① shall be 1.13 m, I (Intensity) = 1.073 x4×57 / 55.3 x 8.8 = 502.72 KN/m ^ 2 /m

Total effective length

=1-2+13+13+13+1.2=41.4m

class A vehicle loading

axle load (ton)	ground contact area	
	b (mm)	w (mm)
11.4	250	500
6.8	200	380
2.7	150	200

A. Intensity of Distributed Load

I = I.F. X axial load / Area under Influence of load

= 0.28× (114 x 39) / 2.33 X 39

= 13.69 KN/m ^ 2/m

E. Live Load and Share Force

To obtain maximum share farce the wheel are adjusted in such a way that the dis-persion edge just touches the support

(B.eff @ 1 and 2) shall be 1.13 m

Thus, B.eff. total = 1.13 +1.20 = 2.33 m.

Design Constrains for M25 Concrete and fe415 steel (from IRC 21)

m = modular ratio = 10 ..... (p.g 18,Table 9) ,

N = Neutral Axis Constant = N = 0.294

J = 1 - N / 3 = 1- 0.294 / 3 = 0.902 , Q = Moment of Resistance Constant Q = 1.104 BM(max)

= B.M. (d.l) + B.M. (I I)

= 8061.62 +65.71 =8127.33 KN / m ^ 2 / m

Total S.F. (max) = S. F @D.L + S. F @ L- = 586.3 kN+ 1281.34 = 1867.64 KN /m ^ 2 / m

III. CONCLUTION

Slab Design

Effective depth required (D.eff)

= $\sqrt{\frac{B.M.(max)}{b \times Q}}$

= $\sqrt{\frac{8127.33 \times 10^6}{1200 \times 1.104}}$

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$$= \frac{B.M.(max)}{\sigma_{st} \times j \times d_{eff}(Provided)}$$

= 219 mm also Considered as 250 mm which is corrected

Area of longitudinal reinforcement(A.st.) = B.M. (max) A.St j x D.eff. (Provided)= 8127.33 x 106/200x0.902 x 250,

Ast = 180206.87 mm2

Distribution Steel should be designed for bending moment = 0.3 x B.M. @ LL +0.2 x BM@DL = 0.3 x 65.71 + 0.2 x 8061.62 = 1632.037 KN./M

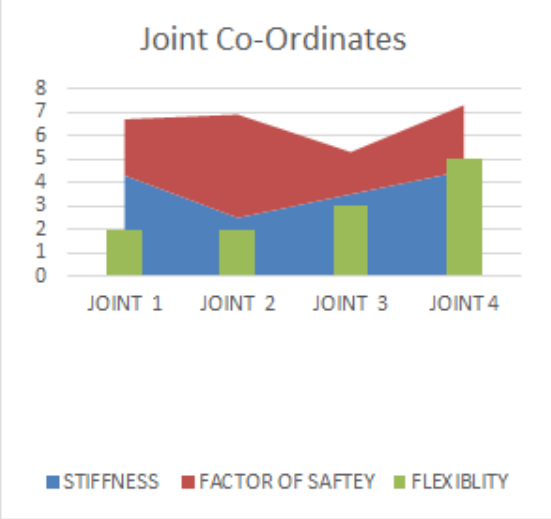
Effective depth available in the width wise direction with 12 mm dia. bar = D.eff. provided - dia. longitudinal bar / 2 - dia. distribution bar / 2

According to the data and given load transformation cross-checked in Staad Pro and we found a Positive response to the Above Calculations.

direction	factor
y	-1.000

IV. RESULT

Members	Joints at various Instant	Moving average	Average load
9	4	12	0.500
10	5.0001	1.5	0
11	7.0000	1.5	0
12	0	0	0
13	0	0.500	0
14	5.0000	10	o
15	6.0000	10	0
16	6.0000	8.000	0
17	7.0000	8.000	0
18	12	0	10.8
19	12	0.500	10.8
20	5.0000	1.5	10.8
21	7.0000	1.5	10.8
22	0	0	10.8
23	0	0.500	10.8
24	5.0000	10	10.8
25	6.0000	10	10.8
26	6.0000	8.000	10.8
27	7.0000	8.000	10.8



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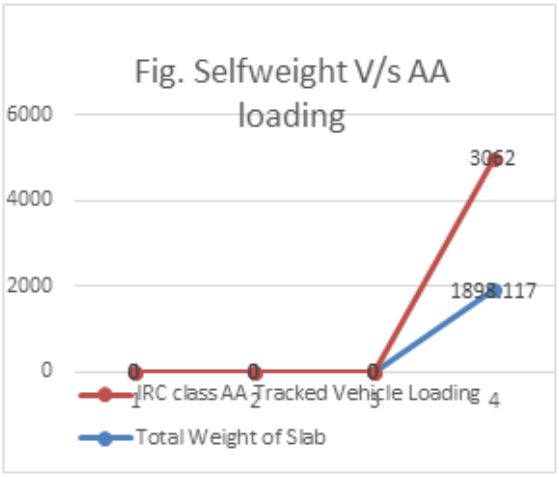

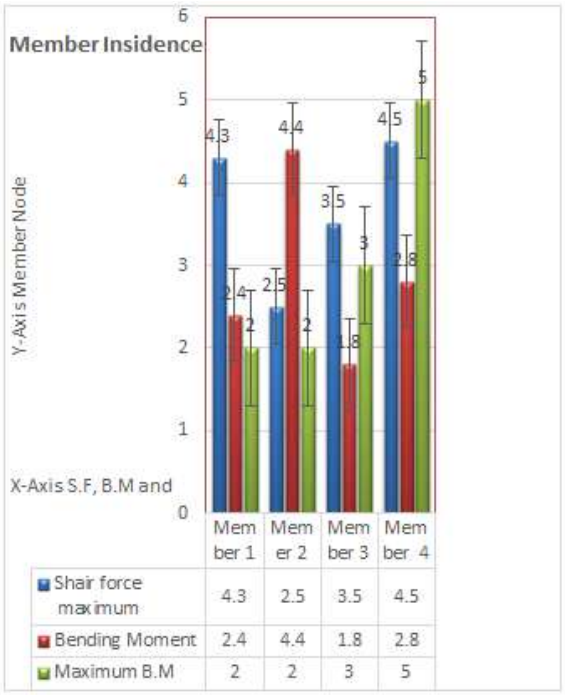

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EFFECT OF GRAPHENE OXIDE IN CEMENT MORTAR AND ITS STRENGTHENING MECHANISM

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ABSTRACT
In the present study, the effect of water-dispersed powder Graphene Oxide (GO) nanoparticles on cement mortar and its mechanical Strength after 3, 7 and 28 days of Curing is analysed. These properties were studied by adding 0.00 w/w% ,0.03 w/w%,0.05 w/w%,0.07 w/w% of cement to Obtain Compressive strength and tensile strength of cement mortar. It observed that for 0.03% w/w of cement addition increase in compressive strength is 23.07%, for 0.05% w/w of cement addition increase in compressive strength is 35.59%, and for 0.07% w/w of cement addition increase in compressive strength is 31.52% after 28 Days of curing. Tensile strength analysis for 0.03% w/w of cement addition increase in Tensile strength is 4.46%, for 0.05% w/w of cement addition increase in Tensile strength is 34.70%, that for 0.07% w/w of cement addition increase in Tensile strength is 37.45% after 28 Days of curing. By the addition of different proportions of graphene oxide, the compressive strength increases till the addition of 0.05 % w/w of cement slightly decreases. For tensile strength with addition of graphene oxide the tensile strength is increased.

Keywords: Graphene oxide, Cementous material, cement mortar, mechanical properties, compressive strength.

1.0 INTRODUCTION
The development ecosystem has grown rapidly over the past few years. The construction industry is an evergreen industry that adapts to changing business needs. Cement-based materials have played an important role in the construction industry. However, conventional cement-based products have the disadvantage of hardness and high brittleness and cause cracking, affecting the performance and life of the product. On the other hand, cement production is encouraged by destroying the environment. The main challenge for sustainable development in the next decade is to design and produce less clinker concrete with lower CO_2 emissions, and to be more reliable and durable. Energy consumption and carbon dioxide emissions in cement production constitute 5% of the world's industrial energy consumption and 5% of the world's greenhouse gas emissions, respectively.[1]

Graphene oxide (GO) properties and structure are similar to graphene. A hexagonal network of carbon atoms with hydroxyl and epoxy groups in the fundamental plane and SP^2 and SP^3 hybrid orbitals consisting of carbonyl and carboxyl groups at the edges.[2]

Graphene oxide (GO) is a graphene derivative with a large surface area and excellent thermal conductivity and mechanical strength, and its surface has a large number of active oxygen groups such as hydroxyl, carboxyl and epoxy groups.[3] Cement mortar composites are widely used in masonry, plastering, repair of damaged stone, patching or filling, plastering, floor levelling and development of prefabricated products. Of all its materials (cementitious materials, water, coarse and fine aggregates), cement has the largest CO_2 emissions and energy consumption.[4]

The objective of the present study is to Investigate the effect of graphene oxide (GO) on Mechanical properties (Compressive Strength, Tensile Strength).

2.0 MATERIALS AND MIX PROPORTION

2.1 Cement
Cement is a fine aggregate that is often used for bonding in concrete mixes. In this study, UltraTech cement of OPC 53 grade was used. The cement of OPC 53 grade is shown in below Figure 1

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Fig.1 UltraTech cement of OPC 53 Grade

2.2 Fine Aggregate

Use fresh local sand without organic matter as per IS 456-2002. The particles were passed through an IS 4.75 mm sieve. These are used to fill the air spaces in the concrete mix and the quality mix used in the study is shown in Figure 2 below.

Fig.2 Fresh Local Sand

2.3 Water

The quality of the water is important because impurities can affect the strength of the concrete and cause corrosion of the steel reinforcement. The water used in the production and maintenance of the stone should be very clean and should not contain oil, acid, alkali, salt, sugar, silt, organic matter and other substances that damage the stone. Therefore, drinking water was used for mixing and purification in this study.

2.4 Graphene Oxide

Graphene oxide (GO) is an oxidized form of graphene. It is an atomic layer produced by the oxidation of graphite and is inexpensive and readily available. Graphene oxide is easy to process because it can disperse in water and other solvents. The graphene oxide used in this study is shown in Figure 3.

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Fig.3 Graphene oxide (GO) (brand: vedayukt india private limited)

MATERIAL PROPORTION OF MORTAR

Mix Proportion (1: 3)

CEMENT	SAND	WATER	GO % W/W of Cement
3.10 kg	7.76 kg	1.302 kg	0%
3.10 kg	7.76 kg	1.302 kg	0.03%
3.10 kg	7.76 kg	1.302 kg	0.05%
3.10 kg	7.76 kg	1.302 kg	0.07%

3. EXPERIMENTAL WORK

3.1 Mixing of Mortar

Fig.4 Mixing of Mortar

In this study, the GO variable was used to create the model. These composites were divided into 0% w/w GO cement, 0.03% w/w GO cement, 0.05% w/w GO cement and 0.07% w/w GO cement. Measure the amount of material needed depending on the particular design and mix them to form the mortar.

3.2 Casting of the Specimens

For the compression test, a standard cubic mold measuring 70.7 mm x 70.7 mm x 70.7 mm is used for testing purposes. A mold sample is used for the tensile test.

3.4 Curing of the test Samples

The test samples are cured for 3 days, 7 days and 28 days in curing tank to check the strength values for cubes.

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3.5 Compressive Strength

In this study, the compressive strength of concrete containing 0% GO, 0.03% 3% GO, 0.05% GO and 0.07% GO was measured after 3, 7 and 28 days of curing. Compressive strength is measured using a UTM machine.

3.6 Tensile Strength

Tensile strength of 0% GO, 0.03% 3 GO, 0.05% GO and 0.07% GO samples cured for 7 days and 28 days were measured. The tests were done on a tensile testing machine (Vertex Cement Tensile Testing Machine)

4 RESULTS AND ANALYSIS

4.1. Compressive Strength

The compressive strength of the mortar is measured in cubes. In the study, 0% 0.03%, 0.05%, 0.07% GO mixture treated on the 3rd, 7th and 28th days was started to be used. Measure compressive strength using a CTM machine

Table 4.1.1: Compressive strength of cubes at 3 days

Sr no.	Proportion of GO	Strength (N/mm^2)	
1	0%	17	
2	0%	16.6	16.53
3	0%	16	
1	0.03%	16.60	
2	0.03%	16	15.86
3	0.03%	15.4	
1	0.05%	18.20	
2	0.05%	16	16.5
3	0.05%	15.40	
1	0.07%	17.5	
2	0.07%	16	17
3	0.07%	17.5	

Table 4.1.2: Compressive strength of cubes at 7 days

Sr no.	proportion of GO	strength (N/ mm^2)	
1	0%	19.6	
2	0%	19.2	19
3	0%	18.20	
1	0.03%	20.41	
2	0.03%	26.60	23.73
3	0.03%	24.21	
1	0.05%	32.41	
2	0.05%	29.80	30.34
3	0.05%	28.81	
1	0.07%	28.01	
2	0.07%	24.41	27.41
3	0.07%	29.81	

Table 4.1.3: Compressive strength of cubes at 28 days

Sr no.	proportion of GO	strength (N/ mm^2)	
1	0%	40.21	
2	0%	37.81	40.41
3	0%	43.21	
1	0.03%	48.81	
2	0.03%	45.61	48.34
3	0.03%	50.61	
1	0.05%	57.81	
2	0.05%	51.81	54.47
3	0.05%	53.81	
1	0.07%	52.01	
2	0.07%	45.01	48.01
3	0.07%	47.01	

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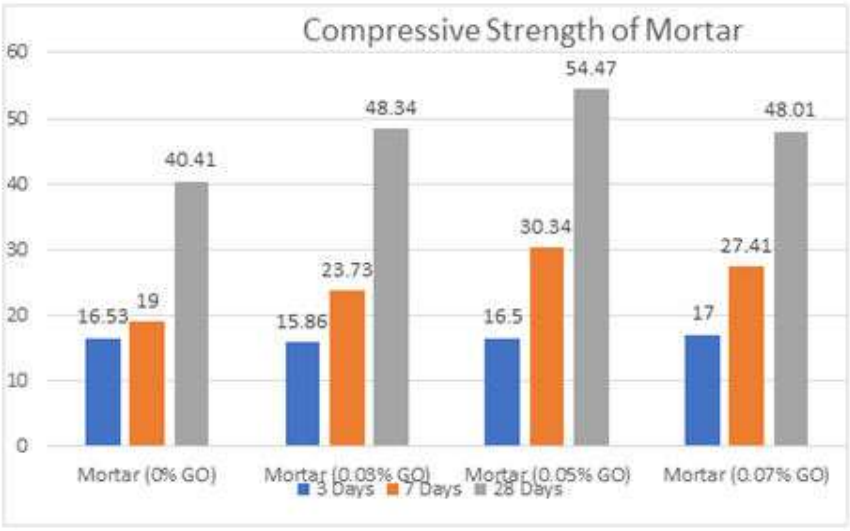

Fig. 5 Compressive Strength of mortar

4.2 Tensile Strength

The tensile strength of the mortars was measured on specimens with 0%, 0.03%, 0.05% and 0.07% GO added and cured for 7 days, 14 days and 28 days.

Table 4.2.1: Tensile strength of cubes at 7 days

Sr no.	proportion of GO	Strength (kg*10)	KN/mm^2
1	0%	13.54	
2	0%	13	2.02
3	0%	13.31	
1	0.03%	14	
2	0.03%	15	2.24
3	0.03%	15.19	
1	0.05%	16.19	
2	0.05%	17.5	2.62
3	0.05%	18	
1	0.07%	18.75	
2	0.07%	19.4	2.89
3	0.07%	18.86	

Table 4.2.2: Tensile strength of cubes at 28 days

Sr no.	proportion of GO	Strength (kg*10)	KN/mm^2
1	0%	19.5	
2	0%	18.75	2.91
3	0%	19.16	
1	0.03%	19.8	
2	0.03%	20	3.04
3	0.03%	20.17	
1	0.05%	24.8	
2	0.05%	25.7	3.92
3	0.05%	26.84	
1	0.07%	25.8	
2	0.07%	26.1	4
3	0.07%	27.01	

Table 4.2.1: Compressive strength of cubes at 28 days

Sr no.	proportion of GO	strength (N/m2)	
1	0%	17	
2	0%	16.6	16.53
3	0%	16	

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1	0.03%	16.60	
2	0.03%	16	15.86
3	0.03%	15.4	
1	0.05%	18.20	
2	0.05%	16	16.5
3	0.05%	15.40	
1	0.07%	17.5	
2	0.07%	16	17
3	0.07%	17.5	

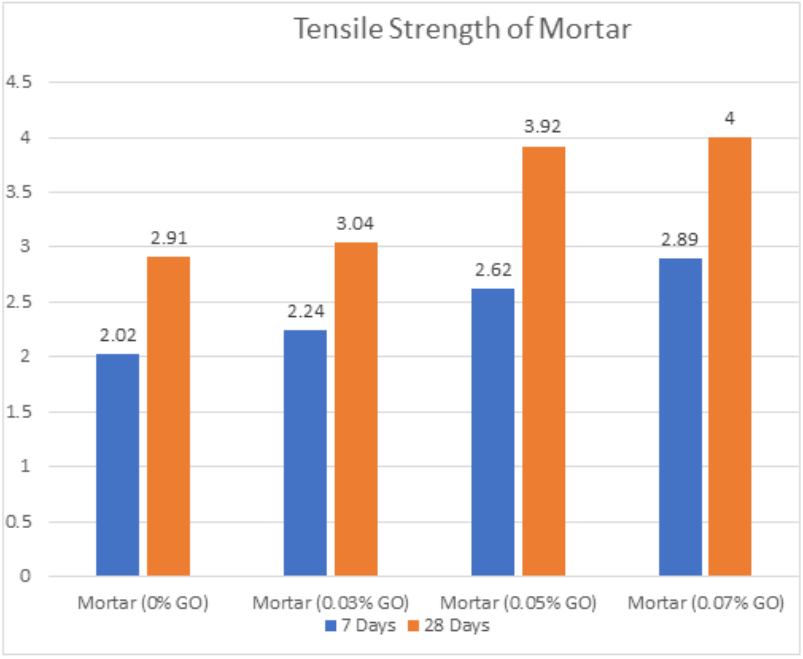

Fig. 6 Tensile Strength Of mortar

The effect of GO on the fresh mortar and on the cement samples was investigated through the methods presented in the previous section. The results are summarized as follows.

• Compressive Strength

Determining compressive strength after 3, 7 and 28 days of curing. Graphene oxide increases the early compressive strength after 3 and 7 days, but less so after 28 days of treatment. In addition, the compressive strength of 0.05% graphene increased by 35% after 28 days, while the compressive strength of 0.07% graphene increased by 31% after 28 days. This shows that the best improvement in compressive strength is in 0.05% w/w cement.

Henrik et al.,2018 The compressive strength of 0.2% graphene decreased by 8% after 28 days, but the addition of 2% superplasticizer 2.0% increased by 7% after 28 days.

(Chintalapudi et al., 2021) Addition of Graphene Oxide in cement increases compressive strength at optimum dosages. An average increase in compressive strength of 28.5% and 46.4% of GO dosages 0.02%, and 0.03% dosage respectively was observed at 28 days of curing.

• Tensile Strength

The tensile strength is calculated after 7 and 28 days of curing. Add of 0.05%,0.07% % graphene oxide, the strength gradually increased 34%, 36% after curing for 28 days.

(Li X, 2017) Tensile splitting Strength was improved by around 15%. In a microstructural investigation, the interfacial transition zone in cement mortar was found to be denser due to the addition of graphene oxide.

CONCLUSIONS

- In general, graphene oxide can be used as an additive to cement products due to its unique properties.
- Graphene oxide creates a good relationship with the cement matrix and increases the interaction between graphene oxide and cement products. This increases the compressive strength of the mortar

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- The optimum strength increased is observed at 28 days of curing with 0.05% adding GO by weight of Cement.
- The addition of graphene oxide also improves the hydration process of the cement, which makes the microstructure denser and improves the overall properties.
- The nanoscale nature of graphene oxide particles enables them to fill the voids in the cement matrix, thereby reducing porosity and increasing strength
- Adding graphene oxide to cement mortar is also an acceptable property to affect the tensile strength of materials widely has been researched.
- With its excellent properties, graphene oxide shows promise in increasing the tensile strength of various material, including cementitious composites.
- Addition of graphene oxide to cement mortar should improve properties such as compressive strength, flexural strength and toughness. The addition of GO can improve the overall durability and performance of cement products.
- GO has hydrophobic properties that can increase the water resistance of the cement mortar.
- Addition of Graphene Oxide reduces the growth of cement mortar. This effect is due to the ability of GO to seal microcracks and improve the relationship between them, thereby increasing the material's resistance to cracking and propagation.
- Cost-effective production processes and energy-efficient synthetic processes are being explored to make the GO industry more efficient.

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COMPARATIVE STUDY OF MULTI-STOREY BUILDING WITH AND WITHOUT SHEAR WALL BY USING STAAD-PRO SOFTWARE

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ABSTRACT
A shear wall is a vertical structural element that resists lateral forces in the plane of the wall through shear and bending. A shear wall building is in no way different from an ordinary framed building. However, it differs significantly when it comes to transference of lateral load. Shear wall are vertical stiffening element designed to resist lateral force exerted on a building by wind or earthquakes. When shear walls are provided at a proper location in a building they can prove to be very efficient at the same time they can act as a partition wall. It is important to select a position of shear wall that will offer the best resistance against the lateral forces. And the design of shear wall is very complicated and time consuming. For these reason structural software's plays an important role in design and construction of high rise structure. In this study, the results are compared by placing shear wall at different locations in same software for the same model. The results are compared on parameters such as displacement, storey drift, bending moment, shear force by using analysis and design software STAAD PRO.

From this study after getting results from all types of analysis, it is clear that location of shear wall is an important factor and model with corner shear wall is best suited than other models for same loading conditions.

Keywords: Shear wall, analysis, displacement, storey drift, bending moment, shear force.

VII. INTRODUCTION

1.1 GENERAL

In the present situation land scarcity and increasing cost of land is the major problem in big cities that we are facing which has led to advancement in construction techniques and with urbanization, high-rise construction has become a necessity. With the increase in height of building lateral forces on these structure also increases, and poses challenges for seismic design so these buildings are needed to be properly designed for these forces, or else it may lead to the failure of the structures. To overcome these lateral forces the beams and column should be design with rigidity and larger in size which directly increase the cost of a building. For economic seismic design the concept of shear wall was introduced.

A shear wall is a vertical structural element that resists lateral forces in the plane of the wall through shear and bending. A shear wall building is in no way different from an ordinary framed building. However, it differs significantly when it comes to transference of lateral load. Shear wall are vertical stiffening element designed to resist lateral force exerted on a building by wind or earthquakes. Columns are compression elements whereas shear wall is compression as well as shear resisting elements. Shear walls are usually provided along both length and wide of buildings. Shear walls are like vertically-oriented wide beams that carry earthquake loads downwards to the foundation. The thickness can be as low as 150mm, or as high as 400mm in high rise buildings (depends on structure). If the ratio of length to the breadth is less than 4mm then it is considered as shear wall. Columns are line loaded elements and shear wall is area loaded elements.

When shear walls are provided at a proper location in a building they can prove to be very efficient at the same time they can act as a partition wall. It is important to select a position of shear wall that will offer the best resistance against the lateral forces. Building considered for a project is a G + 10 residential building situated in seismic zone III which is highest zone in Maharashtra. Building is modelled by using STAAD Pro software.

1.2 Objective

1. To compare the RCC building without and with shear wall in software.
2. To study the behaviour of shear wall in earthquake zone area at different locations.
3. To compare the values displacement, story drift, bending moment and shear force.
4. To learn various aspects of structural software generally used in civil engineering.

VIII. CODAL PROVISIONS

Building Undergo complex earthquake behaviour and hence damage, when they do not have lateral force resisting systems oriented along two plan directions that are orthogonal to each other. A building is said to have

non-parallel system when the vertically oriented structural systems resisting lateral forces are not oriented along the two principle orthogonal axes in plan.

Building with non-parallel lateral force resisting system shall be analysed for load combinations mentioned in clause **6.3.2.2** and **6.3.4.1** of IS-1893 part-I 2016

IX. METHODOLOGY

In this study, a G+10-storey building with grid size 3.5 m x 3.5 m is considered. The number of grids in X direction is 5 and in Y direction is 10 as shown in fig.4.1.The total plan size is 17.5 m x 35 m. This building is designed in compliance to the Indian Standard code of practice for seismic resistant design of building IS1893-2002. The buildings are assumed to be fixed at the base and the floors acts as rigid diaphragms. The height of Ground floor is 4.5m and above the ground is 3.5m. The Depth of foundation is 2.5 m. Building is modelled using the STAAD Pro software. Four models are studied with different positioning of shear wall with different location in the building. Models are studied for zones III comparing lateral displacement, story drift, shear force and bending moment zones for all models.

3.1 STRUCTURAL CONFIGURATION

- Type of frame : Special RC Moment Resistant Frame fixed at the base
- Ground Floor height : 4.5 m
- Above ground floor 3.5 m each story
- Thickness of slab : 130 mm
- Size of Beam : (300x350) mm
- Size of column : (450x500)mm
- Materials : M30 concrete, Fe415 steel
- Thickness of shear wall : 230 mm
- Thickness of outer brick wall: 230mm
- Thickness of inner brick wall: 115mm
- Density of brick wall : 19.2 KN/m^3

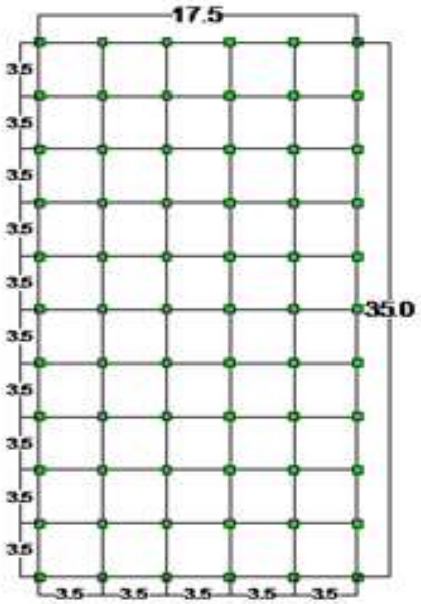

Fig 3.1 Plan

3.2 LOADING DETAILS

- Live load on floor is 3 KN/m^2
- Roof live load is 1 KN/m^2
- Floor finish is 1 KN/m^2

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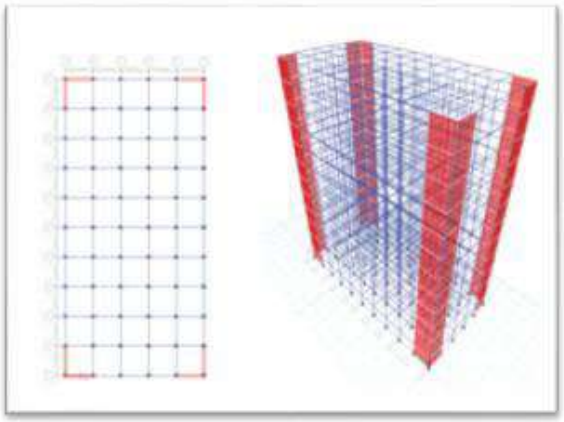
- Wall Load Intensities at ground floor 19.872 KN/m ,9.936 KN/m
- Wall Load Intensities at upper floors 15.456 KN/m , 7.728 KN/m
- Wall Load Intensity at parapet wall 3.97 KN/m

3.3 LOAD COMBINATION AS PER IS 1893-2002

1) 1.5 (DL+LL)
2) 1.2 (DL+LL+EQX)
3) 1.2 (DL+LL-EQX)
4) 1.2 (DL+LL+EQY)
5) 1.2 (DL+LL-EQY)
6) 1.5 (DL+EQX)
7) 1.5 (DL-EQX)
8) 1.5 (DL+EQY)
9) 1.5 (DL-EQY)
10) 0.9 DL+1.5 EQX
11) 0.9 DL-1.5 EQX
12) 0.9 DL+1.5 EQY
13) 0.9 DL-1.5 EQY



X. EXPERIMENTAL RESULTS

4.1RESULTS

4.1.1 Displacement in X and Y Direction

Table 4.1 Displacement in X Direction in Mm

Sr no.	Without	Centre H	Side	Corner
0	2.465	0.802	1.453	0.504
1	12.97	4.383	7.555	2.165
2	20.004	7.144	11.666	3.742
3	26.691	10.116	15.566	5.555
4	33.215	13.256	19.36	7.517
5	39.492	16.454	23	9.541
6	45.388	19.618	26.411	11.563
7	50.742	22.665	29.502	13.526
8	55.374	25.525	32.159	15.279
9	59.085	28.129	34.277	17.058
10	61.691	30.337	35.75	18.509
11	63.214	32.161	36.598	19.855

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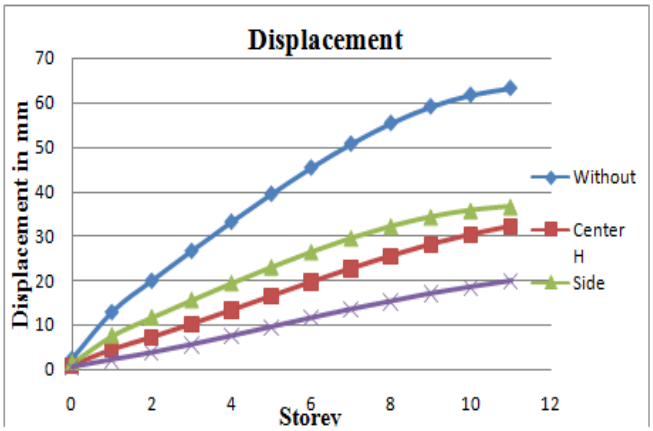

FIG.4.1 DISPLACEMENT IN X DIRECTION

From the above graphs it is observed that Displacement in X Direction is Maximum in Model Without Shear Wall whereas it is Minimum in Model with Corner Shear Wall.

Table 4.2 Displacement in Y Direction In Mm

Sr no.	Without	Centre H	Side	Corner
0	2.606	0.446	0.394	0.507
1	13.671	2.525	1.878	2.115
2	20.664	4.296	3.225	3.663
3	27.265	6.337	4.795	5.443
4	33.67	8.541	6.506	7.355
5	39.794	10.822	8.293	9.319
6	45.509	13.105	10.101	11.264
7	50.655	15.239	11.883	13.144
8	55.055	17.444	13.602	14.908
9	58.51	19.413	15.237	16.524
10	60.822	21.228	16.769	17.967
11	62.002	22.693	18.117	19.29

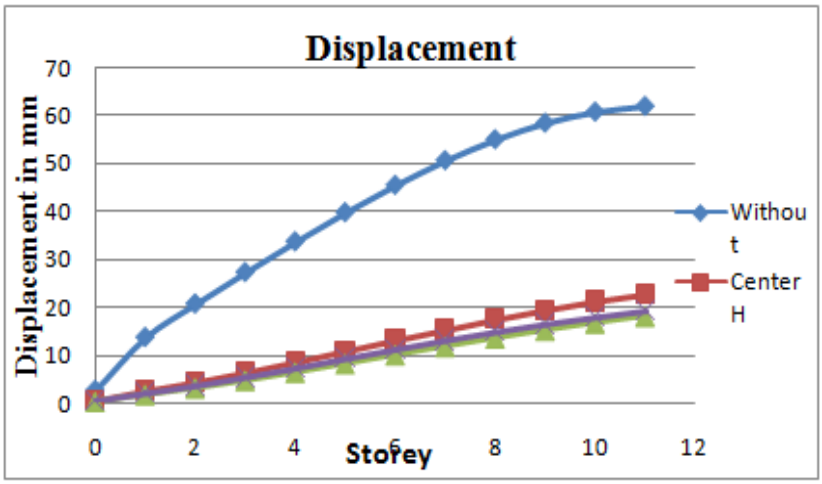

FIG.4.2 DISPLACEMENT IN Y DIRECTION

From the above graphs it is observed that Displacement in Y Direction is Maximum in Model Without Shear Wall whereas it is Minimum in Model with Side Shear Wall.

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4.1.2 Storey Drift in X and Y Direction

Table 4.3 Storey Drift In X Direction in Mm

Storey	Without	Centre H	Side	Corner
0	0.1694	0.0645	0.102	0.0288
1	0.6974	0.025	0.0392	0.0143
2	0.4665	0.021	0.0251	0.0127
3	0.4461	0.0217	0.025	0.0139
4	0.435	0.0222	0.0242	0.0147
5	0.4184	0.0225	0.0231	0.015
6	0.3931	0.0223	0.0214	0.0151
7	0.357	0.0218	0.019	0.0149
8	0.3088	0.0212	0.016	0.0144
9	0.2475	0.0203	0.0122	0.0134
10	0.1739	0.017	0.0078	0.0111
11	0.1005	0.0052	0.0044	0.0041

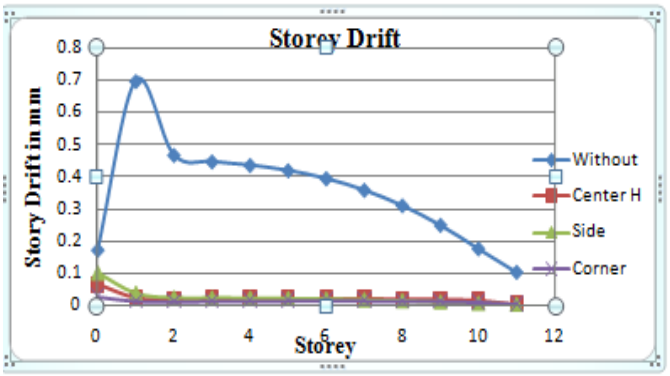

FIG.4.3 STOREY DRIFT IN X DIRECTION

From the above graphs it is observed that Storey Drift in X Direction is Maximum in Model Without Shear Wall whereas it is Minimum in Model with Corner Shear Wall.

Table 4.4 Storey Drift in Y Direction in Mm

Storey	Without	Centre H	Side	Corner
0	0.1781	0.0341	0.0265	0.0288
1	0.7342	0.0151	0.0123	0.0134
2	0.4649	0.0132	0.0107	0.0117
3	0.4404	0.0144	0.0116	0.0128
4	0.427	0.0152	0.0123	0.0134
5	0.4083	0.0155	0.0127	0.0135
6	0.3809	0.0155	0.0128	0.0133
7	0.3431	0.0151	0.0126	0.0129
8	0.2933	0.0147	0.0124	0.0122
9	0.2303	0.0143	0.0122	0.0114
10	0.1543	0.0138	0.0121	0.0102
11	0.0768	0.0061	0.0056	0.0054

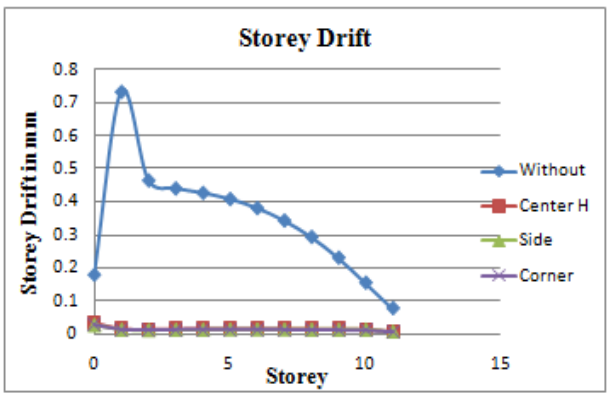

FIG.4.4 STOREY DRIFT IN Y DIRECTION

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From the above graphs it is observed that Storey Drift in Y Direction is Maximum in Model Without Shear Wall whereas it is Minimum in Model with Corner Shear Wall.

4.1.3 Bending Moment for Bending Moment Values Highlighted Columns in Plan as Shown Below is Considered.

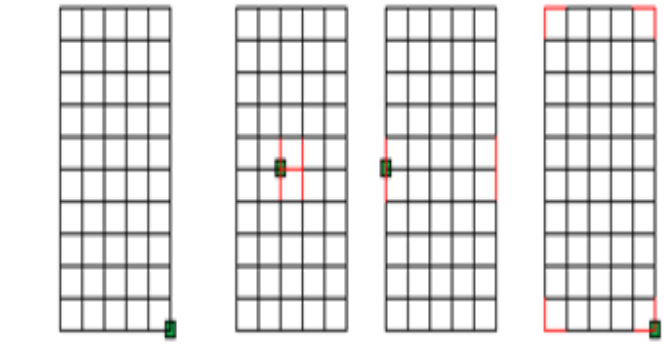

FIG.4.5 COLUMNS CONSIDERED IN DIFFERENT MODELS

Table 4.5 Bending Moment

Models	BM in KN.m
Without Shear Wall	114.37
Centre H Shear Wall	97.753
Side Shear Wall	75.413
Corner Shear wall	26.878

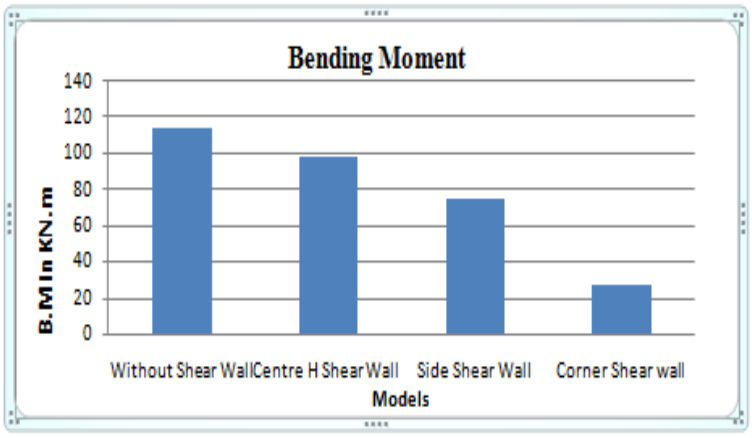

FIG.4.6 MAX BENDING MOMENT

From the above graphs it is observed that Minimum Bending Moment is produced in model with corner shear wall and maximum in model without shear wall.

4.1.4 Shear Force for Shear Force Values the Highlighted Columns in Plan as Shown Below is Considered

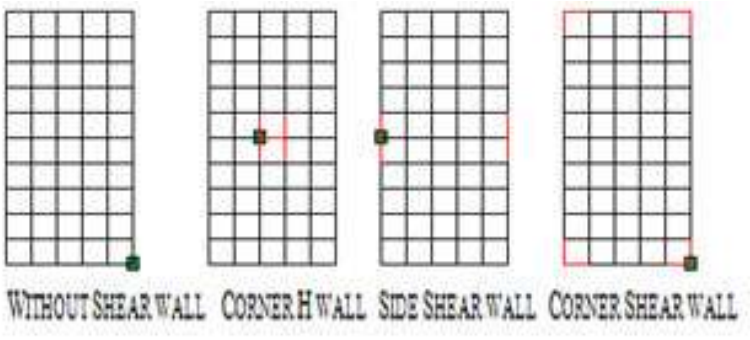

Fig.4.7 Columns Considered in Different Models

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Table 4.6 Shear Force

Models	SF in KN
Without Shear Wall	43.25
Centre H Shear Wall	47.201
Side Shear Wall	30.263
Corner Shear wall	13.277

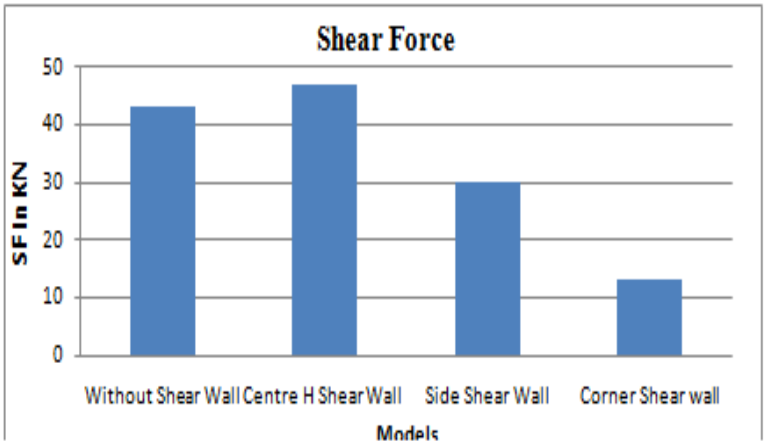

FIG.4.8MAX SHEAR FORCE

From the above graphs it is observed that minimum shear force is produced in Model with corner Wall Maximum in Model with centre H Shear Wall.

From the above all results obtained from STAAD PRO it is clear that model with corner shear wall is having a better result in displacement, storey drift, bending moment and shear force.

V. CONCLUSION

1. The presence of shear wall affects the seismic behaviour of frame structure to large extends and shear wall increases the strength and stiffness of the structure, as it is clear from this study that models with shear wall are having better response to earthquake as compared to model without shear wall
2. From this study we have concluded that the location of shear wall largely affects the behaviour of building in earthquake zone area.
3. In comparison among the locations of shear wall in different models, the best location of shear wall is found in model with corner shear wall as compare to all other models.
4. From the analysis of all four models the values of displacement, storey drift, bending moment and shear force are obtained to be minimal in model with corner shear wall as compare to all other models.

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A REVIEW OF SOIL STABILIZATION USING POLYMERS

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ABSTRACT
Soil is extremely complex, heterogeneous substance which has been subjected to varieties of nature. Properties of soil do not change only with location to location but also with respect to depth, climate and drainage condition of soil. Soil stabilization is the process by which strength properties of soil can be improved with the use of adding some materials like polymer. There is a rapid increase in waste quantity of plastic fibers, if this waste can be utilize for stabilization of soil than problem of solid waste can be resolve and also cost of soil stabilization can be reduced. Polymer soil stabilization is advanced soil stabilisation technique which deal with civil construction polymer soil stabilisation contain Nano polymer technique which is contain vary fine particle. That's why the void filled with polymers and stabilization is possible .

Polymer material are characterized by long chain of repeated molecules unit known as mars. These long chain interline to from the bulk of plastics. the naturals by which the chain interline is determine the plastics macroscopic properties and binding strength. This study presented a review of literature on soil stabilization using polymers.

Keywords: SoilStabilization, Polymers. SoilTech, DustTech

INTRODUCTION
Soil is one of the most commonly encountered materials in civil engineering. All the structures except some, which are founded on solid rock, rest ultimately on soil. Geotechnical engineers all over the world face huge issues, when structures founded on the soil which is expansive in nature. This expansiveness is imparted to such soils when they contain clay minerals like montmorillonite, illite, kaolinite etc. in considerable amount. Due to the clay minerals, the swelling soils expand on wetting and subjected to shrinkage on drying. These soils are commonly unsaturated.The problem of instability of structures made on such soil is mainly due to lifting up of the structures on heaving of soil mass under the foundation on saturation during rainy season and settlement as a result of shrinkage during summer season. Due to this cavity formed, leading to loss of contact between the soil and structures at some points. This successively results in splitting of structure and failure due to loss of shear strength or unequal settlement.

Foundation is very important part of any civil engineering construction work. Load of any structure is ultimately taken by foundation, hence it is very necessary to prepare a sufficient strong base for any structure. Bottom most portion of structure is consist of natural earth surface, this earth surface is known as soil. For successfully transfer of load of structure on the soil it is necessary to prepare soil with desirable bearing capacity, also it is not possible every time to get soil having sufficient strength at every place. Process of increasing strength of soil by artificial process is known as stabilization of soil. The process of soil stabilization refers to changing the physical properties of soil in order to improve its strength, durability, or other qualities. Soil stabilization is important for road construction, and other concerns related to the building and maintenance of infrastructure. Stabilization of soil is carried out by adding lime, coconut coir, fly ash, plastic fiber etc. with the soil.

Investigation into the properties of SoilTech and DustTech treated expansive soils would assess the suitability of using SoilTech and DustTech as stabilizer to reduce swelling of expansive soils. This review study presents the effect of polymers on soil stabilization on engineering properties of expansive soil.

SoilTech Mk. III is a third generation Nano polymer binder used for stabilizing soils for improving the strength of the soil and thereby improving the stability.

DustTech is a water based polymer emulsion which is sticky to touch apparent odour; totally nonflammable. It is a combination of various water based copolymers including ethelyne glycol, polyvinyl acetate, polyvinyl alcohol stabilizer and colanyl pigment for coloring. DustTech is totally miscible with water and will be progressively diluted if admitted to waterway. The base polymer is slowly biodegraded. DustTech is nonflammable, not hazardous, nontoxic, and environmental free.

PROBLEM RELATED TO SOIL
Problems occurring with existing soils are that which encountered by geotechnical engineers. They are considered as a high natural hazardous, which can cause extensive damage to structures such as foundations,

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roads, highways, building, airport runways and earth dams if not adequately treated. Damage caused by expansive soils exceeds the combined average annual damage from floods, cyclone and earthquake. Some remedial measures can be taken to prevent the damages. These are exchanging the soil under the foundation with the other soil, controlled compaction of expansive soil, moisturizing, structure of moisture barriers, lime stabilization and cement stabilization, modification of the structure and lowering the foundations from upper layer to the lower level.

REMEDIAL MEASURES FOR ABOVE DISCUSSED PROBLEM

Soil Stabilization is the process of making something physically more secure or stable. Soil stabilization is process of blending and mixing material with a soil to improve certain properties of the soil. The process may include the blending of soils to achieve a desired gradation or the mixing of additive that change the properties of soil. Soils to achieve a desired gradation or the mixing of additive that change the properties of soil.

CLASSIFICATION OF SOIL STABILIZATION TECHNIQUES

Soil stabilizations are classified on the method of stabilization.

A. **Mechanical Stabilization -** The old method of stabilization is mechanical in nature. Mechanical methods involve physically changing the property of the soil, in order to affect its grade, proportion, and other characteristics. Portable compaction is one of the major types of soil stabilization; in this procedure a heavy weight is put repeatedly onto the ground at regular intervals. Vibrating compaction is another useful technique that works on similar principles; it removes voids between the soil particles by vibrator.

B. **Chemical Stabilization** - Chemical methods are the methods which use chemicals to increase the strength of soil. Chemicals are used to change the proportion of soil particle. All of these techniques rely on adding an additional material to the soil that will physically interact with it and change its properties. There are a number of different chemicals that utilize cement, lime, fly ash, or kiln dust for soil improvement.

C. **Soil Stabilization by Using Polymer** - Researchers invent some innovative techniques for soil stabilization like using polymer, wheat husk fiber and polypropylene etc. These new polymers and substances have a number of important benefits over traditional mechanical and chemical solutions; they are economic and more effective in general than mechanical methods, and significantly less dangerous for the environment than many chemical tend to be.

POLYMERS

Soil Tech Polymer

It is a stabilization agent and was specifically designed & developed for mine haul road stabilization, where excessive loading occurs and where all-weather roads are required. This technology is now used in commercial road design.

Soil Tech Mk. III stabilizing polymers are elastomers, which gain strength from mechanical compaction and do not become brittle when cured. The elastomers are flexible in nature and allows certain amount of flex under load and does not become brittle unlike cement stabilization, will not crack under excessive loading – one aspect in reducing layer work in design phases.

In most cases, the in-situ soils in the area can be used for stabilization. The in-situ materials which would normally be classified as unusable or waste materials, can be transformed into suitably modified aggregates for use in base and sub-base layer construction. The SoilTech Polymers are the forefront of binding marginal soils and turning these materials into useable road construction aggregate. SoilTech Mk. III has been extensively tested with in-situ materials in various parts of the world. SoilTech Mk. III has been extensively utilized in base and sub-base stabilization using in-situ materials, throughout the developing world.

Benefits of Soil Tech Polymer

Reduce the consumption of qurry aggregate in road and there by the minimize the significant environment impact.

In situ material can be usd.

Reduced road crust speed up to construction time

Reduce construction cost.

Reduce maintenance.

Increase the strength and stability of base &subbase layer

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Draw backs of Soil Tech Polymer
The crack may form in soil cement stabilization

It is harmful for environment

Advantage of Dust tech
Control dust –keep livable thing healthy.

Open road to traffic immediately after applying dusttech

Stabiles dust and sand road and prevent them becoming slippery when wet

Improve productivity through better road

Cost effective

Environmentally friendly and skid proof when wet

Easy application

Long life starage

Non- flammable

Problem with many dust tech polymer alternative
Water can be effective short term solution but when the moisture dries if leave the soil more fragile creating even more dust

Oil base emulsion continuously percolate and leaches through the soil, never binding with the road bed particle to stabilize the surface.

REVIEW OF LITERATURE
Following are the literature presented related to soil stabilization using polymers**.** This review contains review of soil stabilization using polymers.

1. T.Raghavendra, et.al (2018) studies the stabilization of black cotton soil using Terrasil and Zycobond. The variation experiment specific gravity, liquid limit, plastic limit, sieve analysis, hydrometer analysis. IS light compaction, unconfined compression test , direct shear test, California bearing ration test , free swell index are conducted on the soil. Cement is used in the constant proportion of 3% of amount of soil and the Nano chemicals terrasil and zycobond are used are 0.6kg/m3, 0.8kg/m3 , 1kg/m3 , 1.2kg/m3 of each. Chemical soil mixing with cement and unconfined compression test is performed. soil mixed with cement and chemical with the respective proportion to the OMC calculated to the soil and mixed .unconfined compressive strength test is performed after the curing period of 7 days ,21 days ,28 days free swell index is performed . for the same proportion of terrasil and zycobond . terrasil is nanotechnology based water dissolvable , bring appears in pale yellow colour in the form of afield.

From the result of investigation conducted, the following conclusion can be made.

- Free Swell index is decreases from 30% to 27.5% with the addition of 0.6kg/m3 of Terrasil and Zycobond and decreased to 26.3%, 25%, 21.05% with the addition of 0.8kg/m3 ,1.0kg/m3 ,1.2kg/m3 when compared to 0% of Terrasil and Zycobond.
- Unconfined compressive strength is decreased when the dosage of the Nano chemicals (Terrasil and Zycobond) is increased.
- But many of journals say that Unconfined compressive strength should be increases by adding cement, Terrasil and Zycobond. Further investigation need to be done why the unconfined compressive strength is decreases.

2. P.K.KOLAY, et.al (2016) studies" the effect of liquid polymer stabilozer on geotechnical properties of fine grained soil", there are Two types of soils were selected in this study i.e., Carbondale soil (clay with high plasticity (CH)) and Galatia soil (silt of low plasticity (ML)) for stabilization purpose. A copolymer liquid stabilizer 'Soiltac' has been selected for this study. According to the Two types of soils were selected in this study i.e., Carbondale soil (clay with high plasticity (CH)) and Galatia soil (silt of low plasticity (ML)) for stabilization purpose. A copolymer liquid stabilizer 'Soiltac' has been selected for this study. According to the manufacturer, the polymer used in the present study is non-toxic and non-hazardous. The pH value of the

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polymer is 5.5. Typically, polymer stabilizers are vinyl acetates or acrylic copolymers suspended an emulsion by surfactants.

The polymer added on 0.5%, 1% ,1.5%, 3%into the both soil and various test to occur .the result get positive and fulfil the conclusion of this study. From the result of investigation conducted, the following conclusion can be made:

- Atterberg limit for Carbondale soil (CH) and Galatia soil (ML) were slightly decreased with the addition of polymer, and no significant changes were observed for both soil.
- With the addition of polymer, MDD increases and OMC decreases for Carbondale soil (CH) and Galatia soil (ML).
- For Carbondale soil (CH), UCS values increases upto the addition of 1.5 % of polymer by weight and thereafter decreases for 3.0 % polymer addition. Also, UCS values increases with the increase in curing period for all soil-polymer mixture. The maximum increase in UCS value (with 1.5 % polymer stabilizer and 28-days of curing period) was 220% with polymer. For Galatia soil (ML), no significant changes in UCS were observed for all soil-polymer mixture at any curing periods. Maximum increase in UCS value was approximately 23% with polymer.
- Unsoaked CBR value for Carbondale soil (CH) increases upto 1.5% of polymer addition and then decreases with 3.0% polymer stabilizer. The increases in unsoaked CBR values from untreated soil are 200% for 2.54 mm deformation and 195.5% for 5.08 mm deformation with 3-days of curing. Almost similar unsoaked CBR values are obtained for 7 and 28 days of curing.
- **3**.Sameer vyas et.al (2016)studies stabilisation of dispersive soil by blending polymer.to stabilisation of dispersive soil from Udaipur 0.5 % and 1 % polyvinyl alcohol (PVA) andurea formaldehyde (UFR), 0.5% polyurethene (PU) and epoxy resin (ER) and 1 % styrene butadiene rubber latex were added to the soil sample. Mechanical analysis of polymer treated soil was done to measure the improvement in soil aggregation and atterbergs limit was tested to get information concerning cohesion properties of the soil. For mechanical analysis and atterbergs limit test, chemicals
- Were added to 4.75 mm and 425 micron passing soil samples, respectively. To compare the effect of polymer with conventional soil stablizer 1.0% of sodium aluminate, calcium aluminate and calcium hydroxide were added to the
- Dispersive soil sample and mechanical analysis was done and index properties were evaluated.
- From the above result it is clear that on adding polymer aggregate size of soil is increasing thus the polymer used for above study are effective in binding soil particles. Lowering of LL, PL and PI indicate that on wetting of soil by rain water it will soften to a lesser extent thus making it more suitable for construction of road or lining of dam.

4. N.Sohaib el.al (2018) studies use of acrylic polymer for stabilisation of clayey soil.in this studies acrylic polymer is used as a stabilizer .which mixed with clayey soil for preparation of soil-acrylic polymer was mixed with chloroform to prepare the acrylic paste and the added to the soil. The chloroform was evaporated later on. Each sample was sealed in plastic sheet to make it air tight sample were then placed in an oven at 40^0C for the desired curing period.

From the studies and experiment conclusion can be Made:

- The use of non-traditional chemical agents (acrylic pol-ymers) can significantly enhance the engineering char-acteristics of soft soil. The soil is reactive with acrylic solution. Optimum percentage of acrylic solution re-quired for stabilization of the soil is 6% by weight of the soil. It can be used as stabilizing agent in conjunction with acrylic is technically and financially feasible as it increases both the strength and durability parameters of soil.
- Compaction effort quickly after mixing acrylic solution is likely to yield maximum strength in the field. The maximum dry density from untreated soil increases to 5.92% with addition of 6% acrylic polymers. Beyond this MDD starts decreasing.
- Unconfined compressive strength increases from un-treated soil to 57% (for 3,7 and 14-days curing) with addition of 6% of acrylic polymer, further addition of acrylic polymer causes decrease in compressive strength.

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- In California Bearing Ratio test, maximum increment obtained from treated soil was 102% at 6% addition of stabilizer in comparison with untreated soil.

5. Lariso.chaindris et.al (2017) studies expansive soil stabilisation (general consideration) which is the paper revive The paper reviews the phenomena of active clays from a mineralogical, mechanical and especially a geotechnical point of view.

Clay soils exhibit, sometimes, a significant volume change due to the variation of water content in the mass of the soil, in response to climatic conditions and the action of vegetation. These volume changes affect the function of the constructions and foundations in contact with the soil and they represent the causes of damage, especially intense, during periods of drought.

The conclude that in general, all lime treated fine-grained soils exhibit decreasedplasticity, improve workability and reduced volume change characteristics. We need to take into consideration that final aim improving also the strength characteristics of the soil. It should be emphasized that the properties of soil-lime mixtures are dependent on many factors such as soil type, lime type, lime percentage and curing conditions.

6. Anjaneyappa et.al (2015) studies characteraction of polymer stabilized . The construction of pavements is becoming costlier due to very high cost of quality construction materials and transportation cost from long distances. Highway engineers are forced to look for ways to reduce the cost of construction and sustainable construction materials and methods. Soil stabilization techniques are important in constructing economical and sustainable roads. Non traditional stabilizer additives are being marketed as cost effective, environmental friendly potential solutions by manufacturers for stabilization of pavement layers with very high claims. Various types of non traditional stabilizers available in the market include chemical, polymer, enzyme based stabilizers.

Conclusion made by this paper was reduction of about 41 to 47% in radial strains below bituminous layers and 38 to 47 % in vertical compressive strain on subgrade were observed for soil stabilized with polymer. Similarly reduction in thickness of granular layers in the order of about of 50% was observed. It is necessary to study the field performance using the polymer stabilizer for both low and high volume roads. The use of polymer for stabilization pavement layers can beconsidered for low volume roads.

7. Athulya P.V. et.al (2015) studies stabilisation of subgrade soil using additives – a case study. The objective of the present study is to conduct experimental study and analyse the strength properties of plain soil, soil with terrasil and soil with cement kiln dust separately by conducting consistency limit test, CBR test, Triaxle test and permeability test and then to compare the effectiveness of these additives on stabilizing the weak soil

Conclusion made by this paper the behaviour of soil varies largely with introduction of stabilizer. It is observed that increment in dosages resulted in decrement of consistency limits. So it is clear that the chemical makes the soil stiff. It is noted that CBR value increases with increase in dosage of stabilizer and an optimum value is obtained. Cement kiln dust being a waste product is economical and the CBR value also showed a considerable increase. The water proofing property of soil had a significant effect of adding Terrasil compared to cement kiln dust. The elastic modulus value for soil with additives showed a considerable increase compared to unstabilized soil.

8. Bibha mahtr et.al (2015) studies a review paper on improvement of subgrade by rbi grade 81 and pond ash The objective of the study is to find out the impact of RBI Grade 81 at 2%,3% and 4% mixed along with pond ash 3%, 6% and 9% on silty and clayey soil and the change in California Bearing Ratio (CBR), Dynamic cone penetration (DCP) Maximum Dry Density (MDD), Optimum Moisture Content (OMC) has been observed through different mixes of RBI Grade 81 and pond ash on soils. . The outcome helps in looking at the change in CBR, DCPT, OMC, MDD value when soils were stabilized by RBI grade 81 and soils stabilized by both RBI Grade 81 and Pond ash.

Conclusion made by this paper.is the RBI Grade 81 is successful in adjustment of most sorts of soils. The increment in CBR esteem fluctuates w.r.t sort of soil. For some soils, the augmentation is substantial with little expansion of the chemicals like fly ash, Sodium Silicate, pond ash, morum and stone dust. Since RBI Grade 81 assistance to use by regional standards accessible soil for road construction, consequently the expense of construction can be diminished by maintaining a strategic distance from substitution of soil. The splashed CBR qualities increment with expansion in RBI 81 expansion recommend its suitability as great stabilizer to enhance execution of delicate soils. The utilization of fly ash alongside RBI Grade 81 essentially enhances the geotechnical properties of soil.

9. Basanta dhakal et.al (2016) studies effect of liquid acrylic polymer on geotechnical properties of fine graned soil.this paper investigation the effect of liquid polymer on the geotechnical properties of fine-grained soil. Commercially available liquid polymer (acrylic polymer) was used to stabilize natural Carbondale soil (Soil A) and commercially available soil (Soil B). The polymer was mixed at various percentages (i.e., 2, 3, 4, and 5 %) of the dry weight of both soils. Tap water was added corresponding to its OMC (optimum moisture content) for a particular soil-polymer mixture and compacted to achieve its maximum dry unit weight. The compacted samples were allowed to cure for 7, 14, and 28 days under confined and open air environment. Unconfined compressive strength (UCS) test was performed to evaluate the strength of polymer stabilized soil. The results show that with the addition of polymer; UCS value for Soil B samples prepared at OMC increases from 30 to 75 % in open air environment and the UCS value increases from 12 to 14 % in confined air environment. Soil A samples prepared at OMC (i.e., 23.50 %) show cracks while curing in open air environment and there is no significant change (i.e., 1.2–13.8 %) of strength in confined air environment. For the Soil A samples prepared with reduced moisture contents (less than OMC i.e., 12.50 %) and cured in open air environment shows increase in UCS strength from 7 to 10 %. Also, California bearing ratio (CBR) test was performed for both soils and there was marginal increase (i.e., 14 %) in CBR value for Soil A but a significant increase (i.e., 340 %) in CBR value for Soil B.

10. Qassun S Mohammad shafique, et.al (2018) studies on improvement on expansive soil using polymethacrylate polymers. In paper investigation one of the worldwide problematic soils expansive clay accompanied by large volume change response when it is subjected to a change in the water content . a chemical method for enhancing the swelling og expansive clayey soil is provided using polymethacrylate (PMA) polymer material . The experiment programme is conducted to estimate the effect of adding the(PMA) polymer on the properties of the prepared expansive soil. Modified clay specimen are characterized based on various experiment and soil sanple prepared various percentage (i.e. 3%, 5% 7%) by weigth of dry soil.

The result indicate that theinduced of PMA polymers with in expansive soil caused decrease in liquid limit, plasticity index, free swell, and optimum moisture content and increase in plastic limit, unconfined compression test and CBR test.

The result of the indicated tht the polymers significantly overcome the problem of expansive soil . in adding higher UCS by 52.8% are observed by adding PMA with a percentage of 7% also adding same percentage of PMA polymer caused increasing in CBR value by 72.8%.

11. Relience private ltd. (2010) companies make the evaluation report of SoilTech treated soil stabilised base layer. The companies is about construction for the power generation, for the installation of machineries or tower. is on the constructed base layer which stabilised by SoilTech polymer. The company make case study on it all result carries out on basis of various test doing by sudhakar reddy from IIT Kharagpur.

Result are very positive and shows the SoilTech is good industries construction soil stabilizer.

12. Sepehr Rezaeimalek1,,et.al(2017) studies on Mixing Methods Evaluation of a Styrene-Acrylic Based Liquid Polymer for Sand and Clay Stabilization in this paper ,focused on applications and provided promising results. This study focuses on the application of a low viscosity liquid polymer for shallow soil improvement. The mixing method of soil specimens treated with the liquid polymer soil stabilizer, which belongs to Styrene Acrylic family, was studied through an experimental testing program. The tested soils included poorly graded sand and sulphate-rich clay. The water, liquid polymer and dry soil were mixed with different sequence to assess the effect on strength. The specimens were cured in controlled environment for up to 35 days before tested. It was found that the curing of the polymer stabilizer in sand and clay were time consuming and took to a month to reach their full strength. The mixing method did not show tangible difference for stabilized sandy specimens and demonstrated significant effect on stabilized clay specimen. Specifically, as to clay, when water was added after the dried soil and polymer were thoroughly, no h

13. J.Ranjitha et.al studies on experimental study on black cotton soil stabilised using SoilTech MK 3 polymer. This paper investigated on the pavement construction *is becoming costlier because of very high cost of construction materials and transportation cost of such materials from long distances. The growing concern over environmental degradation due to borrowing of large quantity of soil and aggregates for construction of pavement has made the search for new techniques of stabilization. The subgrade soil should have high Maximum dry density (MDD) and low Optimum moisture content (OMC) so that it can take up the load of the overlying layers and the traffic. The high MDD and corresponding OMC can be achieved by stabilizing*

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the soil using suitable stabilizer. In the present work the effect of using Nano Polymer called SoilTech MK III as a stabilizer to improve the properties of Black Cotton soil collected from Karnataka, India were determined. The laboratory experiments were conducted on the samples of BC soil and BC soil with stabilizer for Compaction test, UCS (Unconfined Compression Strength) and CBR (California Bearing Ratio) tests. Various samples were prepared by taking soil with different percentage of SoilTech MK III Polymer (0.2%, 0.4%, 0.6%, 0.8% and 1.0%). The comparison of the results with and without the use of SoilTech MK III has been done.

CONCLUSIONS

The review of literature indicate that polymers is a versatile material with attractive properties and advantages, as a result of this polymers is now being used widely all over the world. Waste fibers or plastics have durability, high strength, economic, and also they are non-biodegradable, therefore, may be used for the stabilisation of soil. The use of waste fibers or plastics will results in increasing the solution against the disposal of wastes.

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RC STRUCTURAL ELEMENTS' REACTIONS TO BLAST LOADS: A CURRENT REVIEW

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ABSTRACT
Numerous research concentrated on analysing the responses and failure patterns of RC structures exposed to blast pressures as the frequency of terrorist attacks increased. RC constructions would show brittle damage, localised spallation, and ductile failure modes as a result of the high-rate actions of explosions. The vast majority of studies in the literature had as their primary emphasis the material behavior of RC structures under high-rate blast loads. This study aims to present a comprehensive overview of the analytical, numerical, and experimental studies that have been conducted in the literature to examine the loading processes, dynamic responses, and failure behaviours of various concrete structures exposed to blast loads .The sensitivity of the blast responses of RC structures to various structural and loading-related parameters is also assessed based on the findings of past study.

Keywords: Blast loading, RC Structure, loading factors, blast reaction

I. INTRODUCTION

Understanding the reaction mechanisms of concrete structures and looking into protective measures from a design standpoint are more important than ever due to the possibility of applying blast loads to them during unintentional terrorist attacks or unavoidable occurrences. Explosives and terrorist attacks on significant building or bridge works have resulted in several fatalities, according to the literature. This section provides an introduction to the theoretical underpinnings of blast loads, existing features for blast load prediction in the current design programmes, methods for target structure analysis under explosions, as well as typical damage mechanisms and failure behaviours of various concrete structures.

II. THEORETICAL BACKGROUND

High strain rates between 102 s-1 and 104 s-1 would arise from intense loading, such as blast loading. The ranges of strain rate brought on by various forms of loading are depicted in Figure 1.

In Figure 2, an illustration of the pressure-time history of a blast wave generated by a free-air burst on a target structure that includes two impulse phases is displayed. According to this figure, the shock wave touches the shock front surface of the target structure at time ta. The blast pressure wave propagates throughout the structure as a positive impulse phase from ta+ to and with a peak overpressure of Pso. In a subsequent negative impulse phase until ta+to+to, the blast wave is reflected off the edges and tensile zone of the structure, producing suction forces. Blast loading parameters, such as the kind and weight of the explosive, the standoff distance, and the height of the explosion above the ground, as well as structural components, such as the target's geometry, weight, and size, have a significant impact on this plot's characteristics. The scaled distance (Z) of detonation from the target is the criteria that is most frequently employed, in accordance with Hopkinson-Cranz rule, to categorise blast loadings. The following relationship is established between the equivalent weight (W) and standoff range (R) of explosive charges:

$Z = R/W1/3$

Where W is the equivalent weight of charge and R is the standoff distance.

According to the scaled distance parameter, blast loads may be separated into near-field and far-field detonations, as shown in Fig. 3. The reflected blast pressure places an equal weight on the target structure in a far-field explosion. However, the form of distributed blast loading tends to become more concentrated around the explosion effective zone as the scaled distance for near-field detonations lowers. There are many categories for blast loads based on scaled distance. According to the American Society of Civil Engineers, blast loads with a very short duration compared to the natural period of the structure are classed as occurring in the impulsive area, where the structural responses are only sensitive to the associated impulse. Close-in detonations are described by the American Society of Civil Engineers (ASCE SEI 59-11) as blast loads with scaled distances less than 1.2 m/kg1/3. Another standard has been created by Gel'fandetal et al. based on the charge's r0 dimension. Close-in detonations are referred to in this standard as blast loads with a standoff distance Rn between 0 and 20r0 (0 Rn 20r0). In addition, UFC 3-340-02 defined the scaled distance as 0.4 m/kg1/3 as the

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sensitivity level for scaling blast loads. Therefore, close-range explosions were defined as explosions with blast loads with scaled distances below this value.

Different types of blast loading may be categorised using P-I diagrams, which display correlations between the pressure (P) of the blast and its impulse (I) reaction on the target structure. These graphs give important details on the relationship between blast loading time and amplitude, which are important for assessing the blast reactions of structures and considering ideas for protective design. Figure 4 depicts a typical P-I diagram with two asymptotes for the pressure and impulse parameters. Three areas—impulsive, dynamic, and quasi-static—are distinguished within these asymptotes.

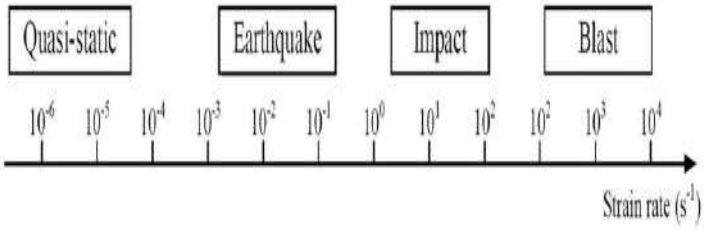


Fig -1: The strain rates that various forms of loading can create.

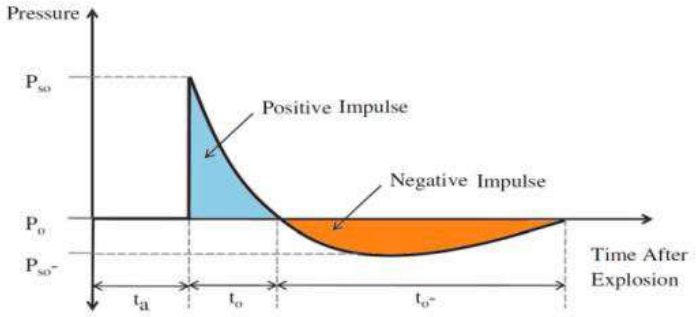
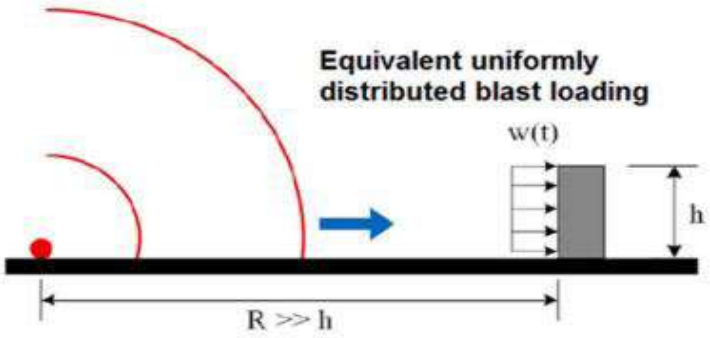
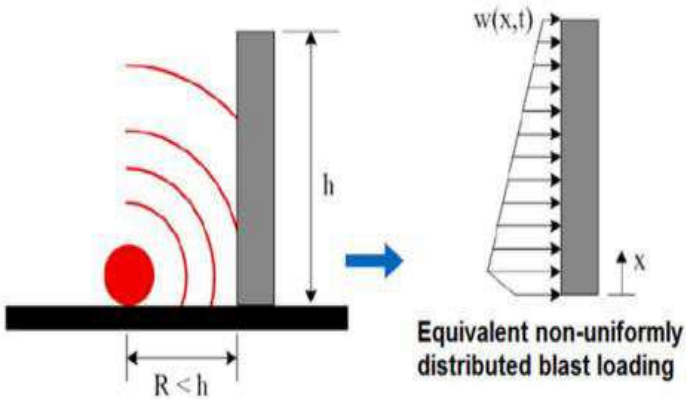


Fig-2: Normal free-field blast pressure–time history plot



a) Far field Detonation



b) Closed in Detonation

Fig -3: Target structures' pressure as they as they are reflected in relation to the scaled distance of the blast loading

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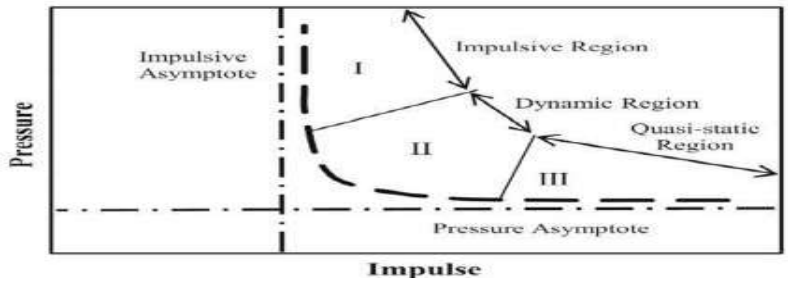

Fig -4: A typical pressure-impluse diagram

III. DESIGN GUIDELINES FOR BUILDINGS TO WITHSTAND BOMB LOADS

Guidelines for the design of structures against blast loads are available from the US Department of the Army, the US Department of Defence, the US General Services Administration (GSA), FEMA, and the American Society of Civil Engineers (ASCE). The essential requirements for the blast resistance of bridge components are, however, only found in a restricted number of design regulations. However, some design information has been supplied by the National Cooperative Highway Research Programme (NCHRP) based on streamlined methods that ignore the collapse behaviours of bridges during explosions. The Federal Highway Administration (FHWA) also provided cutting-edge recommendations on security planning, blast phenomenology, blast reaction mechanisms of bridge structural components, material performance, and protective design ideas. Table 1 gives an overview of current blast design guidelines for buildings, most of which are based on single-degree-of-freedom (SDOF) analyses.

Table I: Summary of the current guidelines for blast loading on structures

Table 1
Summary of the current guidelines for blast loading on structures.

Guideline	Remarks and notes
TM-5-855-1 [ ]	Provides design and analysis procedures for the protective structures exposed to the effects of conventional weapons and for use in designing hardened facilities
TM-5-1300 [ ]	Provides design approaches for structures to resist the effects of blast waves and fragments by considering blast load parameters and structural response modes
UFC 3-340-02 [ ]	Prediction of idealized close-in and far-field blast loads using shock and gas considering dynamic increase factors (DIFs) which provide both flexural and shear failure-based design approaches
UFC 4-010-01 [ ]	Provides appropriate, implementable, and enforceable measures to establish a level of protection against terrorist attacks for all degree of defense and military buildings
FEMA 427 [ ]	Provides an extensive qualitative design approach to mitigate the effects of terrorist attacks by explosions and considering chemical biological, and radiological attacks.
FEMA 428 [ ]	Predicting the expected overpressure on buildings using explosive weight and stand-off distance in both horizontal and vertical distances arising from various vehicles' explosions
ASCE 1997 [ ]	Provides a structural design guideline for blast resistant of petrochemical facilities
ASCE/SEI 59-11 [ ]	Considers dynamic increase factors for structures for only far-range blast loads using single-degree-of-freedom (SDOF) analysis which provide flexural failure-based design approaches
ASCE (7-10) [ ]	Provides the concepts and analysis methods of progressive collapse of integrated and redundant structural systems under explosions
NCHRP 12-72 [ ]	Provides effective methods, structural design, and retrofit guidelines to mitigate the risk of terrorist attacks against critical bridges

IV. METHODS FOR ANALYSIS OF STRUCTURES UNDER BLAST LOADING

The three main kinds of methodologies for the examination of the structural reactions to blast loads are numerical simulations, simplified analytical techniques, and experimental testing. Researchers were able to define the impacts of blast loads operating on various structures in earlier investigations by condensing the target and reflected pressure systems. Using similar single-degree-of-freedom (SDOF) and multi-degree-of-freedom (SDOF) systems, examples of simplified analytical models for idealised blast pressures are shown in Fig. 5a–e. As can be shown in Fig. 5d and e, the bulk of analytical investigations computed the resistance, functions, and load-transformation factors to be employed in simplified SDOF and MDOF systems using idealised continuous systems and lumped inelasticity models. Prior research has shown that analytical procedures are useful in foreseeing the overall reactions of concrete buildings to blast loads; nevertheless, these strategies are unable to account for localised damages to structures, such as concrete spalling. It was evident that experimental investigation and numerical finite element analysis were necessary.

To model blast loads using FE numerical approaches, a variety of software packages, including ABAQUS, LS-DYNA, and AUTODYN, have recently been developed. In LS-DYNA, two methods—Multi-Material Arbitrary Lagrangian-Eulerian (MM-ALE) and Load-Blast-Enhanced (LBE)—are available to model blast loads on structures. In the first method, the blast pressure is immediately applied to the structure's shock-front surface. The blast pressure from the explosion is instead transmitted to the building through a FE medium in the second strategy.

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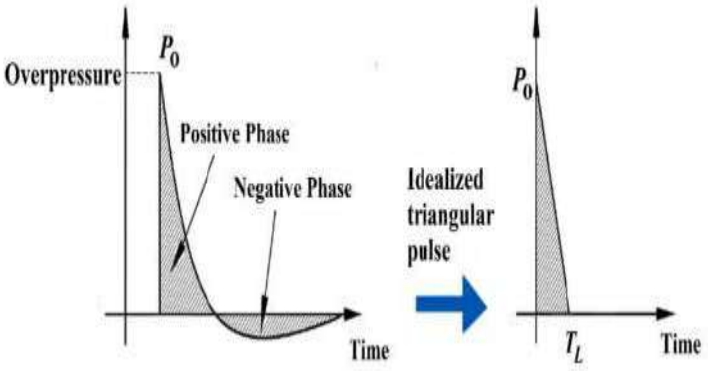
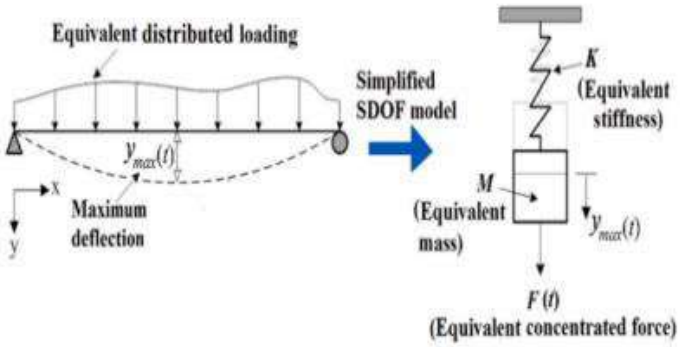
There are multiple methods that make use of various facilities to mimic blast stresses on buildings, as follows:

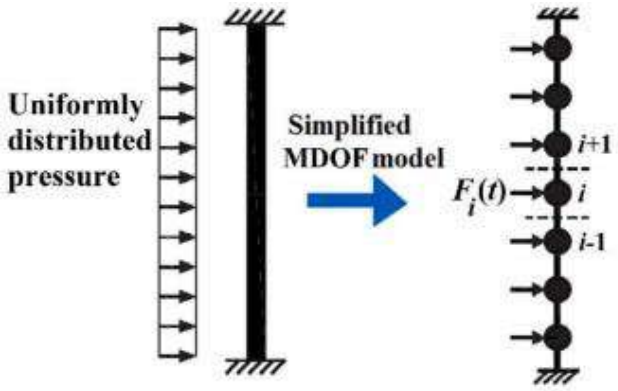
- Explosive charges are employed to provide blast loads for air bursts (Fig. 6a): Using this method, the structure is exposed to an explosive charge (like TNT) that may have a different chemical composition, shape, weight, or size.
- **Shock tube-based blast loads:** A compression chamber generates the shockwaves using shock tube equipment. They were then launched at the target using a variable-length deriver. The shockwave's firing is controlled by a diaphragm with a differential pressure in a spool part. The shockwaves with the right pressure then travel in the direction of a stiff end frame by using an expansion section that has been linked to the shock-front surface of the target structure.
- The following blast loads were created using the University of California, San Diego (UCSD) simulator (Fig. 6c): The University of California, San Diego built an explosive loading facility where dispersion blast impacts are duplicated using hydraulic actuators and delivered to the structure as distributed impact loads utilising elastomer pads attached to actuator heads.
- Blast loads for the Gas Blast Simulator (GBS) (Fig. 6d) The specimen is placed inside a multi-functional system while being subjected to a series of gas blast shock waves using this device, which was developed by the Anti-Explosion and Protective Engineering Ministry Key Laboratory at the Harbin Institute of Technology in China.



a) Idealized blast pressure



b) SDOF Model



c) MIDOF Model

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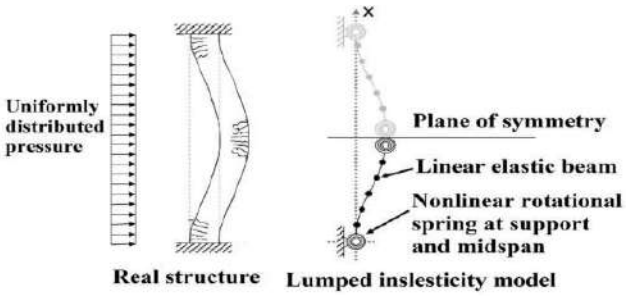
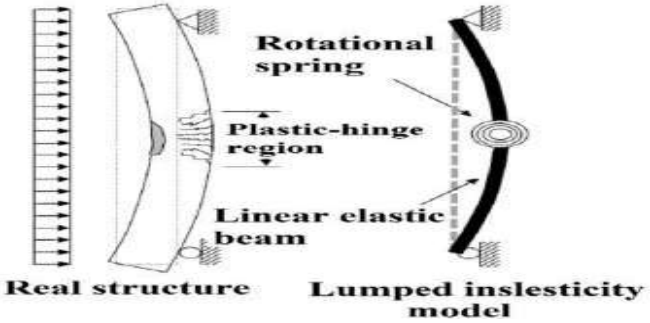
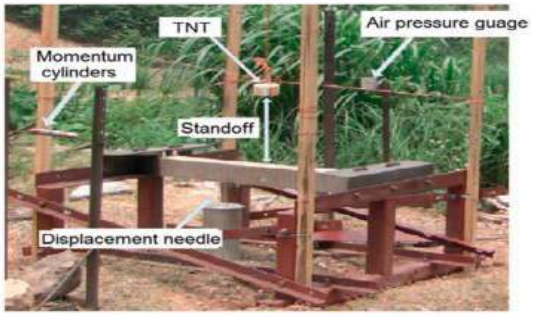


d) Idealized model of a fixed end column

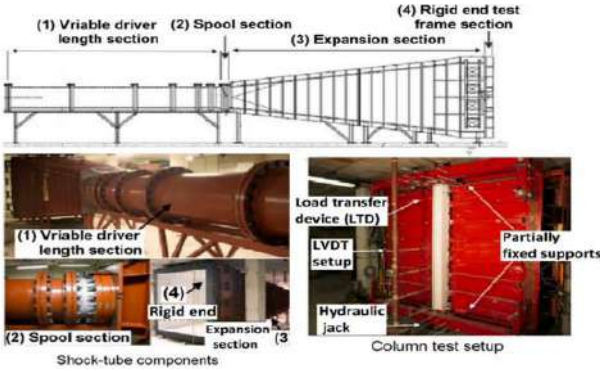


e) Idealized model of a simply supported beam

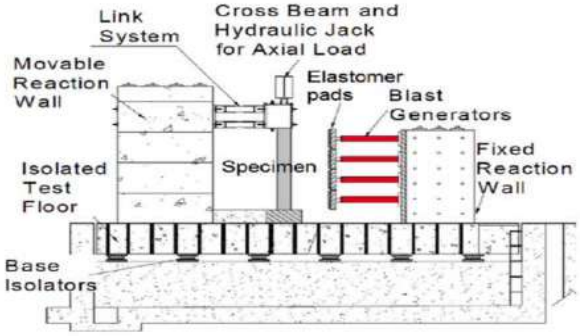
Fig. 5: Example of simplified models adopted by different analytical studies.



a) Air brust using Explosive Charge



b) Shock tube Facilities



c) UCSD Blast Simularo

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d) Component of GBS

Fig. 6: Blast loading experimental setup

V. TYPICAL BLAST LOADS THAT CAUES DAMAGE TO RC STRUCTURES

Damage levels to RC structures brought on by blast loads can be divided into categories based on the detonation scaled distance factor. As a result of suction forces and tensile stresses caused by the blast waves being reflected from these boundaries, concrete structures exposed to contact or extremely close-range explosions may experience varying degrees of localised spalling at the structure's back surface (also known as the tensile zone), as shown in Fig. 7.

McVay's idea on the spalling of concrete in structures made of reinforced concrete following explosions. Table 2 offers a rating of the seriousness of spall damages in concrete structures brought on by reflected stress waves from the structure's tensile zone. Furthermore, it is quite likely that localised spall damage and general deformations of RC structures will occur in near-field detonations. Furthermore, it is quite likely that when RC structures are exposed to evenly distributed blast loads from far-field detonations, global flexural and tensile damages brought on by ductile response modes would be seen. The flexural failure mechanisms of RC columns are categorised in Table 2 based on the McVay displacement-ductility ratio.

RC structural members, such as beams, columns, and slabs, have been the focus of several studies in the literature on damage states and failure mechanisms. Furthermore, the literature has thoroughly described how large-scale infrastructure and structures, such bridges and framed buildings, react to blasts. The varied degrees of blast load damage to RC structures may be categorised using the detonation scaled distance factor displayed in Table 3. According to this classification, concrete structures would suffer from various severe localised spalling under contact or very near-field explosions, localised spall damages coupled with global deformations under near-field detonations, or global flexural damages caused by ductile response modes under far-field detonations.

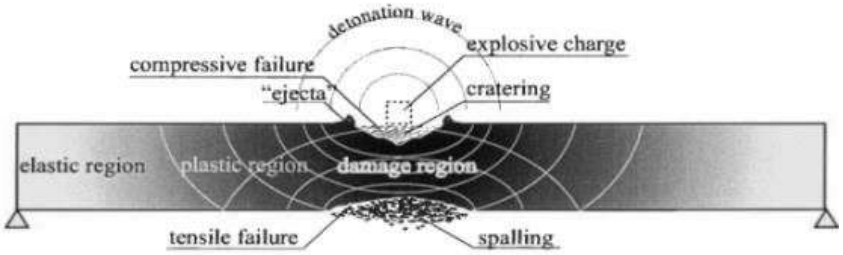

Fig -7: Localised failures during contact detonation in an RC Structure

Table II: Spalling damage classifications

Damage state	Damage description	Scheme of damage
No damage	From no change in the condition of the wall to a few barely visible cracks.	
Threshold spall	From a few cracks and a hollow sound to a large bulge in he concrete with a few small pieces on the floor.	
Medium spall	From a very shallow spall to a third of the wall thickness.	
Severe spall	From just over one third the wall thickness to almost breach.	
Breach	From small hole which barely lets light through to a large hole.	

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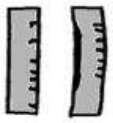
Table III: Flexural failure model based on the displacement ductility Ratio

Failure mode	Damage description	Scheme of damage
Light flexure	From no permanent displacement but a few flexural cracks to a ductility ratio 3.	
Medium flexure	From a ductility ratio of 3–10.	
Severe flexure	From a ductility ratio of 10 to almost breach.	

Note: In the load-displacement curve, the ductility ratio is defined as the ratio of the highest mid-span displacement of the column to the initial yield displacement.

VI. CONCLUSION

This article offers a complete, current analysis of the responses and failure mechanisms of various RC structures under blast loads. A complete analysis of the loading and response processes, damage states, and isolation of structural elements like beams and slabs during explosions were undertaken for concrete structures like the columns used in bridge piers and framed buildings based on the findings of past research.

It was found that the majority of the blast load prediction and explosion-resistant building design procedures in the current design rules are simplified. These analytical methods may be able to anticipate the general flexural and ductile responses of buildings to certain acceptable levels, but they cannot account for the brittle damage modes, localised spalling, and shear failure behaviours of concrete structures.

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ANALYSIS AND DESIGN OF G+20 MULTI STORIED BUILDING BY CHANGING ORIENTATION OF COLUMN

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ABSTRACT
India's population is rapidly expanding, and the country's requirement for land for housing is growing by the day. To meet this infrastructure requirement, land availability is now limited, and in the future, multistory systems will be widely used in India and around the world. This research relies on comparative analysis of multistoried building with shear wall and without shear wall by orientation of column. Shear walls are reinforced concrete structural walls that are designed to withstand lateral loads to resist the earthquake loads. The goal of our project to design and analysis of multistoried building by using STAAD Pro v8i for resistance of earthquake, approach for overcoming the land requirement problem and raise awareness about correct building design and detailing. The construction is thought to be in seismic zone –II for Nagpur location. In this analysis we evaluate dead loads, wind loads, and seismic loads. The load estimations are based on Indian wind standards (IS 875:2015 (part 3)) and seismic standards (1893:2002 (part 1)).

Keywords: Multi Storied buildings, Analysis and Design, Design loads, Shear walls, STAAD Pro

INTRODUCTION
The need for land for residential and commercial purposes in metropolitan areas is increasing as the population grows; multi-story buildings are becoming more frequent in the construction sector. Nowadays, new residences are built as solitary and multi-story structures. Buildings are an important sign of the county's social growth. Many innovative construction approaches have been developed in the current situation. As a result, the buildings are constructed in an economical and timely manner to meet the needs of the people. High-rise buildings, apartments, and multi-story buildings can be contrasted not only in terms of the amount of space required for people, but also in terms of the materials required to create or the cost. Earthquake is one of the most devastating natural disasters that mankind has encountered. Throughout history, numerous approaches and technologies have been used by engineers and architects to address and mitigate the impact of this disaster on diverse structures. To build a seismically resistant structure, it is necessary to understand the cause of seismicity as well as the propagation, nature, and kind of seismic waves emitted. A multi-story building can have a variety of structure configurations. The form of the structure is determined by the height of the building. The economics of such a building is determined by multiple aspects, including the structure's form, material choices, production procedures, and the time necessary to complete certain jobs. Column spacing in a reinforced concrete building is a significant component in determining the dimensions of columns, beams, slabs and shear walls, among other things. Shear wall systems are among the most widely utilized to resist lateral forces such as seismic loading and wind loads. Shear walls offer extremely high strength and stiffness. Structure is made more stable as a result of this. The current work aims to investigate earthquake (seismic) reactions of various level buildings with and without shear walls, taking into account different seismic zones. This paper G+20 high rise structure is analyses and design with and without shear wall by using orientation of column for Nagpur location is located in Zone II by using STAAD Pro v8i.

LITERATURE REVIEW

Vishal V. Gupta, Ashwin Soosan Pillai, Akash Bharmal and Prof. Jaydeep B. Chougale (2020) [1]
The study presented in this paper is based on a comparison of the effects of column orientation and shear wall position on G+ 13 storeyed earthquake resistant structures in STTAD Pro. Shear walls are installed throughout the multi-story structure. Shear walls are concrete structural walls that are reinforced to withstand lateral loads. The analysis for seismic zone III (Mumbai) has been finished. The damping ratio was set at 0.05 and the floor height was set to 3.5. IS (1893:20020 (Part-1) was used to calculate the loads. Eight distinct models with the same loading structure were chosen and analysed. A graphical representation is also developed based on the results and structure analysis. There is a comparison study for lateral displacement, storey drift.

Sangeeta Uikey and Er. Rahul satbhaiya (2020) [2]
The author's research project focused on seismic analysis of tall buildings using STAAD Pro software for design and analysis. The technique used is a restricted state design that follows the Indian standard code of practise. They examined frames and individually validated the software's correctness with the results provided in this work. The acquired results are highly accurate and precise. They constructed and tested a G+4, G+9, G+14, and G+19 story skyscraper for all possible load combinations. The purpose of the study is to analyse structural performance in different seismic zones and soil conditions, as well as to compare the seismic response of a multistory building without the usage of a shear wall.

T. Jayakrishna, K. Murali, Powar satish and J seetunya (2018) [3]
Under earthquake conditions, it is difficult to construct and study a G+7 multi-story building of regular and irregular design. In this study, regular and irregular multistory residential buildings are planned and assessed using the response spectrum approach and STAAD Pro. They performed the dynamic study using a material having linear static characteristics. Seismic analyses are carried out for a number of seismic zones, and the results from all zones are compared. It entails taking the soft soil.In this research, they compare the base shear, period node displacement, and frequencies of various irregular and regular buildings for each zone.

Abhishek Mishra, Anurag Tripathi and Kumar vanshaj (2022) [4]
Seismic analysis and design of a G+20 multistory structure for zone II are performed in this article using STAAD Pro V8i with and without shear walls. The main purpose of this work is to use a linear static technique to analyse storey drift, storey displacement, and base shear with and without the effect of a concrete shear wall. The STAAD Pro V8i-created SMRF RC frame structure building model compares multi-story buildings with and without shear walls.

MD Zubair Pasha and SK Jain (2022) [5]
The main idea behind seismic analysis for earthquake resistant structures is that buildings should be able to withstand mild earthquakes without being damaged. These research analyses and designs G+ 20 RC buildings for four different seismic zones in India. STAAD Pro V8i is used to do this analysis. This research looks at the different bay lengths, number of bays, and bay widths along the horizontal direction. For four separate zones, different seismic zone factor values are calculated and compared.

Narla Mohan, A. Mounika Vardhan (2017) [6]
In this article, Etabs is used to analyses the high rise structure of RC structures in different zones. The building has G+20 stories with a constant story height of 3m and has been seismically analysed for various seismic zones in India. This model is used to examine different bay lengths, bay numbers, and bay widths along the horizontal axis. Different values are calculated and compared for each seismic zone in India.

METHODOLOGY

IS regulations such as 1893:2002 (part 1) and IS 456:2000 were used in the design of multi story buildings. This design necessitated the creation of an architectural plan. A beam and column dimension for analysis and the design purpose is gathered from a high rise building construction site. In STAAD Pro, the following procedures are utilized for modelling:

1. **Structural Modeling:** In STAAD Pro, create a 3D model of the G+20 multistory building, including all structural components such as columns, beams, slabs, and shear walls. Assign material and section properties to the various components.
2. **Load Analysis:** As per the appropriate norms and standards, apply the loads to the structure, including dead load, live load, wind load, and seismic load. Perform load combinations to establish the structure's critical load scenarios. Shear wall placement: Test the effect of shear walls in various locations and orientations on the structure's behavior. To find the most effective shear wall placement, compare the outcomes with and without shear walls.
3. **Design And Optimization:** Based on the results of the load analysis, design structural components such as columns, beams, slabs, and shear walls for strength and stability. Maximized the design by altering component dimensions and changing shear wall placement to provide the highest structural performance in the multi-story building.
4. **Code Compliance:** Ensure that the design conforms to all applicable codes and standards, such as building codes, earthquake codes, and wind laws. Assemble any design changes that are required to meet code requirements.

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5. **Results And Analysis:** Analyze and review the analysis and design data to see if the structure fits the specified performance standards. Examine the implications of shear wall placement on the behavior of a building.

Building Modeling

A 21-storey skyscraper with a ground floor having 4m height and first floor to last floor having 3 meter height for each story and a regular design is modelled for this study. These structures were designed in accordance with the Indian Code of Practice.

Buildings must be Seismic Resistant. Building story heights, excluding the lowest floor, are believed to remain constant. STAAD Pro was used to create the buildings. Two alternative models were investigated, one is design without shear wall and another model is design with shear wall placement in a building in alternative position with a varied column orientation. First model is design and analysis without shear wall is examined with a column size of 0.23 x.0.46 m and also this is design and analysis without shear wall is examined by shifting the column orientation to 0.46 x 0.23m. Then Second model is design and analysis with using shear wall is examined a column size of 0.23 x.0.46 m and also this model is design and analysis with shear wall is examined by shifting the column orientation to 0.46 x.0.23m. The construction is thought to be in seismic zone –II for Nagpur location.

Table 1 - Building geometric details.

Sr. no.	Description	
1	No. of Storey	21
2	Floor to floor height	3m
3	Column size	0.23 x 0.46 m 0.46 x 0.23 m
4	Beam size	0.23 x 0.30 m
5	Slab thickness	150mm
6	Shear wall thickness	120mm

The model of a G+20 structure to be analysed is shown below.

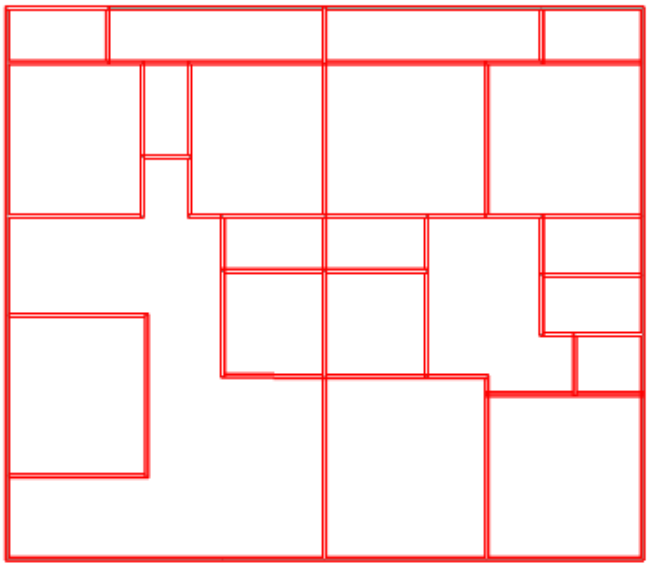

Fig. 1. (a) 2D view of building

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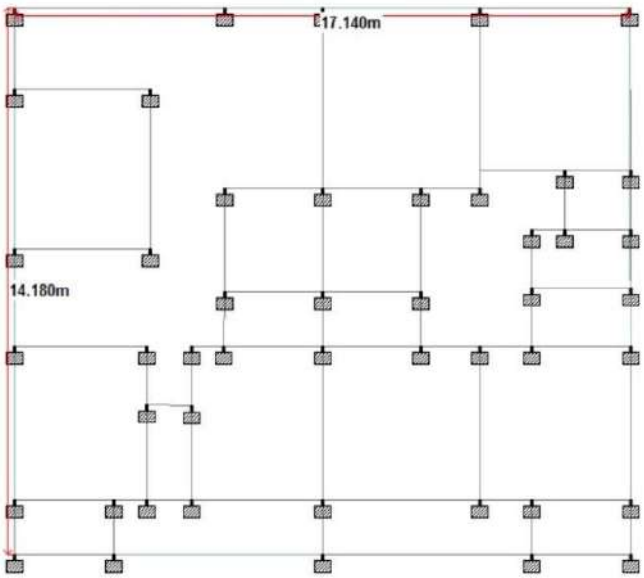

Fig. 1. (b) 2D view of building with Support

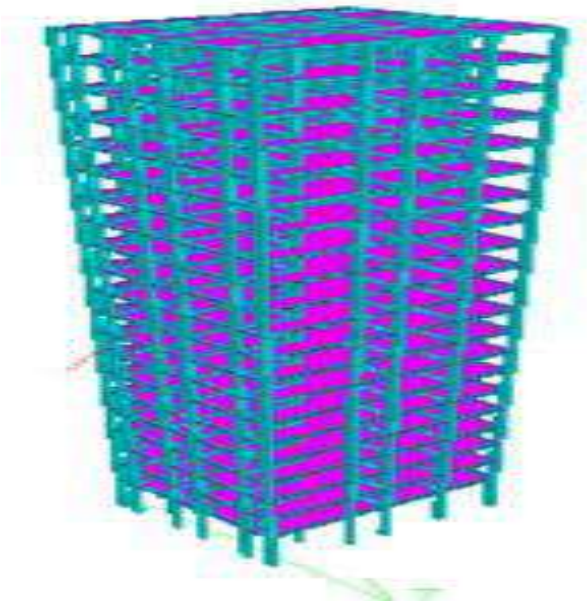

Fig. 2.(a) 3D view of building without shear wall

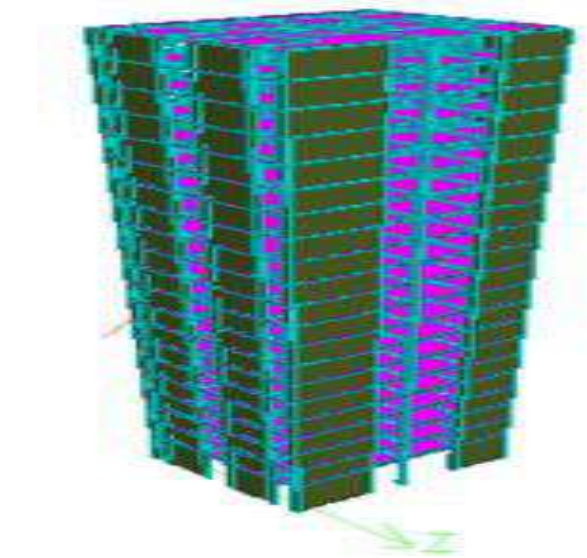

Fig. 2. (b) 3D view of building with shear wall

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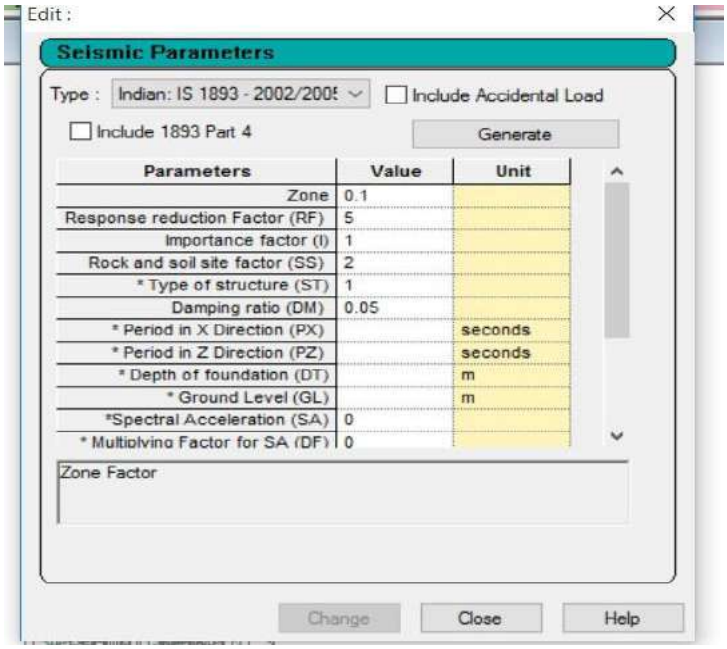

Fig. 3: Seismic Parameters of Multi storied Building

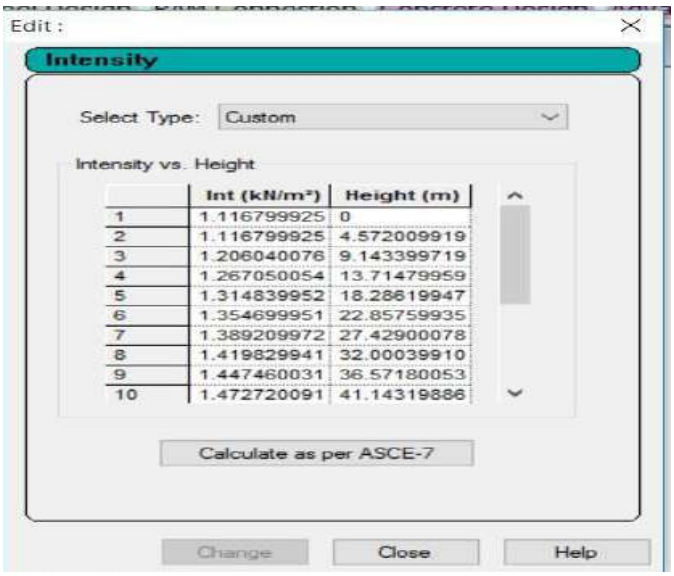

Fig. 4: Wind Intensity

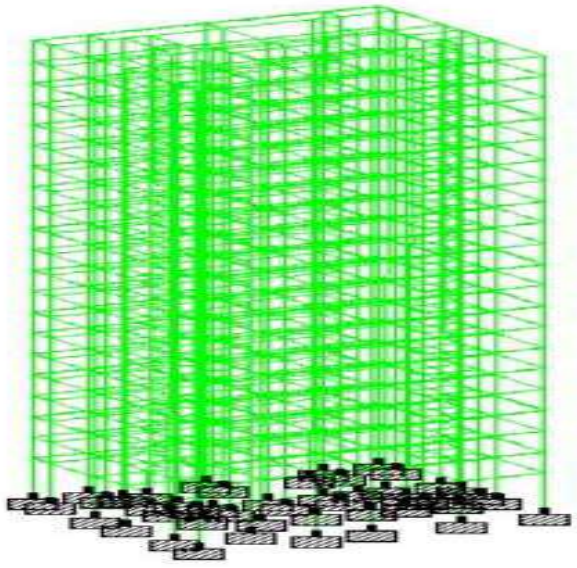

Fig. 5: Displacement in G+20 Multi storied building without shear wall

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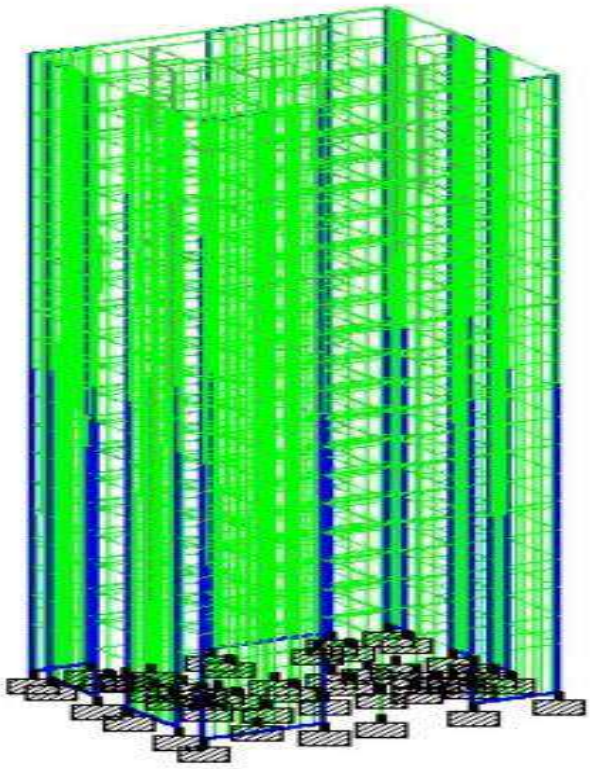

Fig. 6: Displacement in G+20 Multi storied building with shear wall

RESULTS

STAAD Pro was used to analyses and designs a G+20 multi-story structure with and without shear walls by orientation of column in this project. This project yielded the following results:

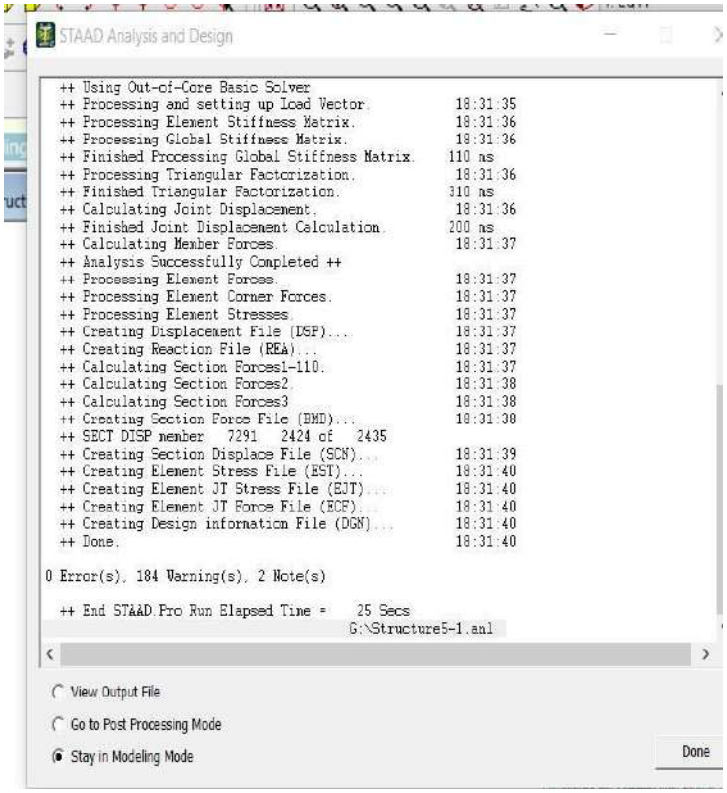

Fig. 7: STAAD Analysis and Design of G+20 Multi storied building without shear wall

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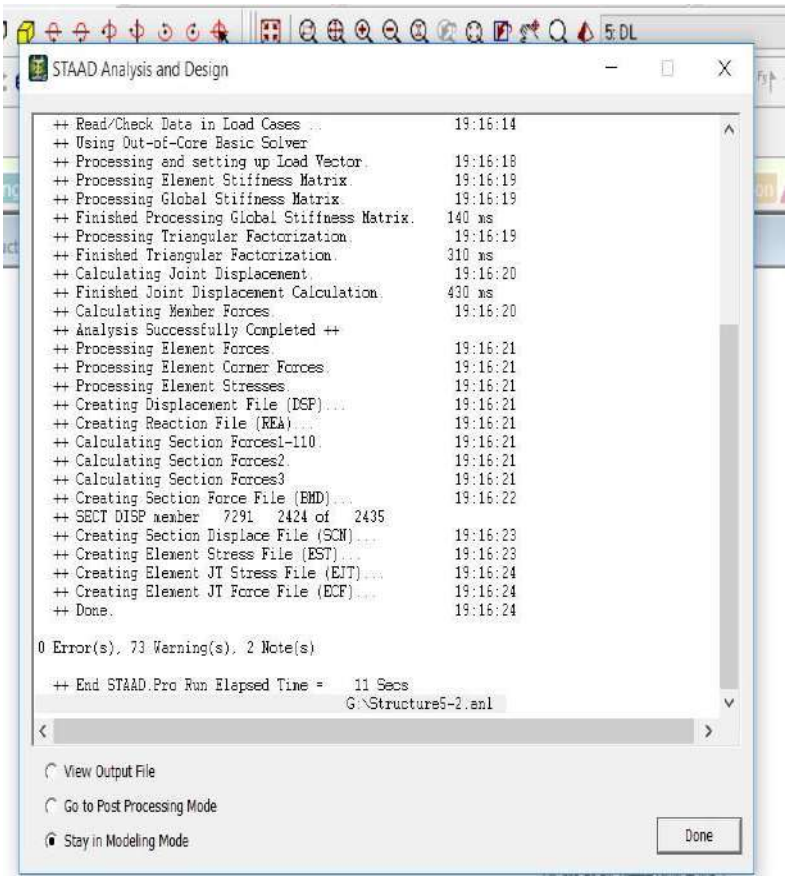

Fig. 8. STAAD Analysis and Design of G+20 Multi storied building without shear wall by orientation of column

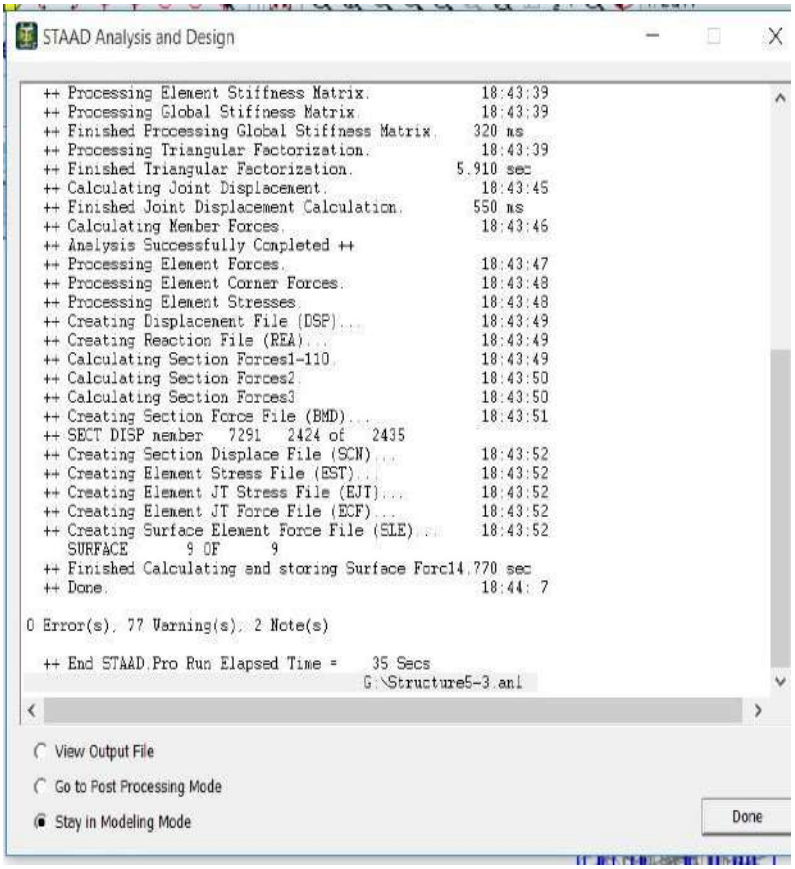

Fig. 9 STAAD Analysis and Design of G+20 Multi storied building with shear wall

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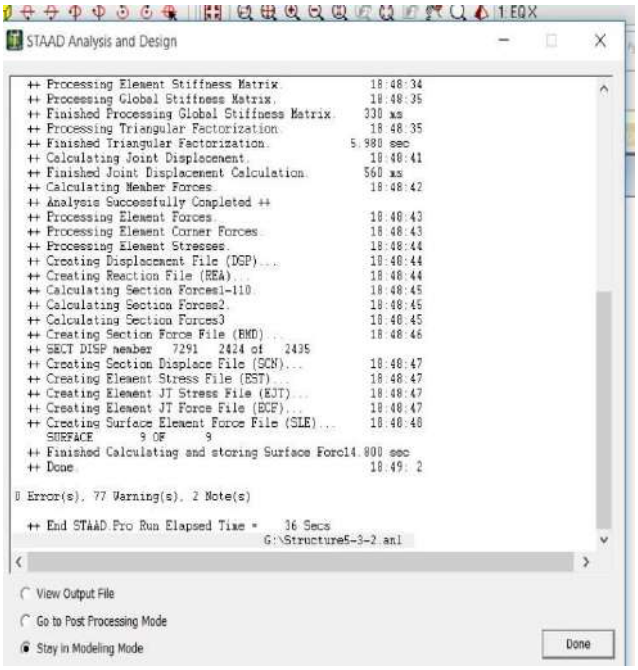

Fig. 10 STAAD Analysis and Design of G+20 Multi storied building with shear wall by orientation of column

For EQ-X direction Shear force in G+20 multi storied building without shear wall without changing orientation of column is more than by orientation of column.

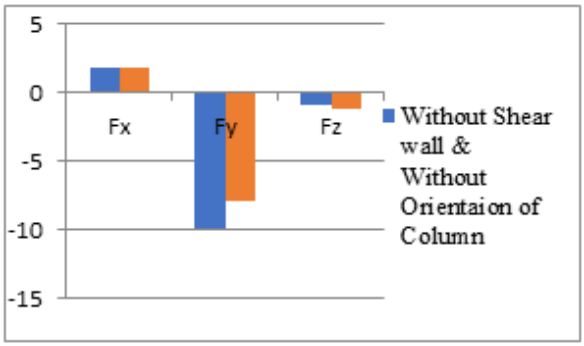

Fig. 11: Comparison of Axial & Shear Force in G+20 multi storied building without shear wall in case EQ-X direction

For EQ-X direction Shear force in G+20 multi storied building with shear wall by changing orientation of column is more than without orientation of column.

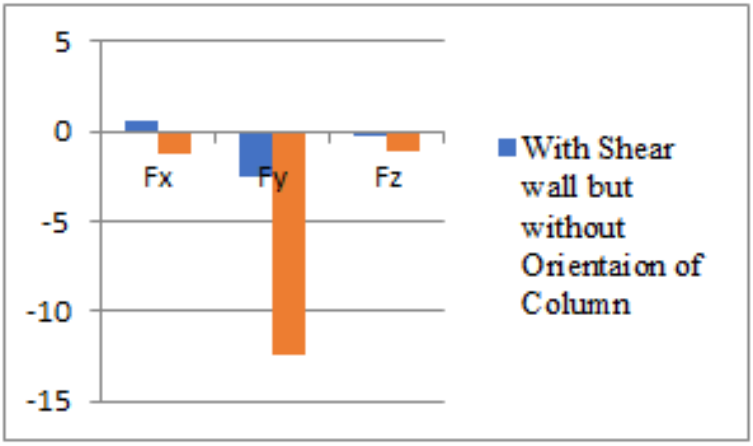

Fig. 12: Comparison of Axial & Shear Force in G+20 multi storied building with shear wall in case EQ-X direction

In EQ-X direction Bending Moment is more in G+20 with shear wall structure by orientation of column and in without shear wall structure Bending moment in Z direction is more in without orientation of column.

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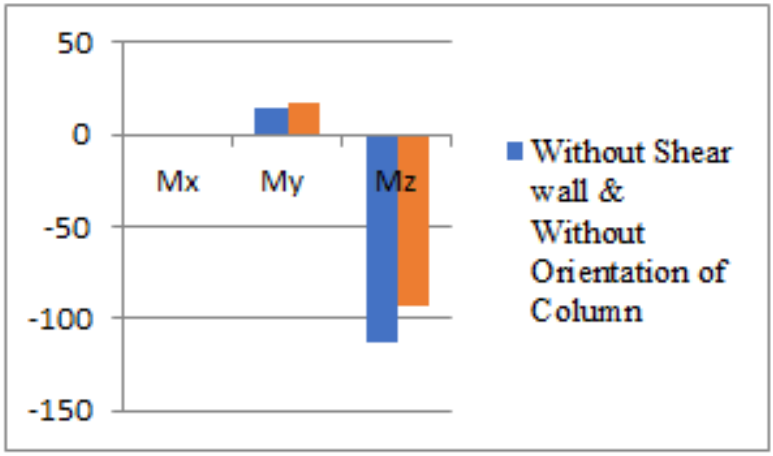

Fig. 13: Comparison of Torsion & Bending Moment in G+20 multi storied building without shear wall in case EQ-X direction

For EQ-X direction Bending moment in G+20 multi storied building with shear wall by changing orientation of column is more than without orientation of column.

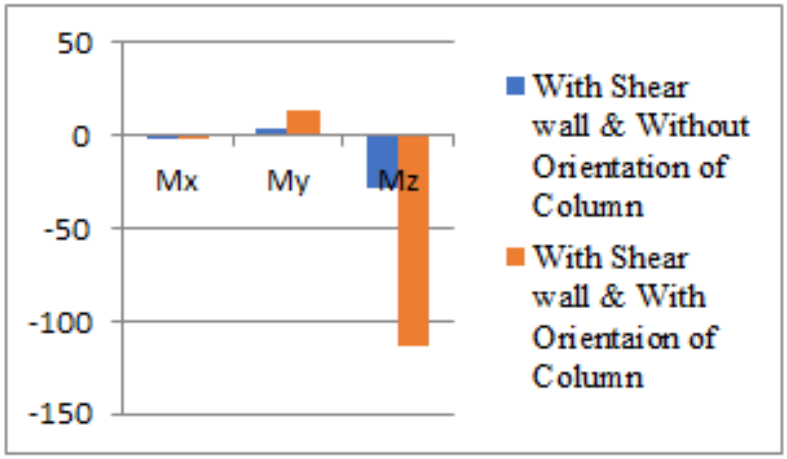

Fig. 14: Comparison of Torsion & Bending Moment in G+20 multi storied building with shear wall in case EQ-X direction

For EQ-Z direction Shear force in G+20 multi storied building without shear wall without changing orientation of column is more than by orientation of column.

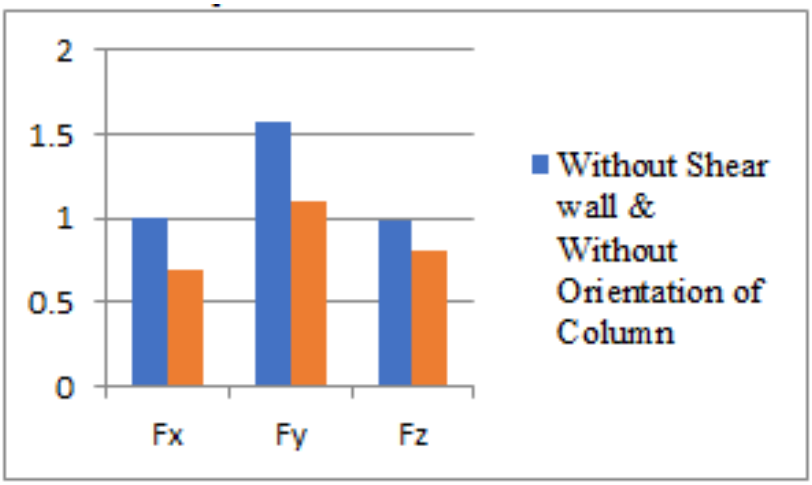

Fig. 15: Comparison of Axial & Shear Force in G+20 multi storied building without shear wall in case EQ-Z direction

For EQ-Z direction Shear force in G+20 multi storied building with shear wall without changing orientation of column is more in Z direction but in Y direction shear force is more in shear wall with orientation of column structure by orientation of column.

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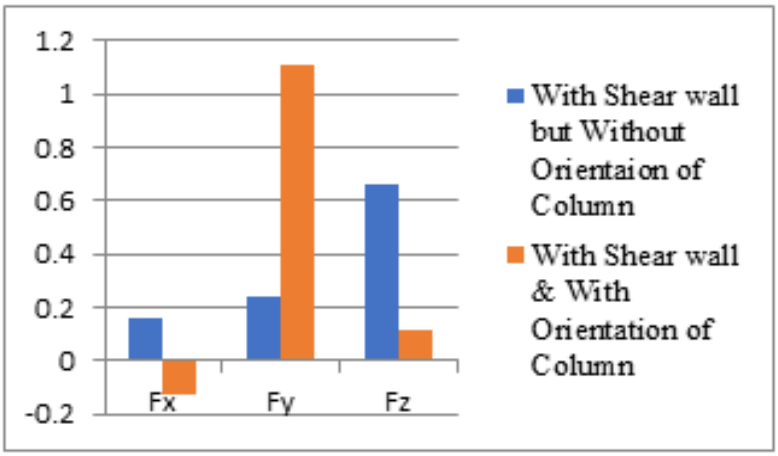

Fig. 16: Comparison of Axial & Shear Force in G+20 multi storied building with shear wall in case EQ-Z direction

For EQ-Z direction Bending moment in G+20 multi storied building without shear wall by changing orientation of column is more than without orientation of column.

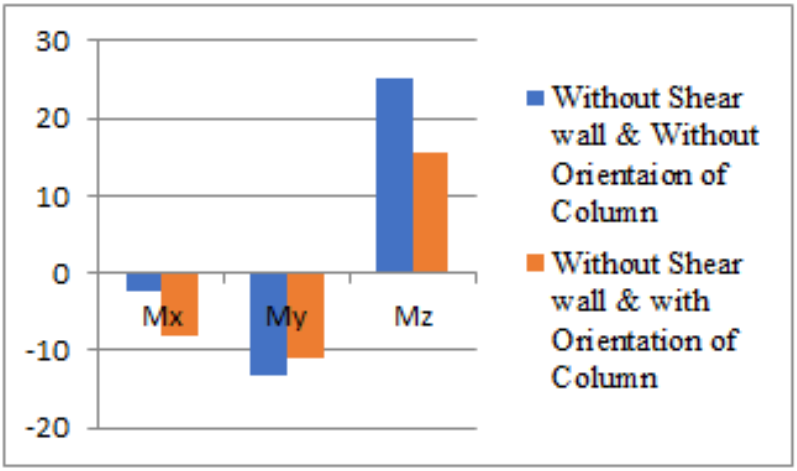

Fig. 17: Comparison of Torsion & Bending Moment in G+20 multi storied building without shear wall in case EQ-Z direction

For EQ-Z direction Bending moment in G+20 multi storied building with shear wall by changing orientation of column is more than without orientation of column.

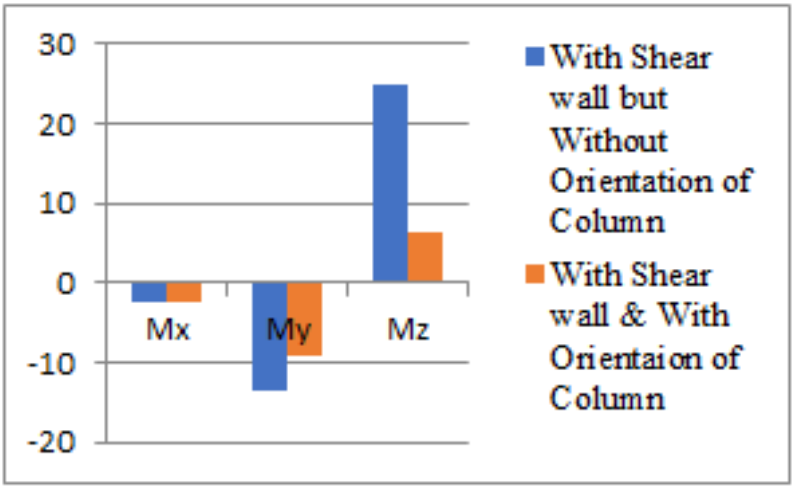

Fig. 18. Comparison of Torsion & Bending Moment in G+20 multi storied building with shear wall in case EQ-Z direction

For WL-X direction Shear force in G+20 multi storied building without shear wall without changing orientation of column is more than by orientation of column.

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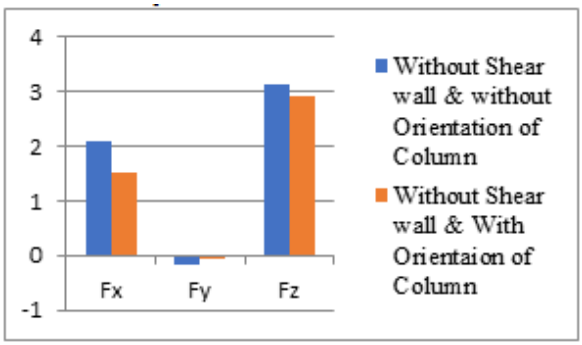

Fig. 19. Comparison of Axial & Shear Force in G+20 multi storied building without shear wall in case WL-X direction

For WL-X direction Shear force in G+20 multi storied building with shear wall without changing orientation of column is more than by orientation of column.

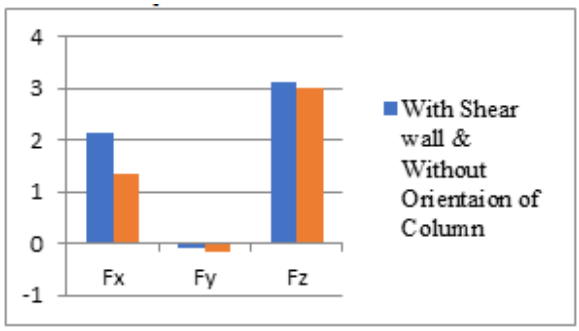

Fig. 20. Comparison of Axial & Shear Force in G+20 multi storied building with shear wall in case WL-X direction

For WL-X direction Bending moment in G+20 multi storied building without shear wall by changing orientation of column is less than without orientation of column.

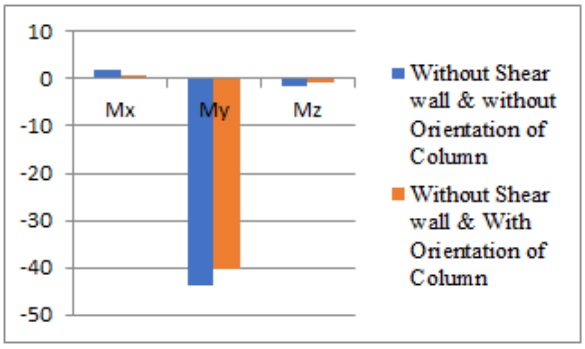

Fig. 21. Comparison of Torsion & Bending Moment in G+20 multi storied building without shear wall in case WL-X direction

For WL-X direction Bending moment in G+20 multi storied building with shear wall by changing orientation of column is less than without orientation of column.

Fig. 22. Comparison of Torsion & Bending Moment in G+20 multi storied building with shear wall in case WL-X direction

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For WL-Z direction Shear force in G+20 multi storied building without shear wall without changing orientation of column is less than by orientation of column.

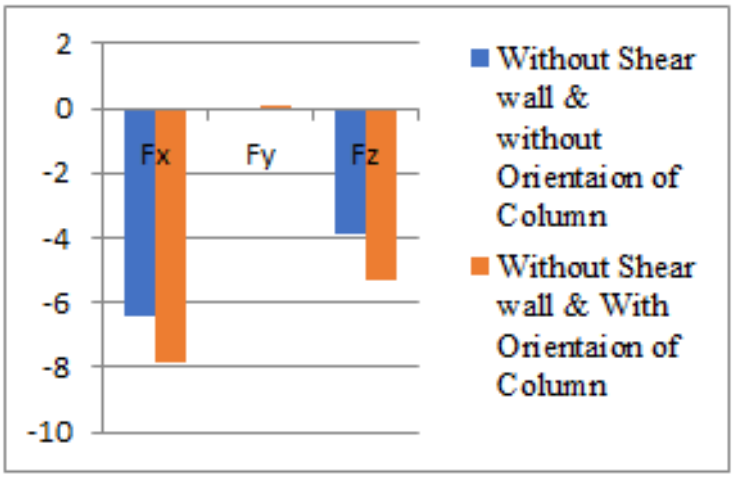

Fig. 23. Comparison of Axial & Shear Force in G+20 multi storied building without shear wall in case WL-Z direction

For WL-Z direction Shear force in G+20 multi storied building with shear wall without changing orientation of column is equal by orientation of column.

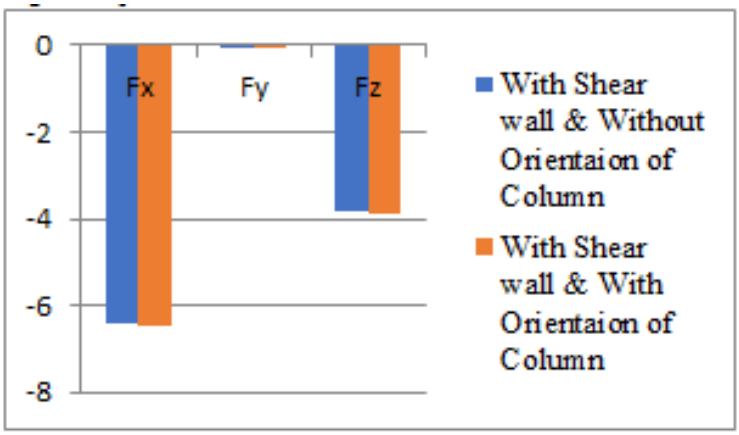

Fig. 24. Comparison of Axial & Shear Force in G+20 multi storied building with shear wall in case WL-Z direction

For WL-Z direction Bending moment in G+20 multi storied building without shear wall by changing orientation of column is more than without orientation of column.

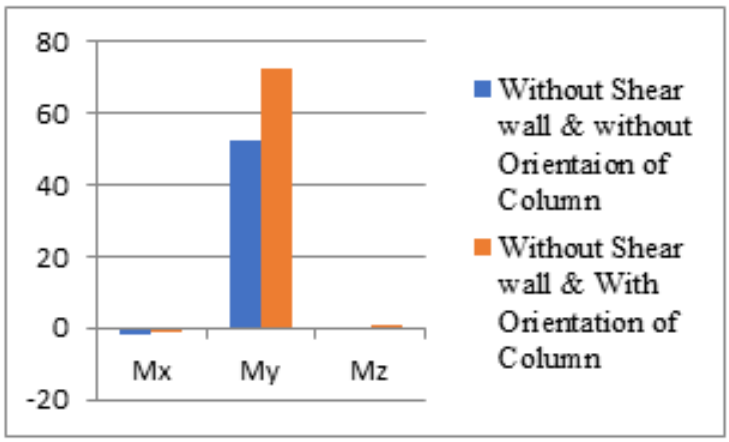

Fig. 25. Comparison of Torsion & Bending Moment in G+20 multi storied building without shear wall in case WL-Z direction

For WL-Z direction Bending moment in G+20 multi storied building with shear wall by changing orientation of column is more than without orientation of column.

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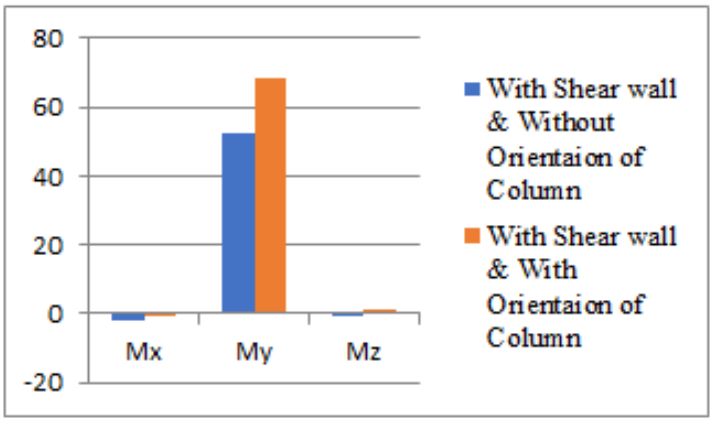

Fig. 26: Comparison of Torsion & Bending Moment in G+20 multi storied building with shear wall in case WL-Z direction

CONCLUSION

The project "Analysis and Design of G+20 Multi-Storied Building with and Without Shear Wall by Changing the Orientation of Columns" has produced important insights into the structural behaviour and performance of multi-story buildings under various design configurations. The following is an overview of the project's principal findings:

1. The use of shear walls in the structural design improves the building's lateral load resistance and overall stability. Buildings with shear walls outperformed those without them in terms of structural performance, particularly in areas prone to seismic activity or severe wind loads.
2. The orientation of columns in a multi-story building can have a big impact on its structural behaviour. It was discovered that changing column orientation, such as utilising a cross-shaped arrangement, can more efficiently distribute lateral stresses and lessen structural vulnerabilities.
3. The location of shear walls within the building is critical to their performance. Shear walls should be placed optimally during the design process to maximise their contribution to structural stability.
4. By strategically employing shear walls and creating columns with appropriate sizes and configurations, a building's structural efficiency in terms of material usage and load-bearing capability can be optimized.
5. Buildings with shear walls performed better in seismic tests than buildings without shear walls. This highlights the significance of shear walls in reducing the danger of structural damage during seismic occurrences.

With the same loading pattern and cross section, a G+20 multi storied building without shear walls and a G+20 multi storied building with shear walls at alternative position by orientation of column were analyzed.

1. First G+20 multi storied building was analysis and design without shear wall by column size 0.23 x 0.46 m and the results produced zero error, indicating that the building is likewise safe for earthquake and wind loads.
2. Then second G+20 multi storied building was analysis designed without shear wall by orientation of column size is 0.46 x 0.23 m, and also the results produced zero error, indicating the building is likewise safe for earthquake and wind loads.
3. Third G+20 multi storied building was analysis and design with shear wall by column size 0.23 x 0.46 m and the results produced zero error, indicating that the building is likewise safe for earthquake and wind loads.
4. Then fourth G+20 multi storied building was analysis designed with shear wall by orientation of column size is 0.46 x 0.23 m, and also the results produced zero error, indicating the building is likewise safe for earthquake and wind loads.

Future Scope: The future scope of this research in performance comparison, seismic analysis and Retrofitting, wind load analysis, foundation design, sustainable design, computational advances, code updates, parametric analysis, integration with BIM and material innovation. Overall, the future scope of analysis and design for multi-storied buildings using STAAD Pro is exciting, as it enables engineers to continually improve the safety, efficiency, and sustainability of structures. It also empowers them to explore innovative approaches to meet the ever-evolving demands of the construction industry and urban development.

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COMPARISON OF SUBSTRUCTURE'S SEISMIC STABILITY WITH THE CHANGE IN UNDERYING SOIL PARAMETERS

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ABSTRACT
There are different types of soil are found on the earth (i.e. Sand, Silt, Clay, Loamy). In Civil Engineering aspects, each type of soil have some trouble due to which the foundation may get failed or damaged. This study discussed the properties of various soils (Sand, Silt, Clay), effect of these soils on structures and covers the guidelines to construct the structure in these types of soils. The main objective of this study is to understand the effect of seismic forces on footing with the change in underlying soil. This project is to analysis of RC Isolated footing on different types of soil for seismic forces and analyzed isolated footing manually and using STAAD FOUNDATION. The aim of this study is to analyze the changes in footing design with the changes in the properties of soils. The footing having some external loading (Seismic Loading) is analyzed and designed for various types of soil i.e. Sand, Silt and Clay. The changes in the pressures for various soil types are determined and studied.

Keywords: Various Soils, Properties, Isolated Footing, Stability.

I. INTRODUCTION

A. Aim:
To study about Substructure's Seismic Stability with the Change in Underlying Soil Parameters.

B. Objective:
The study aims at removing the possibility of failure of foundation by tilting, overturning and sliding due to pressure imposed on soil by foundation being in excess of the ultimate capacity of the soil. The purpose to carry the above mentioned project is:

1. To study the soil construction property.
2. To study the types and function of footing.
3. To study seismic analysis methods.
4. To study effect of seismic forces on footing with change in underlying soil.

C. Need:
Superstructure loads are transmitted to the underlying soil strata through a suitably designed foundation. Therefore, the foundation of a structure is considered the most crucial structural element in a building. Each type of soil such as silt, sand, clay, loamy, black cotton having the effects on foundation like porosity, swell and shrink, lack of drainage, water holding capacity, etc. Thus because of these effects, foundation may get fail or having some major or minor defects. Hence, to overcome or to reduced these effects, it is very necessary to analyze the safety and stability of the foundation.

II. LITERATURE REVIEW
B. Ravi Sankar, et. al (1) Design the isolated footing for cohesive & non-cohesive types of soil for same type of building and try to find which soil is economical & reduced the cost of construction of building by using standard penetration test and finally concluded that, size of isolated footing in cohesive soil is nearly two times more than in non-cohesive soil. Also in cohesive soil the isolated footing is not advisable & more costlier than that of non-cohesive soil. So in cohesive soil pile grouping, well foundation are more suitable than other types of foundation.

Tarun Tiwari, (2) Studied on the effect of soil type for evaluating the seismic performance of footing. By using software STAAD PRO, finding the better technique to make the sensitivity of footing rested on different soil type and finally stated that, soil type which are available at foundation site effects the stability of foundation when subjected to earthquake waves.

Prof. A. R. Gupta, et. al (3) Stated that, it is difficult to construct the structure in black cotton soil because of their poor strength and deformation characteristics. Thus, after discussing on the properties and effect of black

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cotton soil it is concluded that, under-reamed pile foundation & mat foundation is the safest and economical option to construct the foundation in black cotton soil.

Samridhi Singh, et. al (4) Studied the effect of earthquake on different types of foundation such as shallow, mat/raft, pile & structure like gravity dam, arch dam, etc. and provide few ways to overcome the losses during earthquake. The main aim is that, to protect the life of common man from dangerous effect of earthquake.

Komal Bedi, et. al (5) Studied on bearing capacity & settlement of isolated footing for various shape(i.e. square, rectangular, triangular, circular, octagonal, hexagonal, etc.) and stated that, square footing shows the better load settlement behavior for a given settlement indicating higher load carrying capacity.

III. LOADING COMBINATIONS

It's our duty to design a safe and serviceable structure and in order to do so we must predict the magnitudes of various loads that are likely to be applied to the substructure or superstructure over its lifetime.

Load combinations provide the basic set of building load conditions that should be considered by the designer.

I. 1.5(DL+LL)

II. 1.2(DL+LL+EQX)

III. 1.2(DL+LL-EQX)

IV. 1.2(DL+LL+EQZ)

V. 1.2(DL+LL-EQZ)

VI. 1.5(DL+EQX)

VII. 1.5(DL-EQX)

VIII. 1.5(DL+EQZ)

IX. 1.5(DL-EQZ)

X. 0.9DL+1.5EQX

XI. 0.9DL-1.5EQX

XII. 0.9DL+1.5EQZ

XIII. 0.9DL-1.5E

VI. CASE CONSIDERATION MODELLING AND ANALYSIS COMPUTATIONAL BUILDING ANALYSIS:

The details of a structure considered for the analysis is as follows:

It is six storied RCC frame structure comprising of rooms. The dimensions of respective 5 rooms are; Living Room = 3.89 x 3.53 m

Bed Room(1) = 2.81 x 3.54 m Bed Room(2) = 3.47 x 3.84 m Kitchen = 3.55 x 3.54 m

Study Room = 3.23 x 3.84 m Store Room = 5.17 x 2.58 m

Wc = 1.53 x 1.14 m Bath = 1.53 x 1.44 m

Puja = 2.81 x 1.23 m Porch = 2.81 x 2.3 m Height of each floor = 3 m

Depth of footing = 3.1 m

Size of Beam = 0.50 x 0.30 m Size of Column = 0.45 x 0.45 m Total Height of Building = 21.1 m

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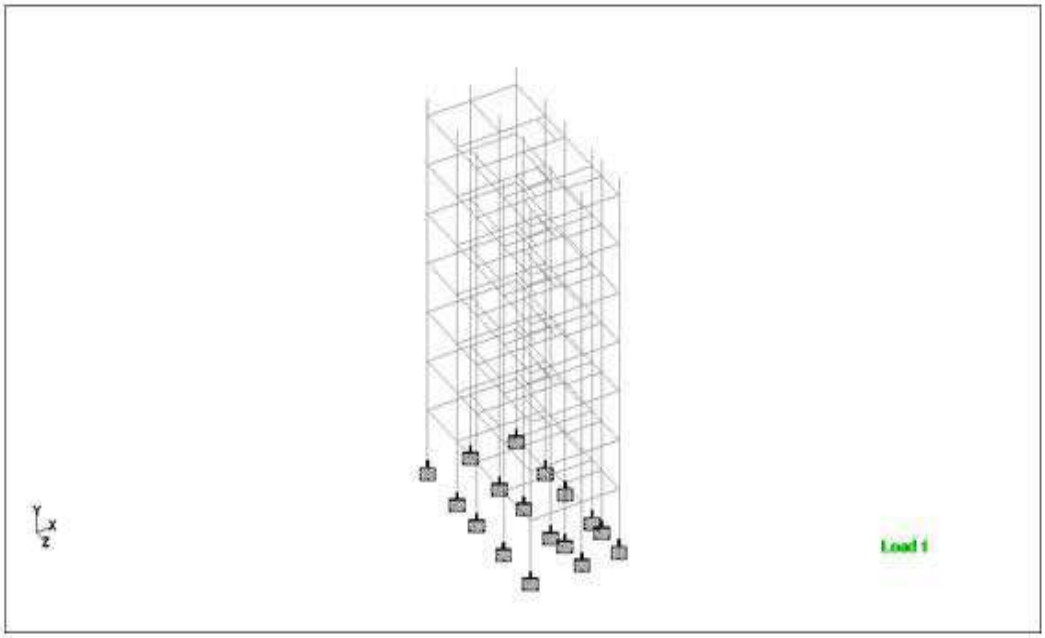

Fig. 1 STAAD-PRO Structure

Table 1: Support Reactions on Isolated Footing

Footing No.	Horizontal Fx (kN)	Vertical Fy (kN)	Horizontal Fz (kN)	Moments Mx (kNm)	My (kNm)	Mz(kNm)
1	63.474	1195.14	56.955	120.694	1.073	130.186
2	62.486	1348.620	75.979	139.905	0.970	128.735
3	60.555	1338.231	76.561	140.511	0.789	124.935
4	58.331	1377.985	73.933	137.722	0.766	120.189
5	59.136	1173.519	56.121	119.412	0.737	112.655
6	82.937	1267.25	53.449	119.412	0.725	150.350
7	81.112	1219.911	50.162	109.170	0.709	149.576
8	79.080	1214.539	58.113	118.958	0.667	147.654
9	74.878	1214.761	63.972	124.832	0.771	141.999
10	64.206	1105.202	75.837	136.602	0.709	125.053
11	71.870	1362.995	58.301	118.958	0.620	138.841
12	60.604	1161.667	53.954	113.696	0.357	130.525
13	59.275	1236.652	71.209	131.157	0.434	129.752
14	59.558	1222.339	71.825	131.856	0.661	128.476
15	56.667	1164.415	73.537	133.526	0.769	123.723
16	56.990	1180.105	76.695	136.626	0.678	126.003
17	55.546	1178.769	57.951	117.741	0.530	122.415

From above table, we can consider one exterior footing and one interior footing. So that, to observe the variations in result due to seismic forces, footing no.3 and footing no.13 is considered for further studies. The output of STAAD design for various cases are:

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CASE 1: FOR SAND (EXTERNAL FOOTING)

Isolated Footing 3

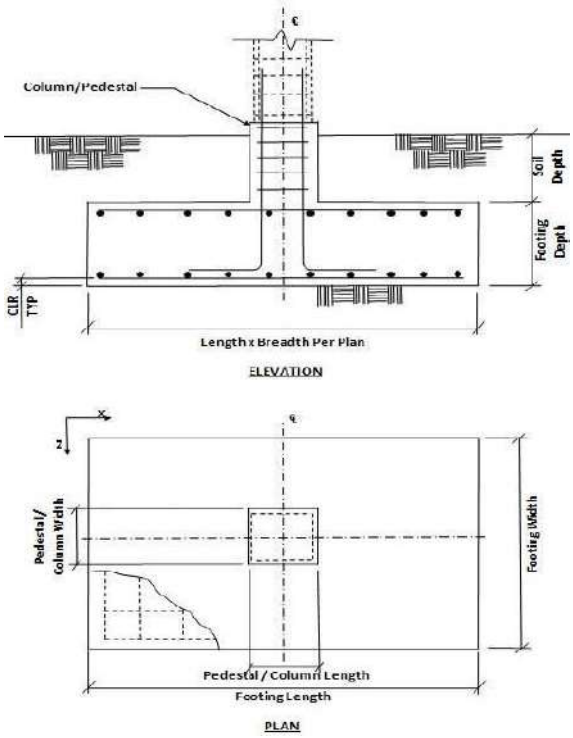

Fig. 1.1 Isolated footing for Case 1

INPUT VALUES FOOTING GEOMETRY

Design Type: Calculate Dimension Footing Thickness (Ft): 550.000 mm Footing Length – X (Fl): 3400.000 mm Footing Width – Z (Fw): 2300.000 mm Eccentricity along X (Oxd): 0.000 mm Eccentricity along Z (Ozd): 0.000mm

COLUMN DIMENSIONS

Column Shape: Rectangular Column Length –X (Pl): 0.450 m Column Width – Z (Pw): 0.450 m **Pedestal**

Include Pedestal: No Pedestal Shape: N/A

Pedestal Height: N/A Pedestal Length – X (Pl): N/A Pedestal Width – Z (Pw): N/A **Design Parameters**

Concrete and Rebar Properties Unit Weight of Concrete: 25.0KN/m^3 Strength of Concrete: 25.000 N/mm^2 Yield Strength of Steel: 415.0 N/mm^2 Minimum Bar Size: Ø10

Maximum Bar Size: Ø32 Minimum Bar Spacing: 110.00 mm

Maximum Bar Spacing: 500.00 mm Pedestal Clear Cover (P,CL): 50 mm Footing Clear Cover (F,CL): 50 mm **Soil Properties**

Soil Type: Drained

Unit Weight: 16.000 KN/m^3

Soil Bearing Capacity: 100.0 KN/m^2 Soil Surcharge: 13.39 KN/m^2

Soil Depth above Footing: 1200 mm Cohesion: 2.000 KN/m^2

Min Percentage of Slab: 0.000 **Sliding and Overturning** Coefficient of Friction: 0.450

F.O.S Against Sliding: 1.500

F.O.S Against Overturning: 1.500

V. OBSERVATION AND REMARK

For the study undertaken, the super structure was analyzed and the footing design is done for exterior and interior footing resting on different types of soil. Case-1 is the modeling analysis and design of footing for sand. Case-2 is for silt type of soil and Case-3 is for clay type of soil.

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Table 2: Input soil properties of different types of soil

	Case 1	Case 2	Case 3
Soil Type	Sand (Drained)	Silt (Drained)	Clay (Un drained)
Unit Weight	16.000 KN/m^3	18.000 KN/m^3	21.000 KN/m^3
Soil Bearing Capacity	100-300 KN/m^2	Up to 75 KN/m^2	75-180 KN/m^2
Soil Surcharge	13.39 KN/m^2	-	17.580 KN/m^2
Depth of Soil above Footing	1.2000 m	1.200 m	1.200m
Cohesion	0.5-2 KN/m^2	75 KN/m^2	10-100 KN/m^2
Un drained Shear Strength	0	0	0
Min Percentage of Slab	0	0	0
Coefficient of Friction	0.450	0.500	0.300

REMARK:
From the above table it can be seen that the Bearing capacity of the silt soil is minimum and is more for sand type. While the cohesion is maximum for clay type of soil. The density is minimum for sand while maximum for clay.

Table 3: Load Combination, Applied loads-Service Stress Level for Footing 3

		Axial (KN)	Shear X (KN)	Shear Z (KN)	Moment X (KN)	Moment Z (KN)
Case 1		266.608	40.630	0.670	1.375	-87.019
Case 2	EQX	-	-	-	-	-
Case 3		266.608	40.630	0.670	1.375	-87.019
Case1		-204.685	-2.479	35.372	75.111	5.226
Case 2	EQZ	-	-	-	-	-
Case 3		-204.685	-2.479	35.372	75.111	5.226
Case 1		9323.851	61.513	53.954	-113.692	-130.542
Case 2	Max. Value	-	-	-	-	-
Case 3		9323.851	61.513	53.954	-113.692	-130.542

FOR FOOTING 13

Table 4: Load Combination, Applied loads-Service Stress Level for Footing 13

		Axial (KN)	Shear X (KN)	Shear Z (KN)	Moment X (KN)	Moment Z (KN)
Case 1		-160.771	41.544	1.977	2.038	-84.218
Case 2	EQX	-	-	-	-	-
Case 3		-160.771	41.544	1.977	2.038	-84.218
Case1		47.271	1.368	50.484	91.031	-2.633
Case 2	EQZ	-	-	-	-	-
Case 3		47.271	1.368	50.484	91.031	-2.633
Case 1		10566.389	-64.206	-75.837	-136.596	128.460
Case 2	Max. Value	-	-	-	-	-
Case 3		10566.389	-64.206	-75.837	-136.596	128.460

REMARK:
From the above tables (i.e. 3 & 4) it can be seen that the values for sand and clay are coming same while the values for case 2 that is silt is absent, which reflects failure of footing.

Table 5: Load Combination, Applied loads-Strength Level for Footing 3

		Axial (KN)	Shear X (KN)	Shear Z (KN)	Moment X (KN)	Moment Z (KN)
Case 1		266.608	40.630	0.670	1.375	-87.019
Case 2	EQX	-	-	-	-	-
Case 3		266.608	40.630	0.670	1.375	-87.019
Case1		-204.685	-2.479	35.372	75.111	5.226
Case 2	EQZ	-	-	-	-	-
Case 3		-204.685	-2.479	35.372	75.111	5.226
Case 1		13985.777	75.154	-53.954	-113.692	-130.542
Case 2	Max. Value	-	-	-	-	-
Case 3		13985.777	75.154	-53.954	-113.692	-130.542

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Table 6: Load Combination, Applied loads-Strength Level for Footing 13

		Axial (KN)	Shear X (KN)	Shear Z (KN)	Moment X (KN)	Moment Z (KN)
Case 1		-160.771	41.544	1.977	2.038	-84.218
Case 2	EQX	-	-	-	-	-
Case 3		-160.771	41.544	1.977	2.038	-84.218
Case1		47.271	1.368	50.484	91.031	-2.633
Case 2	EQZ	-	-	-	-	-
Case 3		47.271	1.368	50.484	91.031	-2.633
Case 1		15849.584	-64.206	80.050	143.014	128.460
Case 2	Max. Value	-	-	-	-	-
Case 3		15849.584	-64.206	80.050	143.014	128.460

REMARK:
The table (5 & 6) shows the values of Earthquake load and maximum load for the 3 cases in which for both sand and clay results are similar while for the silt is it absent showing failure of the footings.

Table 7: Pressure at Corner of Footing for footing 3

	Pressure at Corner 1 (q1) (KN/m^2)	Pressure at Corner 2 (q2) (KN/m^2)	Pressure at Corner 3 (q3) (KN/m^2)	Pressure at Corner 4 (q4) (KN/m^2)	Area of Footing in Uplift (Au) (m^2)
Case 1	96.7092	97.7130	98.2990	97.2651	0
Case 2	-	-	-	-	0
Case 3	174.3920	176.8370	178.2642	175.8191	0

Table 8: Pressure at Corner of Footing for footing 13

	Pressure at Corner 1 (q1) (KN/m^2)	Pressure at Corner 2 (q2) (KN/m^2)	Pressure at Corner 3 (q3) (KN/m^2)	Pressure at Corner 4 (q4) (KN/m^2)	Area of Footing in Uplift (Au) (m^2)
Case 1	97.2688	97.7998	98.7141	98.1831	0
Case 2	-	-	-	-	0
Case 3	174.5163	175.7858	177.9716	176.7021	0

REMARK:
Here it is shown that (in table 7 & 8) the pressure is more developed for clay type soil that is case 3 and it is minimum for the case number 1 that is for sandy soil. It can also be seen that the density of clay is maximum and that of sandy soil is minimum.

Table 9: Stability against Overturning and Sliding for footing 3

	Against Sliding Along X Direction	Against Sliding Along Z Direction	Against Overturning Along X Direction	Against Overturning Along Z Direction
Case 1	3798.982	15740.636	19463.591	81712.456
Case 2	-	-	-	-
Case 3	2523.033	10460.660	14420.556	60501.510

Table 10: Stability against Overturning and Sliding for footing 13

	Against Sliding Along X Direction	Against Sliding Along Z Direction	Against Overturning Along X Direction	Against Overturning Along Z Direction
Case 1	10470.775	20750.995	284165.397	45857.835
Case 2	-	-	-	-
Case 3	7127.459	14155.737	217459.40	35212.654

REMARK:
Here, case number 3 that is for clay soil shows the stability value for sliding and overturning is comparatively low to that of sandy solid.

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VI. CONCLUSION

The study done over here is to analyze the effect of soil type on the stability of substructure that is subjected to seismic forces. For this the superstructure is modeled and analyzed for the reaction values. This reaction values are inserted as the force values that are acting on the rectangular RCC footing. Thus, the overlying forces are same for all the cases. Now with the change in underlying soil condition, three times the footing is analyzed and designed. Case for sandy soil, Case 2 for silt and case 3 for clay soil. The effect of Seismic forces and maximum forces are studied. The values of pressure on corners, centers, stresses on footing and stability against overturning and sliding is studied. The comparison of the three cases shows that the for same overlying superstructure loads and reactions the footing fails if it is silt soil which is having density (<75 N/mm^2) in mid as compared to sand and clay soil. Further it can be seen that the values for pressure is more for clay soil and the safety values against sliding and overturning is less as that compared to sandy soil. Thus, the study shows over here that even if the seismic forces are considered the footing fails for silt, is good enough for clay and is more stable and sound for sandy soil. Thus the preliminary subsoil study becomes necessary for stability of structure against seismic forces.

VII. ACKNOWLEDGEMENT

At this moment I feel grateful and loyal to my supervisor, **Dr. A. R. Gupta** for his Enthusiastic suggestions and kind help towards me in achieving success of my project. His constant encouragement and in valuable share of his valuable time with me made such a difficult task so easy. I take this opportunity to express our heartfelt gratitude to all those who helped me in various ways during the project at MKCT, Akola.

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I would like to use this opportunity to express my gratitude to all the faculty members of the Civil Engineering Department who played a vital role in bringing me to this level.

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PROBABLE USE OF ALUMINIUN ALLOY (DURALUMIN) REINFORCED REBAR IN CONCRETE CONSTRUCTION

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ABSTRACT
Steel bars are most frequently utilized in the construction industry. However, issues with weight, corrosion, and environmental impact arise during the manufacture of steel bars. The present study investigates the potential applications of Duralumin as a sustainable and high-performing substitute for traditional steel bars. The study compares the characteristics of Duralium to industry norms and produces interesting results. The yield stress of the Duralium was an 450 MPa, it can be increase to upto 850 MPa(depends on composition) needed for Fe500,550 bars. According to IS:1786–2008 specifications, the elongation percentage of around 40% can be achieved by Duralium. Moreover, Duralium showed a Young's Modulus value of over 200 GPa, meeting the IS:456–2000 guidelines' minimum value requirement.

INTRODUCTION
A significant percentage of the world economy is contributed by the steel manufacturing sector. Iron ore is often used to make steel; around 98% of the mined ore is utilized in this process. Steel is one of the basic materials used in the furniture, cookware, and automotive, as well as construction and electrical instrument production industries. The building industry uses about 25% of the world's annual production of steel. The demand for steel has increased as compare to previous years. It is established that alternative materials can be used for steel rebar. Certain alternative rebar has already been determined to be unacceptable. Fibre Reinforced Polymer (FRP) rebar is one type of alternative rebar material. It is a composite material made of fibers encased in a polymer matrix. discovered that the use of FRP as a substitute for steel rebar and an explosive model of failure in columns with GFRP bars could have a significant financial impact. Bamboo is also frequently used in concrete as a steel rebar substitute. the conclusion that using bamboo instead of rebar in concrete is a bad idea because it causes problems with stiffness and durability. Stainless steel reinforcing bars are also being investigated as a possible substitute for carbon steel bars in concrete. Its minimum chromium content of 10.5% results in the formation of a thin, self-regenerating oxide layer that offers good corrosion resistance. It provides usable mechanical characteristics. Specifically, stainless steel rebar that has been hot rolled is more ductile than carbon steel. However, compared to carbon steel rebar, the price of stainless steel rebar was discovered to be between 4 and 9 times higher.**Duralumin** is a strong, hard, lightweight alloy of aluminium, widely used in aircraft construction. It is composed of manganese, magnesium, and copper. One unique type of metal that is strengthened by heat treatment is duralumin. It can be machined, riveted, welded, well spun, or tempered. Duralumin that has undergone effective heat treatment can effectively resist corrosion. It has ductility and can support large weights. It works particularly well for building aircraft. In the field of civil engineering, this study looking into the possibility of using Duralumin as an alternative to steel bars in RC elements is extremely important. By investigating the application of Duralumin in place of traditional steel bars in reinforced concrete structures, this study potentially shifts the paradigm in construction methods. The innovative nature of this study will influence future civil engineering practises by stimulating research into resilient, affordable, and environmentally friendly construction materials and techniques.

LITERATURE REVIEW
Rama Rao et al. [1], different particulate weight fractions (2.5, 5, and 7.5%) were used in the liquid metallurgy techniques used to create the aluminum alloy-boron carbide composites. Phase identification on boron carbide was done through x-ray diffraction studies; SEM microstructure analysis was performed; and compression and hardness tests were used to characterize the composites. The findings indicate that the amount of boron carbide has increased. The composite materials saw a decrease in density and an increase in hardness. Conversely, as the weight percentage of boron carbide in the composites increased, so did the composites' compressive strength. Ravichandran and associates [2]. created and examined the forming behavior of hybrid powder metallurgical composites based on aluminum. Using the powder metallurgy technique, aluminum-based metal matrix composites were created from Al-TiO2-Gr powder mixtures, and their cold upsetting forming characteristics were examined. The Karunamoorthy group [3]. Analyzed that In order to investigate the mechanical behavior of MMC, 2D microstructure-based FEA models were created. The effects of clustering

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and randomness have been accounted for in the model. From the model, the effects of particle clustering on the stress-strain response and the failure behavior were examined. Since the properties depend on the arrangement of the particles in the microstructure, the microstructure analysis of MMC was used to optimize the properties. To model the microstructure for finite element analysis (FEA), the image of the microstructure is first converted from raster to vector form, then it is pushed to the IGES step and meshes in the FEA model in ANSYS 7. Failures like fracture and DE cohesion at the particle interface are anticipated for both particle-clustered and non-clustered micro structures. They examined the causes of the failure and the impact of the particle arrangement. S. Zinatloo-Ajabshir [4]The use of advanced materials and composites is causing a paradigm shift in a number of industries and maintains great promise for improving human life, environmental sustainability, economic stability, and the production and storage of clean energy. a notable advancement in the field of nanostructured materials, with a focus on the production and use of cerium vanadate (CeVO4) nanoparticles for electrochemical hydrogen storage. Compatibility, high strength, resistance to cracks, resistance to chemicals, lightweight design, high impact strength, high resistance to corrosion, flexibility, and durability are a few advantages and benefits of composites in civil engineering construction. L.C. Hollaway et al [5] The kind of material used for the matrix determines how the composites are categorized. Polymer-matrix composites (PMCs), metal-matrix composites (MMCs), ceramic matrix composites (CMCs), and carbon-matrix composites (CAMCs) are the four main categories of composites. MMCs are composed of a ductile metal or alloy matrix that has been strengthened with additional metal, organic, or non-metallic substances.

METHODOLOGY

Duralumin is an alloy, It is an alloy made up consists of 91-95% aluminium, 3.8-4.9% copper, 1.2-1.8% magnesium, 0.3-0.9% manganese, <0.5% iron, <0.5% silicon, <0.25% zinc, <0.15% titanium, <0.10% chromium and no more than 0.15% of other elements together. This alloy is extremely hard. These alloys find application in areas where hard alloys are necessary, such as in the defense industry's vehicle armor. These alloys were the first aluminum alloys to be widely used that could be shaped.

Although Duralumin is an aluminum alloy, it is lightweight and hard. Its yield strength is typically 450 MPa, though there are a few variations depending on the type, composition, and temper.

The chemical formula for Duralumin is AlCu4Mg. It is an alloy made up of aluminium (Al), copper (Cu) and magnesium (Mg). From Duralumin. Duralumin is an aluminum alloy that is hard, lightweight, and robust. In addition, it is impermeable and reflective. It is an easily shaped metal that is malleable. It is an excellent heat and electrical conductor. It has no smell and creates aluminum oxide when it reacts with the surrounding oxygen. It doesn't corrode easily. Its thin surface is composed of a layer of corrosion-resistant pure aluminum that encases the robust duralumin core. When Duralumin alloys are in their normal state, they are typically pliable, soft, and workable. They are easily forgeable, rolled, and folded. They can also be drew in different forms and forms. Although its strength is great, it is easily lost when wielded. Because of its ease of transformation, it is utilized in the building of aircraft. Because of its great strength and low weight, it is appropriate for use in aircraft construction.

Aluminum is a very resistant to corrosion metal that is lightweight. It can be shaped into any pattern or shape that you like. allow us to construct structures that would be impossible to build out of wood, steel, or plastic. Due to its high cost, aluminum was not used in the construction industry in its early stages of evolution. However, after electrolysis and processing were introduced, the price of aluminum dropped by 80%, increasing its use in the building industry.

Sr, No	Chemical Composition	Contents
1	Aluminum (Al)	90 to 95 %
2	Magnesium (Mg)	0.80 to 1 %
3	Iron (Fe)	0.26 to 0.50 %
4	Manganese (Mn)	0.3 yo 0.50
5	Titanium (Ti)	0.03 to 0.07
6	Zinc (Zn)	0.04 to 0.08

Table 1: Chemical Composition

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Fig 1: Billet of Duralumin

Fig: Bar of Duralumin

RESULTS

Duralumin can be use as reinforced rebar in construction because it follows mechanical properties as per steel rebar and it also follows specification instructed by IS1786–2008 and IS 456:2000.

Aluminium is a lightweight metal with a high level of corrosion resistance. It can be molded into any desired shape or pattern. enable us to build structures that are not achievable with wood, steel, or plastic. In its early stages of development, aluminium was not used in the construction industry due to its high cost. However, the cost of aluminium decreased by 80% with the introduction of electrolysis and processing, leading to a rise in its use in the construction sector.

CONCLUSION

1. Strength and Durability: Duralumin has favorable strength and durability, which makes it appropriate for use in the manufacturing of aircraft and other sectors requiring high-strength, lightweight materials.
2. Duralumin provides good corrosion resistance; however, its long-term performance in concrete structures should be taken into account, particularly in environments where exposure to moisture, chloride, and other corrosive agents is a concern.
3. Cost and Availability: It is important to carefully consider the cost and availability of duralumin as a reinforcing material in construction. It is crucial to weigh the practicality and economic viability of employing duralumin rebar as opposed to conventional steel rebar.
4. Code Compliance: All applicable building codes, standards, and regulations must be followed when using duralumin as a reinforcing material in construction. For construction applications, it's critical to confirm that duralumin rebar satisfies all applicable safety and structural standards.
5. Research and Testing: In order to evaluate duralumin's performance as a reinforcing material in concrete structures, more research and testing are required. This entails assessing bond strength, long-term structural behavior, and compatibility with concrete.
6. Industry Acceptance: Duralumin rebar's acceptance and adoption in the construction sector are contingent upon its demonstrated efficacy, affordability, and enduring dependability as a reinforcing material

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AN ASSESSMENT OF MECHANICAL PARAMETERS OF BACTERIA-BASED CONCRETE

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ABSTRACT
Despite its considerable compressive strength, conventional concrete is prone to cracking when subjected to tensile pressure. Recently, biological compounds have been used to treat concrete fractures and increase the serviceability of concrete structures. The primary objective of this study was to evaluate the mechanical properties of self-healing concrete that uses microorganisms. Two bacteria from the Bacillus family were selected to act as bioagents in the concrete. The bioagents were diluted with water to a concentration of 105-107 cells/mL and used to treat fractures in the concrete. The self-healing concrete was then subjected to compressive and flexural testing to determine its mechanical properties after being cured for a few days. The results showed that, compared to ordinary concrete, the self-healing concrete cured for 14 and 28 days had a 7% and 18% higher compressive strength, respectively. The self-healing concretes had a flexural strength of 11% and 28% higher than the conventional concrete after being cured for 14 and 28 days, respectively. This indicates that the bioagents used were effective in sealing the surface fissures of the concrete and making it unsuitable for habitation.

1. INTRODUCTION
Significant issues plaguing the construction industry today include resource shortages, energy consumption, and carbon dioxide emissions. Concrete is a crucial structural component in constructing large and small units worldwide. It is preferred due to its high compressive strength and ability to take on various shapes. However, concrete has a limited tensile strength, resulting in the formation of internal and external cracks. Steel reinforcement is commonly used to enhance tensile strength, though it only partially eliminates the occurrence of cracking.[1]

By extending the life of existing structures, the need for new constructions must be reduced. Furthermore, reducing the expenses associated with repairs and maintenance resulting from the early breakdown of structures is imperative. Only by stopping the development of cracks and their expansion can all of the characteristics above be achieved. Despite extensive safety measures, weather, incompetent labor, and human mistakes can lead to fractures. A crack's development is not an issue, but its expansion jeopardizes the concrete structure. It impacts the functionality of concrete if ignored. Uneven settling, shoddy design, contraction, and repetitive application of loads are the causes of the development and spread of cracks [2]

Concrete buildings can have several issues, including lowered longevity, security, and integrity. One of the main factors contributing to these problems is the dissolution of concrete due to cracking [3]. The heat generated during the hydration process initially causes the fracture to appear in the concrete. To prevent these fissures, water was sprayed, and wet hessian garments were used to provide consistent surface temperature [4]. Another issue that leads to the degradation of concrete structures is reinforcement corrosion. Reinforcement is protected by a passive layer that forms on its surface; when this film is destroyed, gases and chlorides can enter the concrete fractures, causing corrosion [5]. When it comes to treating cracks in underground buildings and bridges, it is challenging.

Concrete cracks can lead to the exposure of reinforcement to gasses and chlorides, which can initiate the corrosion process and weaken the concrete structure. This can reduce its strength, durability, and impermeability.[6] To increase the service life of a concrete structure, it is essential to address its durability.[7] Repairing invisible fractures can be a challenging and expensive task.[8] Rebuilding or repairing structural damage requires a large amount of cement, which increases the production of dangerous pollutants, posing a threat to the environment.[9] Moreover, the breakdown of concrete structures can lead to economic strain. Sustainable development is the only way to address the issue of concrete cracking and ensure long-term durability.[10]

Self-healing originated from biological systems, where many plants and animals can fully recover from significant harm. This concept has practical applications in solving various technical issues [11]. Asphalt concrete used in road construction has a self-healing quality similar to cement concrete. Fissures in asphalt concrete can directly impact pavement performance, but the asphalt's ability to fill micro-cracks can increase road service life and enhance structural performance [12]. High-performance fiber-reinforced cementitious

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composites, such as engineering cementitious composites, are used to slow the spread of cracks and prevent them from widening [13].

Self-healing concrete is a revolutionary material that can fix cracks and fissures independently. The process involves using microorganisms that absorb oxygen from the concrete, effectively preventing corrosion. Two ways to fill in the cracks are to hydrate inactive cement particles and produce C.S.H. gel and calcite crystals. The production of calcium carbonate is illustrated in Equation (1).

$$CaO+CO2\rightarrow CaCO3 \quad (1)$$

Several factors, including biological agents (15-21), chemical agents (22-27), encapsulated capsules (23-27), and pozzolanic materials (28), have been studied to enhance the effectiveness of repairing fractures. Fracture healing prolongs the lifespan of concrete buildings. Numerous scholars are working towards sustainable development (29-32). This essay focuses on exploring the growth and structure of bacteria in concrete. It investigates how different bacterial cell concentrations affect the mechanical properties of concrete, such as its flexural and compressive strength.

2. MATERIALS AND METHODS

2.1 Cement, Sand, and Aggregates

This study analyzed the properties of 53-grade Portland cement, commonly used as per the Indian Standard Specifications code IS 269-2015. The fine aggregate was limited to a maximum size of 4.75 mm, while the coarse aggregate was limited to 20 mm, as per Indian Standard Specifications code IS 383-2016. Additionally, natural sand was used in its construction. The study utilized M-20 grade concrete and concrete products based on M-20 grade concrete.

Table1. Chemical composition of cement

Sr. No.	Compounds	Percentage of Chemical Composition (%)
1	CaO	61.85
2	SiO2	20.07
3	Al2O3	5.32
4	Fe2O3	4.62
5	MgO	0.83
6	Chloride content	0.0028
7	Others	3.94

Table2. Physical properties of cement, coarse aggregate, and fine aggregate

Sr. No.	Material properties	Values
1	The specific gravity of cement	3.15
2	Fineness of cement	225
3	Standard Consistency of cement	31.5%
4	Initial setting time of cement	30min
5	Final setting time of cement	600min
6	The specific gravity of coarse aggregate	2.94
7	Fineness modulus of coarse aggregate	0.96
8	The specific gravity of fine aggregate	2.83
9	Fineness modulus of fine aggregate	13.2

2.2 A Bacteria Culture.

The current study uses two types of ureolytic bacteria: Bacillus pasteurii and Bacillus megaterium, each with a different cell concentration. The bacterial cultures were conducted in a medium of nutrient broth. To make the broth solution, 100 ml of distilled water, 0.3 grams of beef extract, 0.5 grams of peptone, and 0.5 grams of sodium chloride were combined and sterilized for 20 minutes at 121°C. After allowing it to cool, the culture was inoculated into the medium. We used the Gram staining procedure to determine the bacterial form and captured images using a microscope. We analyzed the bacterial growth pattern using a concrete composition medium.

2.3 MIX PROPORTIONS AND SPECIMENS PREPARATIONS

The concrete specimens are prepared using M20 grade concrete for both control and bacterial concrete specimens as per IS 10262-2019 [37]. The mix calculations of concrete are shown in Table 3

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Table3: Mix calculations of concrete specimens

S. No	Materials	Units(kg/m3)
1	OPC	340
2	FA	795
3	CA	1222
4	Water	187
5	Admixtures	2.718

Table 4: Mixes of concrete

Sr. No.	Mix ID	Bacteria Type	Cell Concentration
1	Control mix	-	-
2	Sporosarcina pasteurii	Sporosarcina pasteurii	10^5
3	Sporosarcina pasteurii	Sporosarcina pasteurii	10^6
4	Sporosarcina pasteurii+ Bacillus Megaterium	Sporosarcina pasturii+ Bacillus Megaterium	10^7
5	Bacillus Megaterium	Bacillus Megaterium	10^5
6	Bacillus Megaterium	Bacillus Megaterium	10^6
7	Bacillus Megaterium+ Sporosarcina pasteurii	Bacillus Megaterium+ Sporosarcina pasteurii	10^7

Sporosarcina pasteurii and Bacillus megaterium prepare the bacterial samples, with cell concentrations ranging from 105 to 107 cells per milliliter of water. The concrete samples were cured using ordinary water IS 9013-1978 [38]. The mechanical parameters are evaluated by casting the specimens in various mold shapes. The prepared concrete mixtures were poured into an array of oil-coated molds that formed the structure. Compaction was performed using a tamping rod with 25 strokes to ensure the concrete was distributed correctly and uniformly in the molds. The concrete samples were removed from the molding framework after 24 hours and put in the curing tank for 7, 14, and 28 days. Averages of five samples were collected, and the test findings were provided.

To evaluate the mechanical properties of concrete, cube specimens are cast and tested for compressive strength using dimensions of 150mm x 150mm x 150mm and flexural strength using dimensions of 100mm x 100mm x 500mm. Concrete sample mixtures are presented in Table 4.

2.4 Experimental Plan.

2.4.1 Compressive Strength

During the curing process, concrete samples of 150 mm x 150 mm x 150 mm were tested for their compressive strength. The test complied with the code IS 516-2013 on bacterial and standard concrete samples. A compression testing machine with a 2000 K.N. capacity was used to evaluate the sample by applying a loading rate of 140 kg/cm2/min. The compressive strength was determined by computing the compressive load to cross-sectional area ratio. You can refer to Figure 1 for the detailed compressive strength testing procedure.

Figure1: Compressive strength test for concrete specimen.

2.4.2 Flexural Strength Test

The Flexural strength test was carried out using a two-point loading method by the code I.S.: 516-1959. The specimens used were of size 100 mm × 100 mm × 500 mm (length × width × depth). This test measures the resistance of a beam or a slab to bending failure. The Flexural strength test results are expressed in terms of rupture modulus. The samples were subjected to a loading rate of 140 kg/cm2/min, and the flexural testing

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machine can handle up to 100 KN of force. The formulas in Eq. (2) can be used to calculate the flexural strength. Figure 2 illustrates the testing process of the Flexural Strength Machine.

$fb=3PL/2bd2$ (1)

Figure 2: flexural strength testing of concrete Specimen

2.5 EVALUATION OF OUTCOMES:

The substance's mechanical properties, such as compressive and flexural strength, are used to measure and describe the self-healing products.

2.5.1 Compressive Strength

The control and bacterial mix specimens were cast with dimensions of 150mm x 150mm x 150mm, and the compressive strength tests were conducted per the guidelines of IS 516-2013 [39]. The strength was good for 14 and 28 days of curing, even after cracking. Bacillus halodurans, with a concentration of 105 cells/ml of water, exhibit more healing than other mixtures by forming calcite crystals. The compressive strength of the samples with Bacillus halodurans increased by 51.67 Mpa for 14 days and 62.15 Mpa for 28 days of curing compared to the control mix samples. You can find the compressive strength data in Figures.

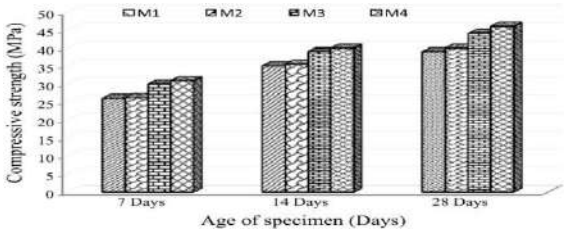

Figure 3: Compressive Strength of Concrete Specimen for various Bacteria

2.5.2 Flexural Strength

The samples were made using two concrete mixtures - regular and biodegradable. They underwent testing for flexural strength using two-point loading, following the standard guidelines of IS 516-1959 [40]. The flexural strength was evaluated after 28 days of curing, post-breaking. The study reveals that biodegradable specimens' flexural strength is higher than regular concrete specimens after 28 days of curing. The bacterial strain, mixed culture (CC+BP+BMG), with a concentration of 106 cells/ml of water, creates an EPS layer with a higher healing rate. The flexural strength data is displayed in the figure.

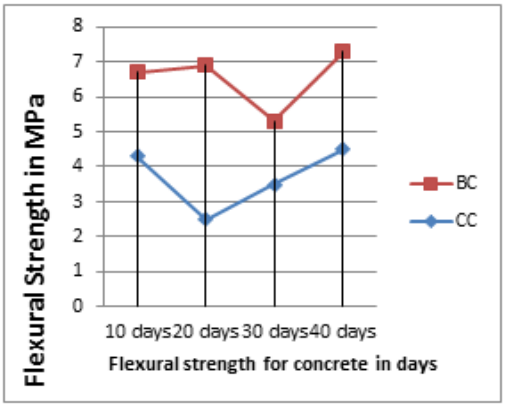

Figure 4: Flexural Strength of Concrete Specimen

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CONCLUSIONS

In this Research, we discuss the behavior of biological agents in repairing surface cracks in concrete. The results of the Gram staining technique show that Sporosarcina pasteurii and Bacillus megaterium are rod-shaped bacteria. Microbiological activity reveals that the growth pattern of Bacillus halodurans is more similar to that of Bacillus subtilis in the concrete composition medium. The study calculates how well bacteria perform in concrete regarding mechanical properties, compressive strength, and flexural strength. The bacteria produce calcite crystals that help restore concrete's compressive strength. Creating an EPS layer of bacteria also makes concrete more flexible yet sturdy. Specimens cast using bacillus mix culture with 10^6 cells/mL concentration exhibit higher compressive and flexural strengths due to calcium carbonate synthesis.

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RESERCH ON OPTIMIAZATION OF WATER TO CEMENT RATIOON PROPERTIES OF FLY ASH BASED CONCRETE

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Abstract —
In this Project the main advantages inthe use fly ash in concrete admixtures is described.As it has been seen, the use of waste ashes made by thermal power stations turns out to be not only in an improvement of intrinsic properties of concrete as mechanical strength, workability, durability and resistance to chemicals attacks and freeze cycles, but also an interesting solution intheperspective of a sustainable design which uses waste materials of a production process hardly reusable. Finally, it is important to say that when fly ash are used in concrete, the potential for leaching of trace elements is very low. This is due to the constituents of fly ash being encapsulatedinthe matrix of the concrete.

I. INTRODUCTION

The water–cement ratio is the ratio of the mass ofwater (w) to the mass of cement (c) used in a concrete mix: the typical values of this ratio f = w⁄c is generally comprised in the interval 0.40 and 0.60.

Among the various types of industrial byproducts, fly ash is the most commonly used precursor, which is a readily available byproduct produced in coal-fired power plants. Many existing research studies have reported that the fly-ash-based geopolymer concrete has shown superior mechanical properties, high durability, and refined microstructures as compared to traditionalcement concrete.

II. EXPERIMENTAL DESIGN

- **Cement**

Properties Values

- Specific Gravity 3.12
- Normal Consistency 29%
- Initial Setting time 65min
- Final Setting time 275 min
- Fineness 330 kg/m2
- Soundness 2.5mm
- Bulk Density 830-1650 kg

- **Coarse Aggregate**

Aggregates larger than 4.75 mm in size aretermed as coarse aggregates.

- **Coconut Coir/ Fibre**

Coconut fibre is a good insulator in itself and as such it can improve the thermal properties ofconcrete. This is particularly useful in a tropical country like India wherethe mercury levels are quite high for most part of the year, so as to maintain the room temperatures within comfort levels of its inhabitants. It can also reduce the load on air conditioning systems thus reducing the power consumption.

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III. TESTING OF MATERIALS

MATERIAL: ORDINARY PORTLAND CEMENT

Procedure

- Weigh accurately 100 g of cement to the nearest 0.01 g and place it on a standard 90micronIS sieve.
- Break down any air-set lumps in the cement sample with fingers.
- Agitate the sieve by giving swirling, planetary and linear movements for a period of 10minutes or until no more fine material passes through it.
- Collect the residue left on the sieve, usingbrush if necessary, and weigh the residue.
- Express the residue as a percentage of thequantity first placed on the sieve to the nearest 0.1 percent.
- Repeat the whole procedures two more times each using fresh 100 g sample.

Determination of Consistency of Cement Material: Ordinary Portland cement; Water.**Procedure**

- Take 400 g of cement and place it in the enameled tray.
- Mix about 25% water by weight of dry cement thoroughly to get a cement paste. Total time taken to obtain thoroughly mixed water cement paste i.e., "Gauging time" should not be more than 3 to 5minutes.
- Fill the Vicat's mould, resting upon a glassplate, with this cement paste.

  After filling the mould completely, smoothen the surface of the paste, makingit level withtop of the mould.

  Place the whole assembly (i.e., mould + cement paste + glass plate) under the rod bearingplunger.

  Lower the plunger gently so as to touch the surface of the test block and quickly releasethe plunger allowing it to sink intothe paste.

  Measure the depth of penetration and record it.

  Prepare trial pastes with varying percentages of water content and follow the steps (2 to7)as described above, until the depth of penetration becomes 33 to 35mm from the top of mould.

Determination of setting times of cement Material: Ordinary Portland cement; water.***Procedure***

Prepare a uniform cement paste by gauging 400 g of cement with 0.85 times the water required to give a paste of standard consistency. The procedure ofmixing and filling the mould is same as standard consistency.

Start the stopwatch or note down the timewhen water is added to the cement.

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Determination of Initial Setting Time:

Place the test block confined in the mould and resting on the non-porous plate. under the rodbearing the initial setting needle (with cross section 1 mm); lower the needle gently until it comes in contact with the surface of the test blockand quickly release, allowing it to penetrate into the test block

Sieve Analysis of Course and Fine AggregatesMaterial:

a) Fine aggregates (1 Kg)

b) Coarse aggregates (5 Kg)

Procedure

Take the aggregate from the sample byquartering.

Sieve the aggregate using the appropriatesieves.

Record the weight of aggregate retainedon each sieve.

Calculate the cumulativeweight ofaggregate retained on each sieve.

Calculate the cumulative percentage ofaggregate retained

Add the cumulative weight of aggregateand calculate the fineness modulus using

formula:

Fineness modulus for fine aggregates-CC/100

Fineness modulus for coarse aggregates-ΣCC/100+5

Measurement of Workability of Concrete bySlump Cone Test:

Procedure

Clean the internal surface of the mould thoroughly and place it on a smooth horizontal,rigid and non-absorbent surface,such as of a metal plate.

Fill the mould to about one fourth of its height with concrete. While filling, hold the mouldfirmly in position

Tamp the layer with the round end of the tamping rod with 25 strokes disturbing thestrokesuniformly over the cross section.

Fill the mould further in 3 layers each time by $1/4^{th}$ height and tamping evenly each layer as above. After completion ofrodding of the topmost layer strike of the concrete with a trowel or tamping bar, level with the top of mould.

Lift the mould vertically slowly and remove it.

The concrete will subside. Measure the height of the specimen of concrete after Subsidence.

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The slump of concrete is the subsidence, i.e., difference in original height and height up to the topmost point of the subsided concrete in millimeters.

Tests for Determination of CompressiveStrength of Concrete

Procedure:

Calculate the material required for preparing the concrete of given proportions

Pour concrete in the lightly greased cube moulds.

Fill concrete in two layers each of approximately 75 mm and ramming each layer with 35 blows evenly distributed over the surface of layer.

Struck off concrete flush with the top of the moulds.

Level the concrete at the top of the mould by means of trowel and give proper identificationmark of the specimen.

Immediately after being made, they should be covered with wet mats.

Specimens are removed from the moulds after 24hrs and cured in water. Keep it forcuringup to 28 days.

Testing of Concrete Cubes

Take the cube out of water at the end of three days with dry cloth. Measure the dimensionsof the surface in which the loadis to be applied. Let be 'L' and "B" respectively.

Place the cube in compressive testing machine and apply the load uniformly at the rate of35N/mm².

Note the load at which the cube fails. Let it be 'P. Also note the type of failure andappearance cracks.

Calculate the compressive strength of the cube by using formula P/A. Where A is theareaof loaded surface

IV CONCLUSIONS

Increasing the water content ratio generally increases the strength but may also result in shrinkage of the concrete hence altering durabilityand permeability factors.

Decreased water demand. The replacement of cement by fly ash reduces the water demandfor a given slump. When fly ash is used at about 20 percent of the total cementitious, water demandisreduced by approximately 10 percent. Higher fly ash contents will yield higher water reductions. The decreased water demand has little or no effecton drying shrinkage/cracking. Some fly ash is known to reduce drying shrinkage in certain situations.

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having *"Optimization of water to cement Ratio onproperties of fly ash-based concrete"*.

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A REVIEW PAPER ON WATER FOOTPRINT FOR MULTISTORIED BUILDING

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ABSTRACT
The supply of fresh water is limited. The demand for this limited and valuable resource is rising due to India's population increase and growing urbanization, which is causing scarcity and water stress. Buildings are recognized for being extremely water-intensive, requiring vast volumes of fresh water throughout the course of their existence, prompting the development of numerous water-saving techniques. Water use cannot be avoided, but since fresh water is so vital to life, it should be conserved. This Paper outlines various strategies for water conservation during construction to help reduce waste caused by excessive water use.

Keywords: Resources, Demand, Population, Water, Building.

I. INTRODUCTION

Fresh water is an extremely valuable natural resource, and there are many reports that the global supply of fresh water is rapidly running out. Without water, life on Earth is not conceivable. Global fears about climate change have projected severe.

The World Business Council for Sustainable Development (WBCSD) projected in its Vision 2050 statement that more than 500 million people in the BRIC (Brazil, Russia, India, and China) countries would be living in water-stress conditions by 2030 as a result of water scarcity brought on by declining eco-system services. To combat the issue, India has set a target of 20% increase in water-use efficiency under the National Action Plan for Climate Change (NAPCC) and the National Water Mission. The Indian government's National Water Policy acknowledges the:

1. Is it feasible to determine a building's water footprint or capital water content in India?
2. Knowing the water footprint, or embodied water, of its constituent material at least the common ones will be crucial to understanding the mentioned information. Exist any such reports or statistics on study in this field for Indian products?
3. It will also be critical to comprehend the volume of water consumed, both directly and indirectly, throughout the actual construction process. How is the amount of water needed for construction for Indian buildings estimated?

II Literature Review

A Review of Water footprint in Building Construction

Every building project uses a lot of resources, and one of the most important ones is water. Water is utilized extensively when building structures and producing other products, but the amount of water used is not properly tracked. The earlier Research papers visit the site and conduct a comparative analysis of data to examine how much water a specific building uses. Water use is inevitable, but since fresh water is so vital to human survival, it should be protected. This document outlines various strategies for water conservation during construction to help reduce waste caused by excessive water use.

Studies on Virtual Water Content of Urban Buildings in India

For Kolkata and Pune, the virtual water content was determined to be 19.3588 kl/m2 and 16.2707 kl/m2, respectively. According to previous research, the inherent water component was far more substantial than the induced water component. For Kolkata and Pune, the inherent water component made up 61.45% and 82.00% of the virtual water, respectively. The study's key conclusion was that, in comparison to their counterparts in mild climates, buildings in warm, humid climates utilized more water in their on-site operations. The amount of virtual water is equivalent to the average annual water needs of 1233 families.

Assessment of water resource consumption in building construction in India

The process of building requires a lot of resources, including energy, water, land, and materials. Buildings are necessary to provide our basic need for shelter, hence using these resources will inevitably occur. But since natural resource stocks are running low and ecosystem functions are deteriorating, consumption must be prudent, deliberate, and waste-free. Human reactions to the perceived threat of materials, land, and energy limits, respectively, include the search for alternative and recycled resources, the utilization of numerous floor

areas, and the application of renewable energy. However, there is still a long way to go in terms of water resource management in the design and operation of buildings, particularly given the fact that the quantity of water consumed per unit area of construction is still mostly unreported. A number of ground breaking studies on embodied.

Water Footprint of Cities: A Review and Suggestions for Future Research

Cities are hotspots for the consumption of commodities, which has an impact on water resources locally and globally. Water travels "virtually" across borders in cities as a result of the massive trade in goods and services. Investments in water supplies and decisions made about urban planning have an impact on both virtual and actual water flows, which in turn affect the growth of residential, commercial, and industrial areas. The significance of this type of teleconnection with water in water decision-making is becoming more widely acknowledged. It is uncommon to recognize the importance of commerce and virtual water flows as a substitute for growing a city's "actual" water supply; instead, the focus is usually on the steady growth of artificial potable water sources. We conduct a review of the literature on water footprint studies in order to assess floor areas and the usage of renewable energy.

III. FUTURE APPROACH

1. Explore the role of green infrastructure in reducing water footprint.
2. Discuss innovative architectural and design approaches that integrate water sustainability.
3. Investigate the potential of Internet of Things (IoT) for real-time water monitoring and management.
4. Discuss smart building solutions that optimize water use.
5. Examine advancements in grey water and rainwater harvesting systems.
6. Discuss the feasibility and benefits of integrating these systems into multistorey buildings.
7. Emphasize the importance of involving residents, businesses, and local authorities in water management.
8. Analyse existing and potential future policies related to water use in multistorey buildings.
9. Emphasize the importance of education and awareness campaigns.
10. Discuss strategies for informing and engaging building occupants in water conservation practices.

IV. METHODOLOGY

To avail of a common platform, one residential building in each of the cities of Kolkata and Pune were studied by

Residential case studies in Kolkata and Pune

Project data	Case study in Kolkata	Case study in Pune
Location	Rishra	Pimple Nilakh
Number of floors	3 towers of Ground + 12 Floors	6 towers of Ground + 12 Floors
Number of dwelling units	210 nos	144 nos
Total floor area	20368 m2	17280 m2
Project duration	38 months	44 months
Project completion	2014	2013
Type of structure	RCC framed structure with RCC pile foundation	RCC framed structure with RCC pile foundation

Calculating the water used during construction (induced virtual water) and the water embodied in the primary building components (inherent virtual water).In Each project's natural and artificial water was then totalled to determine the amount of virtual water for each case study. A comparison of both of their virtual water cities was subsequently completed in order to get definitive results. A succinct overview of the two housing projects that were examined in Pune and Kolkata. In order to calculate the intrinsic virtual water, my major building materials, such as steel, cement, and bricks Glass and aluminium were taken. The study needed to limit itself to these informative resources because published information pertaining to these alone.

V.CONCLUSION

1. The review underscores the critical importance of water conservation in building construction, emphasizing that the extensive use of water in construction projects is often inadequately monitored. As fresh water is

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essential for human survival, the document stresses the need for proper tracking and protection of water resources during construction activities.

2. The study on virtual water content in urban buildings in India reveals substantial variations between cities. The inherent water component, comprising a significant portion of virtual water, highlights the need for context-specific strategies. The findings also indicate that buildings in warm, humid climates tend to use more water in on-site operations, emphasizing the role of climate in water consumption patterns.
3. The assessment of water resource consumption in building construction in India points out that the inherent water component significantly outweighs the induced water component. In Kolkata and Pune, for instance, the inherent water component accounts for a substantial percentage of virtual water. This suggests the necessity of tailored water management approaches considering the dominant role of inherent water in certain regions.
4. The review acknowledges the challenges in water resource management within the design and operation of buildings. Despite efforts to address material, land, and energy limits through alternatives and recycled resources, there's a noticeable gap in reporting the quantity of water consumed per unit area of construction. The document emphasizes the need for improved water resource management practices in the building sector.
5. The review on the water footprint of cities highlights the role of urban areas as significant consumers of commodities, affecting both local and global water resources. The study emphasizes the virtual movement of water across borders due to trade and the impact of urban planning decisions on water flows. It calls for a shift in focus from artificial potable water sources to recognizing the importance of commerce and virtual water flows in urban water decision-making.
6. The document suggests that the teleconnection with water in urban areas is gaining recognition, emphasizing the need to consider both virtual and actual water flows. It critiques the common focus on expanding artificial potable water sources and advocates for a broader understanding of water supply dynamics, considering the influence of commerce and virtual water flows in shaping urban growth.
7. In conclusion, the review calls for continued research in understanding water footprints, especially in the context of cities and building construction. It advocates for sustainable practices, alternative resources, and improved water management strategies to address the challenges posed by the extensive use of water in construction and urban development.

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STABILISATION OF BLACK COTTON SOIL USING FLY ASH AND CRUMB RUBBER POWDER

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ABSTRACT
Use of recycled waste materials for civil engineering applications can provide an attractive way to reduce the wastes to be disposed of and it may help in improving engineering properties of soil. Scrap tires are one such waste material which has many properties that can be effectively utilized for civil Engineering applications. In this study a recycled waste product mixture crumb tire and fly ash was used as an additive with black cotton soil to analyze the effect of additive on soil properties. Statically compacted soil specimens have been prepared at optimum moisture content and maximum dry density by adding 2%, 4% 6%, 8% 10% 12% by weight of mixture of fly ash & rubber crumb powder to parent soil. It has been observed that there is a decrease in maximum dry density (MDD) due to an increase in percentage of mixture of fly ash & Tyre crumb rubber powder. Lower specific gravity of crumb rubber may have caused the decrement in MDD values. Also it was observed that due to increase in percentage of mixture of fly ash crumb rubber powder, unconfined compressive strength value of the soil increased. California bearing ratio tests were carried out on soil and soil mix with fly ash crumb rubber mix to study the effect in strengthening the sub grade. Results have shown increase in CBR values. Therefore it is suggested that the waste mixture of fly ash and crumbed tires and can be safely used in the sub grade as a soil binder which will effectively hold the soil with increased strength values. Using a non-traditional waste product as a stabilizer not only affects engineering properties of soil positively, but it also helps in disposal of waste material

Keywords: Black Cotton Soil, Fly Ash, Crumb Rubber Powder, Soil Stabilization

I. INTRODUCTION

In recent times, global population has increased significantly Available resources are incapable of fulfilling the demand caused by the population growth. Researchers are striving to create new technologies and methods to improve the techniques that are currently being used to utilize the resources. Thus, it becomes necessary to employ such techniques to make the best use of available resources. Civil engineering aspect of proper utilization includes Soil stabilization through which we can modify soil with inferior engineering properties into soil that has adequate engineering properties.

Investigation into the properties of Mixture of Rubber Crumb and fly ash treated Black cotton soils would assess the suitability of using mixture as stabilizer to reduce swelling of Black cotton soils. This synopsis represents the effect of Mixture of Rubber Crumb and fly ashpowder stabilization on engineering properties of Black cotton soil. Soil engineering tests likeMoisture content, Atterberg limits, Optimum moisture content Maximum Dry density, California Bearing Ratio Test, Unconfined Compression strength Test etc were conducted onvirgin soil and stabilized soil obtain from site by mixing them in various Proportions..

It improves the engineering properties of the soil, e.g.

a) Strength - to increase the strength and bearing capacity.

b) Volume stability - to control the swell-shrink characteristics caused by moisture changes,

c) Durability - to increase the resistance to erosion, weathering or traffic loading.

d) To reduce the pavement thickness as well as cost.

2. SOIL STABILIZATION.

Soil stabilization is a general term for any physical, chemical, biological or combined method of changing a natural soil to meet an engineering purpose. Improvements include increasing the weight bearing capabilities & performance of in-situ subsoil, sands & other waste materials in order to strength.

2.1 Methods of Soil Stabilizations

There will be four methods of soil stabilization are as follows:

i. Mechanical stabilization

ii. Physical stabilization

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iii. Chemical stabilization

iv. Physio chemical stabilization

2.2 Benefits of Soil

Improve the mechanical qualities of local road construction soil.

i. Increase loading capacity.

ii. Improve structural integrity.

iii. Reduce harmful moisture penetration.

iv. Provide longer economic life of road bed.

v. Reduce maintenance costs.

vi. Lower road constructions costs.

2.3 Soil Properties

Some of the important properties of soils that are used by geotechnical engineers to analyze site conditions & design earthworks, retaining structures, & foundation are- Specific weight or Unit weight.

i. Porosity.

ii. Void ratio.

iii. Permeability.

iv. Compressibility.

v. Shear Strength.

vi. Atterbegs Limits.

3. MATERIAL

3.1 Black Cotton Soils:-

As a part of this investigation, the expansive black cotton soil was acquired from the site Valya, Maharashtra. The black cotton soil thus obtained was carried to the laboratory in sacks. A small amount of soil was taken, sieved through 400 mm sieve, weighed, and air-dried before weighing again to determine the natural moisture content of the same. The various geotechnical properties of the procured soil are as follows.

Table 1: Standard Properties of black cotton soil

Soil Properties	Results
Grane Size analysis	Gravel=10% Sand=20% Fines=70%
Specific Gravity of Soil	2.35
Liquid Limit (%)	48
Plastic Limit (%)	32.65
Plasticity Index(%)	15.35
Optimum Moisture Content OMC(%)	24.88
Maximum Dry Density MDD(%)	1.51
CBR @ 2.5 mm Penetration	2.68
CBR @ 5 mm Penetration	2.19

3.2 Fly Ash:

A waste material extracted from the gases emanating from coal fired furnaces, generally of a thermal power plant, is called fly ash. The mineral residue that is left behind after the burning of coal is the fly ash. The Electro Static Precipitator (ESP) of the power plants collect these fly ashes. Essentially consisting of alumina, silica and iron, fly ashes are micro-sized particles. Fly ash particles are generally spherical in size, and this property makes it easy for them to blendand flow, to make a suitable concoction. Both amorphous and crystalline nature of minerals are the content of fly ash generated. Its content varies with the change in nature of the coal used for the burning process, but it basically is a non-plastic silt. For the purpose of investigations in this study, fly ash was

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obtained from SesaSterlite, Jharsuguda. To separate out the vegetation and foreign material, this fly ash was screen through a 2 mm sieve. The samples were dried in the oven for about 24 hours before further usage.

Table 2: Properties of fly ash

S.No	Observations	Sample 1	Sample
1	Mass of empty pycnometer (M1)	0.656	0.656
2	Mass of pycnometer + soil(M2)	1.03	1.02
3	Mass of pycnometer + soil + water(M3)	1.754	1.751
4	Mass of pycnometer + water (M4)	1.54	1.54
5	Specific gravity G=(M2-M1)/(M2-M1)- 2(M3-M4)	2.33	2.37
	Specific Gravity Mean	**2.35**	

3.3 Crumb Rubber Powder

Tire wastes can be used as a l'8 ht weight material either in the form of powder, chips, shredded and as a whole. They are used above and below ground water. Many works regarding the use of scrap tires in geotechnical application have been done especially as embankment materials (Humphrey, D.N. 1993, Humphrey 1997, Humphrey 1999). The reuse application for tire is how the tire are processing basically includes shredding, removing of metal reinforcing and further shredding until the desired materials are achieved. Scrap tires perhaps rank among the most extensively researched and implemented recycled materials in recent years. Potentially usable forms include whole tires, sliced tires, tire chips, and smaller soil-like particles referred to collectively as crumb rubber. However not all of the rubber is recoverable.

S.No	Particulars	Value
1	Specific gravity	2.9 to 3.10
2	Colour	Gray
3	Size	15 to 100 microns
4	Densit	1000 to 1500 kg/m3

S.No	TYPE OFRUBBER	CRUMB TYPE %
1	Size	600µ to 300µ
2	Colour	Black
3	Specific gravity	1.12
4	Density	348 kg/m3

4. METHODOLOGY

The different types of test are carried out on virging soil,Fly Ash powder and crumb rubber Powder.The test are performed as per the recommendation methods in IS 2720 use for soil properties investigations.Then different test carried out by adding the stabilized material that is Fly ash and crumb rubber powder in different percentages by weight of soil as 0%,2%,4%,6%,8% and the result are observed at this different ratio of stabilized materials.

The result and observations are :

Specific Gravity of Soil Sample

Similarly Specific Gravity of Rubber Crumb Powder=0.79

Mechanical Sieve Analysis of Soil Sample

Sr No	IS Sieves	Weight of soil Retained	% Weight of Soil Retained	Cummulative % Weight of Soil Retained	% of Finner
1	4.75mm	0.508	28.53	28.53	71.47
2	2.36mm	0.23	12.92	41.45	58.55
3	1.70mm	0.221	12.41	53.86	46.14
4	1.00mm	0.24	13.48	67.34	32.66
5	600micron	0.246	13.82	81.16	18.84
6	300micron	0.236	13.25	94.41	5.59
7	150micron	0.078	4.38	98.79	1.21
8	PAN	0.021	1.17	100	0

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Sr No	Observation	Sample1	Sample2	Sample3	Sample4	Sample5
1	No of Blows	45	40	35	29	20
2	Mass of empty Container (m1)	40	41	42	42	38
3	Mass of container + wet soil(m2)	72.81	76.9	92.6	79.1	79.1
4	Mass of container + dry soil(m3)	64.9	66.2	76.9	67.1	69.1
5	Mass of Water(m2-m3)	7.91	10.7	15.7	12.0	10.0
6	Mass of Dry soil(m3-m1)	24.9	25.2	34.9	25.1	28.1
7	Water Content=(m2-m3)/(m3-m1)*100	31.76%	42.46%	44.98%	47.80%	45.80%
Liquid Limit= From Graph		48%				

Liquid Limit of Soil Sample

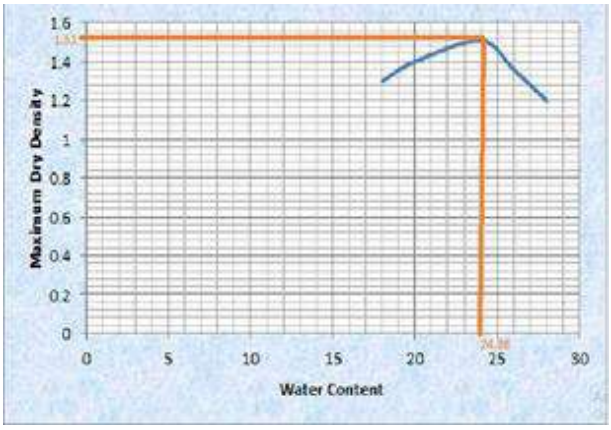
Plastic Limit of Soil Sample

Sr No	Observation	Sample1	Sample2	Sample3
1	No of Blows	45	44.8	42.9
2	Mass of empty Container (m1)	40	41	42
3	Mass of container + wet soil(m2)	88	81	79.3
4	Mass of container + dry soil(m3)	75	73.2	69.3
5	Mass of Water(m2-m3)	13	7.8	10
6	Mass of Dry soil(m3-m1)	35	32.2	27.3
7	Water Content=(m2-m3)/(m3-m1)*100	37.14%	24.2%	36.63%
Plastic Limit Mean =		32.65		

Optimum moisture content and Dry density of samples

Sr No	Mix Proportion Fly Ash and Crumb Powder	Maximum dry density	Optimum moisture content
1	0% Fly Ash 0 % Crumb Powder	1.51	24.88
2	2% Fly Ash 2% Crumb Powder	1.626	20.13
3	4% Fly Ash 4% Crumb Powder	1.75	20.48
4	6% Fly Ash 6% Crumb Powder	1.80	15.64
5	8% Fly Ash 8% Crumb Powder	1.50	17.53

Omc Mdd Curve for Soil Sample



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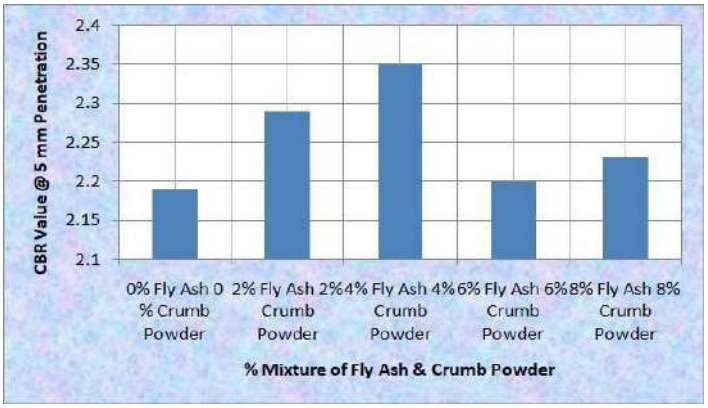
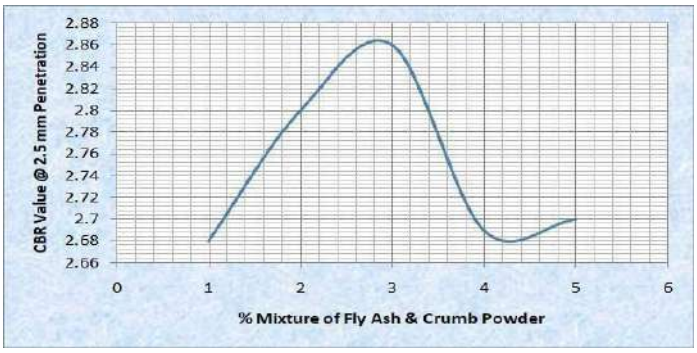
Optimum moisture Content and Dry Density Value From the above results, the maximum dry density of black cotton soil is obtained with 4% to 8% mixture of fly ash and rubber crumb powder replacement only.

California Bearing Ratio Values

Sr NO	Mix Prapoetion	CBR Value for 2.5mm penetration in %	CBR Value for 5 mm Penetration in %
1	0% Fly Ash 0 % Crumb Powder	2.68	2.19
2	2% Fly Ash 2% Crumb Powder	2.80	2.29
3	4% Fly Ash 4% Crumb Powder	2.86	2.35
4	6% Fly Ash 6% Crumb Powder	2.69	2.20
5	8% Fly Ash 8% Crumb Powder	2.70	2.23





From the CBR test results it is clear that there is a considerable improvement in California Bearing Ratio (CBR) of black cotton soil with addition of 4% to 8% mixture of fly ash and rubber crumb powder. where as in all remaining cases there isdecrease in CBR value with addition of mixture of fly ash and rubber crumb powder.Therefore adding of 4% to 8% mixture to soil can improve the CBR test values thereby increases the soil bearing capacity

Unconfined Compression Strength Value with different mix Praportion.

Sr No	Mixture %	Sample 1		Sample2	
		% Strain at Failure	Stress at Failure	% Strain at Failure	Stress at Failure
1	0% Fly Ash 0 % Crumb Powder	1.2	112	1.1	122
2	2% Fly Ash 2% Crumb Powder	1.3	149.3	1.4	139
3	4% Fly Ash 4% Crumb Powder	1.4	141.5	1.4	152.1
4	6% Fly Ash 6% Crumb Powder	1.8	159	1.7	160
5	8% Fly Ash 8% Crumb Powder	1.7	156	1.6	157

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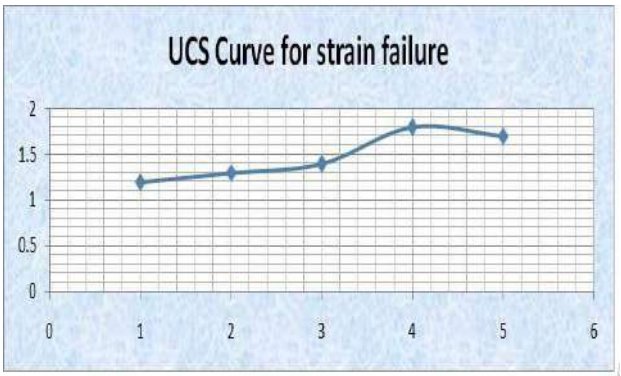

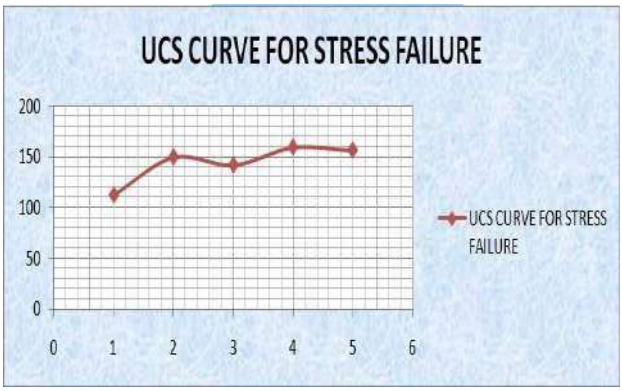

From the UCS test results it is clear that there is a considerable improvement in Unconfined Comression Strength UCS of black cotton soil with addition of 4% to 8% mixture of fly ash and rubber crumb powder. where as in all remaining cases thereis decrease in UCS value with addition of mixture of fly ash and rubber crumb powder. Therefore adding of 4% to 8% mixture to soil can improve the UCS test values thereby increases the Compression strength.

CONCLUSIONS

i. From this study it is concluded that there is a considerable improvement in California Bearing Ratio (CBR) of black cotton soil with addition of 4% to 8% of mixture of fly ash and crumb rubber powder as soil stabilization when compared to only black cotton soil.

ii. From this study it is concluded that there is a considerable improvement in California Bearing Ratio (CBR) of black cotton soil with addition of 4% to 8% of mixture of fly ash and crumb rubber powder as soil stabilization when compared to only black cotton soil.

iii. As the percentage of rubber powder increases, the CBR (California Bearing Ratio) value decreases.

iv. Only at a range of 4 % to 8% mixture of fly ash and crumb rubber powder may gives effective dry density and will give higher CBR values. Dry density and CBR values goes on decreasing with 10%,12%,14% of Mixture.

v. Therefore adding of 4% to 8% mixture of fly ash and crumb rubber powder to soil can improve the CBR test values there by increases the soil bearing capacity.

vi. Adding of 4% to 8% mixture of fly ash and crumb rubber powder to soil can improve the UCS test values there by increases the soil Unconfined compressive stregth.

vii. Observing its economic cost and quality of stabilization improvement, it is clear that this type of stabilization may be applicable in stabilization of black cotton soil in construction of road or in shoulder portion of highways and other related construction

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WATER POLLUTION STATUS OF DIFFERENT RIVERS IN INDIA- A REVIEW

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ABSTRACT
The presence of one or more contaminants, or combinations of them, in the water for long enough periods of time to have the potential to harm property, human, animal, or plant life (aquatic life), or to unreasonably impede the enjoyment of life or property. This condition is known as water pollution. To put it another way, it's the contaminating of water sources, including rivers, lakes, ponds, seas, and even groundwater. This results from the untreated discharge of effluents or environmental pollutants into water bodies. The entire biosphere is impacted by water pollution, including individual species and the natural biological communities that support them. The majority of the aquatic life that was living in the contaminated water body dies as a result. Additionally, if that water is eaten untreated, it can cause a number of diseases like cholera, dysentery, diarrhea, malaria, dengue, chickungunia, etc. and in rare circumstances could be fatal.

Keywords: Ganga River, Water pollutant, WQI, Hardness, alkalinity

1. INTRODUCTION

Rivers play a vital role in human civilizations by providing water for a variety of purposes, sustaining wildlife and flora, enhancing the aesthetics and landscape, regulating the climate, and serving as a source of hydropower. Because there are less human impacts in the upper reaches of the Yamuna River, the water quality there is found to be good. However, as the river flows through semi-urban and urban areas, it begins to receive pollution from various point and non-point sources as a result of anthropogenic activities. River flow varies greatly depending on the drainage pattern and climate. Turbulence and the prevailing current cause vertical mixing to occur. In order to obtain water for different purposes, urbanization and industry are developed next to rivers; however, this leads to the frequent release of wastewater without adequate treatment, which severely pollutes the rivers. The river profile can be used as a tool to assess the quality of the water at different locations by taking into account the pollutants that the water body is receiving. As a result, the river can be measured in kilometres, from its source to its terminus. The following locations should be marked with km stones along a river's length: ii) sampling stations; ii) points of confluence for tributaries (or, if there are none, points of confluence for sub-tributaries); iii) cities and towns; and iv) waste water or effluent outfalls that meet the river.

Assessment of river quality consists of following:

- Assigning dissolved oxygen (DO), biochemical oxygen demand (BOD), fecal coliform (FC), total coliform (TC) or any other pollutant's profiles with respect to actual distances between consecutive sampling stations and interpretation of river monitoring data.
- Assessment of profile of entire length and profile of polluted length of river.
- Identification of pollution sources (point as well as nonpoint) in a given stretch.
- Monitoring of river profile after implementation of conservation or mitigation measures, providing large sets of information for digitization with the help of Geographical Information System (GIS).
- Converge all parameters into a single value index which can be used to prepare a water quality map, which will be helpful for planners, decision or policy makers for mitigation action at the governmental level[1]

Water is the most abundant chemical in the human body. All biological activities occur in water, and it is an active participant in those reactions. Without water, life cannot exist. Rivers serve as the primary supply of drinking water in both urban and rural areas, and they play a vital role in public health and environmental standards. Water in a river is often gathered from rainfall, surface runoff, and the discharge of stored water in natural reservoirs such as a glacier. Rivers, in addition to being a rich source of fish, also indirectly benefit agriculture by providing water for irrigation. Due to rapid increase in human population and industrialization, as well as wastewater disposal, water quality has deteriorated in recent years. The rivers are one of the world's most contaminated landscapes. Because rivers pass through towns, industrial zones, and agricultural areas, they have long been used for disposal of sewage. According to a World Health Organization (WHO) study, household waste accounts for 80 % of water contamination[2].

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The main purpose of the study is to check the status of river pollution in India through different literatures.

2 Related Work- Ashali Chandrakant Kharake et al. has carried out study on water quality of Godavari river in Nashik city, to evaluate water quality of Godavari river 10 sampling stations were determined, and 8 parameters were selected. The physico-chemical analysis of water samples indicates that the river water sample has alkaline properties. As pollutants are added in the river water at various stations, it has decreased dissolved oxygen value. Due to addition of pollutant at these stations BOD and turbidity values have increased. TDS and F-coli parameters showed increased value at S10 due to sewage and burial activities. Water quality parameters pH, DO, BOD and F-coli were used to calculate water quality index (WQI) for evaluation of water quality. The water quality index values of Godavari river of about 24 km the stench from Gangapur dam to Dasak Bridge show that due to urban slums, weekly markets and religious tourism lots of urban waste have been generated. It may be in liquid or solid forms responsible for water pollution. The computed WQI values are between 35.01 and 133.44 in the study area. The WQI classification shows that S2 has good water quality status, but as it enters in city considerable changes in WQI were observed at S7, S8 and S9 sites due to burial activities, encroachment and contamination. In spite of all efforts made by government authorities, local people and entrepreneur are not aware about river pollution. From the above analysis, it has been concluded that the acceleration of population increases the human interventions along the river which deteriorate the water quality. Hence, the suggested measures would help to minimize human interventions in and along the river Godavari. It is also helpful to minimize negative consequences of such impacts in the future and conserve the water resource[3].

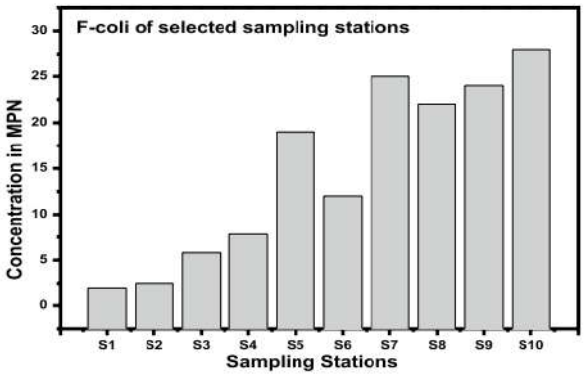

Fig. 1 F-coli of selected sampling station

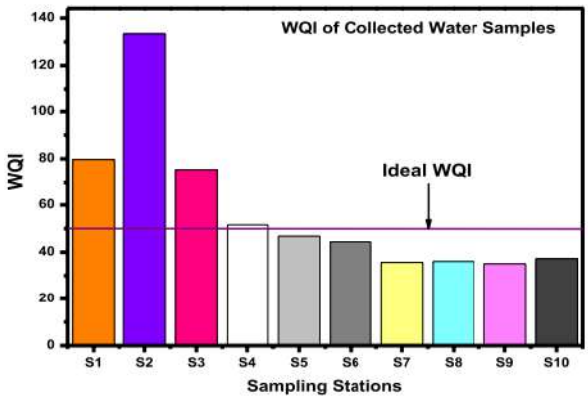

Fig. 2 WQI of collected water samples

Parameters	Max	Min	Mean	Sum
pH	8.7	7.5	8.1	81.6
TS	616	66	341	2896
DO	7.5	1.9	4.7	41.7
TDS	412	120	266	1955
Turbidity	24.97	4.6	14.7	114.56
BOD	52	2.5	27.25	286

Max—maximum, Min—minimum

Table 1 Statistical summary of physico-chemical parameters

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Parameters	pH	TS	DO	TDS	Turbidity	BOD
pH	1.0					
TS	−0.6430	1.0				
DO	0.4718	−0.7704	1.0			
TDS	−0.6297	**0.9137**	−0.7437	1.0		
Turbidity	−0.6395	**0.9578**	−0.7181	**0.9397**	1.0	
BOD	−0.4523	**0.8565**	−0.9632	0.7776	0.7888	1.0

Computed by Researchers

Table 2: Karl Pearson correlation matrix for water samples of Godavari river water in Nashik city (June 2019)

Sr. No.	Stations	WQI	Color Code
1	Gangapur Dam	79.67	
2	Someshwar Waterfall	133.44	
3	Navsya Ganpati	75.30	
4	Rameshwar Mahadev Temple	51.59	
5	Bapu Bridge	46.8	
6	Goda Park	44.34	
7	Chopra Bridge	35.6	
8	Ramwadi Bridge	36.01	
9	Ganesh wadi	35.01	
10	Dasak Bridge	37.24	

Table 3: WQI rating of various sampling sites of Godavari river

M.P. Sharma et al. has carried out study on Water Quality Profile of Yamuna River, India. The river Yamuna is the main tributary of Ganga River having length of 1,376 km. About 57 million people of north India depend on it. Its annual flow is about 10,000 cusecs and accounts for more than 70% of Delhi's overall water supply. Available water treatment facilities are not adequate to remove all the pollutants. Consequently, the Yamuna leaves Delhi as a sewer, laden with the city's biological and chemical wastes. Downstream, at Agra, this becomes the main municipal drinking water source. Here, too, the existing treatment facilities are inadequate to treat the pollutants. Thus, consumers in Delhi and Agra ingest unknown amounts of toxic pesticide residues each time they drink water (CSE 2008). CPCB has been regularly monitoring the entire stretch of the Yamuna river under the National River Conservation Program (NRCR) and National Water Quality Monitoring Program (NWQMP). Monitoring was done at 19 sampling locations in five stretches from the origin of Yamuna River at Yamunotri to its confluence with Ganga River at Allahabad (CPCB 2008). The water quality parameters in various stretches in 2004 are given in Table 5. The NSF WQI was applied after conversion for DO and coliform (Gronewold and Wolpert 2008).

Water quality status at river Yamuna during the year 2004 reflects that the Delhi stretch is severely polluted as compared to the other stretches. The total coliform in the entire river stretch is significantly high and generally does not conform to designated water quality criteria. BOD in the Himalayan stretch remains within limit of 3 mg/ l, due to less anthropogenic activities while at upper and diluted stretches, the BOD level is almost within the limit. In Delhi and mixed stretches the BOD values remain above the limit because of heavy sewage discharge and less flow, after which the river recovers itself in the deterioration of water quality without any control (A-B) and accelerates pollution due to industrialization (B-C). If public concern starts early (point B), it takes some time (B-C) for the relevant authorities to initiate control measures. If the measures are insufficient, the rate of increase in pollution is lowered (C-D2), but if the economic activity is still growing, or if the assimilation capacity of the environment (storage, dilution, self-purification) is limited, the pollution rapidly reaches the threshold concentration (C-D1) where severe or irreversible damages occurs. If proper action is taken, the pollution reaches a maximum (E) after a time-lag (CE) which depends on the effectiveness of the control, on the water residence time and on the pollutant interaction. Finally, a tolerable environmental level (F) may eventually be reached, although this is not equivalent to the pristine level (O). Four phases of environmental problem development (I-IV) are applicable for different types of pollution problems with different level of socioeconomic development (adapted from Chapman 1996).[1]

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	Types	Examples
1.	oxygen demanding wastes	human and animal waste, decaying vegetation
2.	plant nutrients	nitrates and phosphates
3.	infectious agents	bacteria, virus, protozoa, fungi
4.	organic matters	oil, detergents, pesticides, etc.
5.	inorganic metals & chemicals	acids, heavy and toxic metals
6.	priority pollutants	DDT (organic chlorine), PCBs (polychlorinated biphenyl), persistent organic pollutants (dioxin and furan)
7	heat	used water from cooling in industries
8.	radioactive substances	fallout products, radioactive wastes

Table 4: Classification of major water pollutants

Water Quality Parameters	Original Weights from NSF WQI	Modified Weights by CPCB
DO	0.17	0.31
Fecal Coliforms	0.15	0.28
pH	0.12	0.22
BOD	0.1	0.19
Total	0.54	1.00

Table 5: Original and Modified Weights for the computation of NSF WQI based on DO, Fecal Coliforms, pH and BOD (CPCB 2001)

	NSF WQI	Description	Class	Color Code	Remarks
1.	63-100	Good to Excellent	A	Blue	Non polluted
2.	51-63	Medium to Good	B	Green	Non polluted
3.	38-50	Bad	C	Yellow	Polluted
4.	<38	Bad to very bad	D or E	Red	Heavily polluted

Table 6: NSF WQI for various designated-best-use (CPCB 2001)

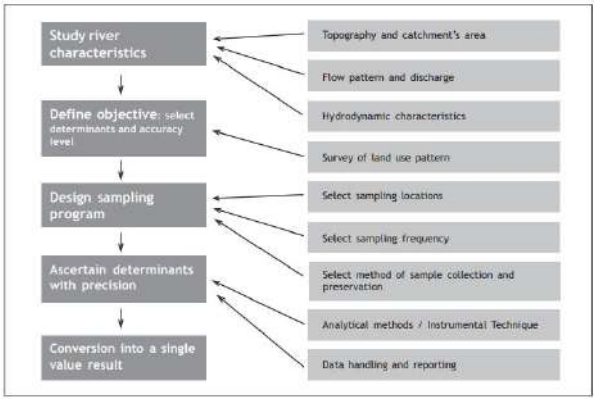

Figure 3: Flow Chart of Overall Procedure (modified after NEERI 1986)

Shoeb Peerzade et al. has carried out Study on physico-chemical analysis of flowing water of Bhima River in Solapur District Maharashtra state India. The physico- chemical analysis of Bhima river water is given in Table 1. Temperature is basically important for its effect on certain chemical & biological activities in the organism attributing in aquatic media. In the Indian subcontinent the temperature in most of the bodies range between 7.8 to38.5Co .[5],The water temperature range between 27Co to 30Co in all the spot sample. The variation is mainly related with the temperature of atmosphere & weather condition. The PH values of water bodies (river) found in alkaline side (PH>7). The PH values of all sample ranges from 7.10 to 8.62. In general the PH values are higher in winter than other season. The variation can be due to the exposure of water to atmosphere biological activities & temperature changes. Alkalinity is imparted by salts like carbonate bicarbonate nitrates. The alkalinity ranged between 340 to 425 mg/lit, with maximum being at Phandharpur. High chloride level indicates pollution from domestic sewage. Chloride were found maximum at Mohol.Thesulphate concentration in the water were very high ranging between 50.6 to190.8 mg/lit. The source of sulphate could probably be from the mineral rocks antbropogenically added & also enter with rain. [8], Dissolved oxygen (DO) is one of the important parameter in water analysis. It reflects the physical & biological processes prevailing in the water. Non polluted is normally saturated with DO. [1] The dissolved oxygen was found maximum at Karmala (13.06 & minimum at Madha (4.59).

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Biochemical oxygen demand (BOD) is the amount of oxygen required by the bacteria in stabilizing the decomposable organic matter. The BOD range from 1.45to 3.42. High concentration of BOD was recorded at Mohol (3.42) is due to huge losd of sediments & sewage water. Chemical oxygen demand (COD) is the amount of oxygen consumed during the chemical oxidation of organic matter using strong oxidizing agent like acidified potassium dichromate. The COD is linked with the heavy pollution from paper industries domestic sewage & Industrial effluents on the bank of river. In present study COD ranges from 11.2 to 21.4 mg/lit.The highest valueof COD Indicate the most of the pollution caused by industrial effluents upstream. Similar results were also reported by Pande & Sharma.

In present study total hardness (TH) ranges from 192.8 to 459.2 mg/lit. It is maximum at Madha& minimum at Malshiras. These finding suggest that the water body of Bhimariver is very hard. Although hard water has no known effect on health but it is unsuitable for domestic use. It also forms heat insulating scales in the boiler reducing their efficiency. [10], As regard to total dissolved solids (TDS) the BIS (1991) maximum permissible limit is 1500 mg/lit. for drinking water. The of the TDS in the study area ranges from 260.6 to 310.2 mg/lit. which are well below the maximum permissible limit as mentioned above[2].

Parameter	karmala	Madha	Malshiras	Pandharpur	Mohol
Temp. (C^o)	27	28	27	30	29
PH	7.25	7.13	7.52	8.62	7.10
Alkalinity (mg/lit.)	360.0	411.0	340.0	425.0	380.0
Chloride (mg/lit.)	140.20	80.0	168.40	220.12	50.50
Sulphate (mg/lit.)	85.50	50.60	19.80	65.40	75.0
Dissolved Oxygen (mg/lit)	13.06	4.59	9.66	10.50	8.77
BOD (mg/lit)	1.45	3.14	3.77	2.03	3.42
COD (mg/lit.)	14.40	19.50	11.20	26.80	21.40
Total Hardness (mg/lit.)	266.20	459.20	192.80	320.30	432.70
TDS (mg/lit.)	310.20	270.50	280.80	260.60	295.90
Calcium	60.0	78.10	108.50	165.30	146.20
Magnesium	72.60	35.30	58.40	70.90	86.50

Table 7: Physico- Chemical Analysis of Bhima River

Neeru Bansal et al. has carried out Study on Ahmedabad's Impact on the Sabarmati River. Heavy Metal Pollution The bathing standards for water bodies do not include heavy metals. Since the Sabarmati receives the treated/untreated industrial effluents, it becomes important to analyse the extent of heavy metals present in the river, especially downstream of Ahmedabad as the river is the only source of water for the villages downstream. The Bureau of Indian Standards has defined standards for the heavy the heavy metals for water to be used for drinking purpose as well as for reclaimed water to be used for irrigation if used for a long term (Table 8). Some of the heavy metals (for example, copper and zinc) are essential as trace elements to maintain the metabolism of the human body, but they may have toxic effects at higher concentrations. Many other metals (for example, mercury, cadmium and lead) have direct toxic effects on human health. Heavy, metals are non-biodegradable and tend to bioaccumulate and biomagnify in the food chain. Even if the heavy metals are present in undetectable concentration, their biomagnification may lead to a concentration that becomes toxic. The long-term exposure to these may cause damage to the nervous system, lung, kidney, liver, and other vital organs.

Heavy Metals	Total Chromium	Copper	Iron	Lead	Nickel	Zinc
Drinking water standards	0.05	0.05	0.3	0.01	0.02	5.0
Standards for long-term irrigation use	0.1	0.2	5.0	5.0	0.2	2.0
Number of samples	23	23	23	23	23	23
Number of samples not meeting drinking water standards	19	12	9	12	12	0
Number of samples not meeting irrigation water quality	0	0	6	10	1	0

Source: Unpublished GPCB data. The data till March 2013 was obtained by filing an application under the Right to Information Act for the PhD research of the first author, and was updated further up to March 2017 by approaching the GPCB in person.

Table 8: Heavy metal pollution in the Sabarmati river, 2014-2017

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The analysis of heavy metals in the Sabarmati at Miroli (monitoring point downstream of the city) is presented in Table 2. There are 23 samples taken from April 2014 to March 2017 for which details are summarised. It is observed that a large number of samples are not meeting the drinking quality standards for heavy metals such as chromium, copper, iron, lead and nickel. The only metal for which drinking water meets the standards is zinc. Even if we consider the standards for water to be used for irrigation, a large number of samples fail to meet the desired norms for iron and lead. The high pollution levels in the Sabarmati, downstream of Ahmedabad, after the discharge of treated sewage and industrial effluents raise doubts on the effectiveness of the treatment plants in reducing pollution and their compliance of effective standards. The levels of pollution in the river are way higher than the desired values[4].

Gajanan Pratapwar Bansal et al. has carried out Study on Water Pollution in River Ganga.

The Ganges suffers from extreme pollution levels, caused by the 400 million people who live close to the river. Sewage from many cities along the river's course, industrial waste and religious offerings wrapped in non-degradable plastics add large amounts of pollutants to the river as it flows through densely populated areas. The problem is exacerbated by the fact that many poorer people rely on the river on a daily basis for bathing, washing, and cooking. The World Bank estimates that the health costs of water pollution in India equal three percent of India's GDP. It has also been suggested that eighty percent of all illnesses in India and one-third of deaths can be attributed to water-borne diseases. The main cause of water pollution in the Ganga river are the increase in the population density, various human activities such as bathing, washing clothes, the bathing of animals, and dumping of various harmful industrial waste into the rivers.

- **Religious traditions**

During festival seasons, over 70 million people bath in the Ganga to clean themselves from their past sins. Some materials like food, waste or leaves are left in the Ganga which are responsible for its pollution. Traditional beliefs hold that being cremated on its banks and to float down the Ganga will atone for the sins of those who die and carry them directly to salvation. In Varanasi alone, an estimated forty thousand bodies are cremated every year, many of those are only half-burnt.

Figure 3: Real scenario during festival season

- **Water shortage**

Along with ever-increasing pollution, water shortages are getting noticeably worse. Some sections of the river are already completely dry. Around Varanasi, the river once had an average depth of 60 metres (200 ft), but in some places, it is now only 10 metres (33 ft). To cope with its chronic water shortages, India employs electric groundwater pumps, diesel powered tankers, and coal-fed power plants. If the country increasingly relies on these energy-intensive short-term fixes, the whole planet's climate will bear the consequences. India is under enormous pressure to develop its economic potential while also protecting its environment something few, if any, countries have accomplished. What India does with its water will be a test of whether that combination is possible.

- **Mining**

In Kumbh Illegal mining in the Ganges river bed for stones and sand for construction work has long been a problem in Haridwar district, Uttarakhand, where it touches the plains for the first time. This is despite the fact that quarrying has been banned Mela area zone covering 140 km2 area in Haridwar

Calculation of Water Quality Index

The complicated scientific information can be converted into a single number through WQI. It is a dimensionless number that can be arrived by studying many parameters that affects water quality into a single

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number making it easy for a common man to understand the quality of water. WQI is calculated on the basis of several physic – chemical parameters which is then multiplied by a weighing factor and the final aggregate is obtained using arithmetic mean. WQI tool is used successfully by many authors as a means to state the quality of water for water bodies. The calculation of the WQI is well explained and the same formula was applied to calculate the WQI in the present study.

Calculation of Quality rating (Qi):

Quality rating for each parameter was calculated by using the following equation

$$Qi = \frac{(V_{actual} - V_{ideal})}{(V_{standard} - V_{ideal})} \quad X\ 100$$

Where,

Q_i = Quality rating of ith parameter for a total of n water quality parameters.

V_{actual} = Actual value of the water quality parameter obtained from laboratory analysis

V_{ideal} = ideal value of that quality parameter can be obtained from the standard tables.

V_{ideal} for pH = 7 and for other parameters it is equating to zero and

DO V_{ideal} = 14.6 mg / L

$V_{standard}$ = Recommended WHO standard of the water quality parameter.

Calculation of Unit weight (Wi): Unit weight was calculated by a value inversely proportional to the recommended standard (Si) for the corresponding parameter using the following expression

$$Wi = \frac{K}{Si}$$

Where,

Wi = Unit weight for nth parameter,

Si = Standard permissible value for nth parameter

K = proportionality constant, For the sake of simplicity, K is assumed as 1, The overall WQI was calculated by aggregating the quality rating with unit weight linearly using the following equation

$$WQI = \frac{\sum WiQi}{\sum Wi}$$

Where, Qi = quality rating, Wi = Unit weight

DISCUSSION

a) Temperature Temperature is an important parameter as it is responsible to increase the solubility of many minerals, salts and gases. It was found to be 200C for both the samples.

b) pH pH is defined as the negative logarithm of hydrogen ion concentration. The pH for potable water should be between 7 to 8. There are many factors that affect the pH of the water such as presence of dissolved gases, salts, bases, acids. In the present study the pH was found to be 7.88 for S1 and 8.0 for S2, which according to ISI and WHO standards is high.

c) Alkalinity Alkalinity is the capacity of water to neutralize the acids. The presence of bicarbonates, carbonates and hydroxides causes alkalinity in the water. These salts in water are due to the dissolution of minerals from rocks, soils, plant and microbial activities and discharge of industrial wastes. The alkalinity that was reported in the present study was also found to be on the higher end 125 mg/L in S1 and 130 mg/L in S2 respectively.

d) Electrical Conductivity Electrical conductivity is capacity of water to conduct electrical current. It is due to the presence of dissolved salts and minerals. The conductivity was found to be 90 µs/cm for both S1 and S2 samples.

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e) Total hardness Hardness is an important property of water that prevents lathering of water with the soap solution and if exceeds the tolerance limit may lead to serious illness. It causes serious damage to the products of industries and machinery if untreated water is used. The main causes of hardness in water are the presence of bicarbonates, chlorides and sulphates of calcium and magnesium. Total hardness was reported as 133 mg/L and 138 mg/L for samples S1 and S2 respectively, which according to WHO standards is high but average according to ISI standards.

f) Total Dissolved Solids Total Dissolved Solids is an aggregate of all the dissolved solids present in the water. The amount of Total Dissolved Solids was reported as 80 mg/L for both S1 and S2 samples which is not a matter of concern as it is in the safe limits[5].

Parameter	Methods	WHO Standars	ISI Standards	S_1	S_2
Temperature	Thermometric	……..	…….	20^0	20^0
pH	pH metry	7.0-8.0	6.5-8.5	7.8	8.0
Alkalinity	Titration	120	200	125	130
Electrica Conductivity	Conductometry	1400	……	90	90
Total Dissolve Solid	Filtration method	1000	500	80	80
Total Hardness	EDTA titration	100	300	133	138

Figure 4: Data related to WHO standard

Water Quality Index Level	Water Quality Status
0-25	Excellent water quality
25-50	Good water quality
50-75	Poor water quality
75-100	Very poor water quality
>100	Unsuitable for drinking

Table 9: Water Qaulity Index (Wqi) Status of Water Quality

Summary

On the basic of above work it can be said that it highlights widespread contamination and degradation of rivers due to various anthropogenic activities, including industrial discharge, agricultural runoff, and improper waste disposal. The paper emphasizes the urgent need for effective pollution control measures, sustainable water management practices, and stricter regulatory frameworks to safeguard the health of India's rivers. Overall, the review underscores the gravity of the situation and calls for concerted efforts from policymakers, industries, and the public to address and mitigate the escalating water pollution crisis in the country.

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HEALTH PROBLEMS OCCURRED DUE TO PRESENCE OF FLUORIDE IN DRINKING WATER, ITS DETECTION AND REMEDIATION TECHNIQUES: A REVIEW

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ABSTRACT
Fluoride poisoning has become a major global threat to human civilization. The primary sources of fluoride in drinking water include volcanic activity, rich fluoridated soil, grasses, grains, and fodder. The World Health Organization has established an upper limit of 1.5 mg/L for fluoride in drinking water, though some countries have established their own standards based on their particular circumstances. Numerous health issues, such as dental and skeletal fluorosis, osteoporosis, muscle damage, fatigue, joint-related issues, and stomach disturbances (such as nausea, occasional blood vomiting, abdominal pain, diarrhea, weakness, and hypocalcemia) can result from drinking water contaminated with high levels of fluoride ions. Fluoride poisoning has become a major global threat to human civilization. The primary sources of fluoride in drinking water include volcanic activity, rich fluoridated soil, grasses, grains, and fodder. The World Health Organization has established an upper limit of 1.5 mg/L for fluoride in drinking water, though some countries have established their own standards based on their particular circumstances. Numerous health issues, such as dental and skeletal fluorosis, osteoporosis, muscle damage, fatigue, joint-related issues, and stomach disturbances (such as nausea, occasional blood vomiting, abdominal pain, diarrhea, weakness, and hypocalcemia) can result from drinking water contaminated with high levels of fluoride ions.

Keywords: fluoride, nanofiltration, health problems

1. INTRODUCTION

All life on Earth depends on water to function. It is an essential element. However, the rapidly rising contamination is a topic worth paying attention to in terms of environmental health and degradation. [3] The fluoride-based salts were present in the groundwater naturally in the same string. It is a dangerous contaminant that, when its concentration surpasses the permitted limit, causes long-lasting distress, according to the World Health Organization (World Health Organization, 2011). Due to various factors like weathering, volcanic activity (since fluorine accumulates during the magmatic crystallization and differentiation processes of the magma), and air/water conveyance, groundwater is more frequently impacted than surface water.[1] Furthermore, rocks and minerals like fluorspar, sellaite, fluoroapatite, and villiaumite dissolve in water streams due to the presence of fluoride in them. The presence of fluoride has been made worse by past civilization and increased human activity as a result of industrial sectors like steel, aluminum, semiconductors, bricks, fertilizers, and pesticides. The results indicate that fluoride contamination is very likely. Furthermore, [2] discovered that fluoride concentrations in industrial effluent can range from 250 mg/L to 1500 mg/L, and in severe circumstances, up to 10,000 mg/L. Fluoride can accumulate in organic materials from living things, soil, and water. This can be harmful to one's health. [5] It is therefore becoming increasingly evident that this is a significant issue for the environment and public health of serious health disorders.[7]

It is also an anabolic species that stimulates various cell types and can bind to organic materials, such as enzymes, to obstruct its actions at the milli and micro levels. Some very visible conditions are dental and skeletal fluorosis, osteoporosis, arthritis, and bone deterioration. Initially, joint issues, fatigue, muscle strains, and chronic issues may arise. It can adversely affect the kidney, liver, endocrine glands, heart, arteries, nervous system, and several other sensitive objects in extreme cases.

Because fluoride is highly reactive in the field of water treatment and recovery, eliminating it is imperative in order to address the aforementioned drawbacks. Because of its ionic measurements, treatment is particularly difficult. While many researchers attempted to use massive engineering techniques, such as electrodialysis, reverse osmosis, coagulation, adsorption, and nano-filtration, to treat fluoride-rich streams.[9] Reviews typically address one or two aspects of the issue, and occasionally important details that may be necessary to comprehend the topic holistically are left out.

The most recent medical information is frequently absent from technical papers. Fluoride, for instance, is still referred to as a two-edged sword. It is now undeniably clear from recent medical research that fluoride does not contribute to the formation of enamel, which shields teeth from cavities. It has been documented that controlled medication can reverse the effects of fluorosis; however, prompt diagnosis is essential. This highlights another crucial element of the synergistic association between fluoride and aluminum. Additionally, a study that

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evaluates potential issues related to the fluoridation of water practice—which has been adopted in certain countries because of its alleged benefits—has been cited. Since these are the two most widely used procedures in the field, Coagulation-based techniques have received special attention in certain reviews. while others have provided a detailed description of adsorption-based technologies.[1] In our review, we have included papers on the synthesis of new PACl varieties that we have developed that have shown to be more effective than the chemicals currently available for coagulation. We have also included adsorption processes to a useful comparison of the two in terms of their respective uses and limitations. Reliability in reporting laboratory or field results is also dependent upon the avoidance of fluoride analysis in water reviews pertaining to defluoridation. In this section, we've discussed recently developed techniques ranging from strip-based analysis of use at site to highly sensitive techniques that are said to be free from aluminum interferences that affect analysis based on widely used equipment, such as ion selective electrodes.

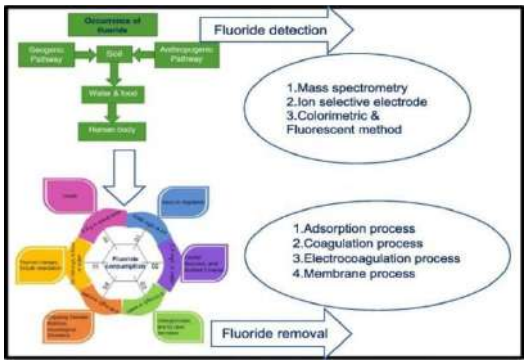

Table 1 : Graphical overview [10]

SECTION SNIPPETS

1.1 Possible Natural Fluoride Occurrence Pathways Include:

In the lithosphere, fluoride is the thirteenth most prevalent anion. It exists in varied concentrations and ratios in all of the planet's water supplies. The topography of the areas where these bodies of water are caught determines the fluoride levels in the lakes, rivers, and canals. [8] The mineral content of the rocks that water moves through determines the fluoride content of subterranean water and aquifers**.**

1.2 Health Issues Relating to Excess Fluoride Intake

This group includes many health problems that require attention. More serious adverse effects in humans than vomiting, excessive salivation, nausea, cramping in the muscles, and abdominal pain can result from acute fluoride exposure. While consuming tap water won't directly cause this, it might if drinking water inadvertently spreads as a result of an industrial accident or explosion. It is important to recognize that eating a lot of nutritious food may not always be good for us.

1.3 WHO and Various Nation's Drinking Water Standards

To guarantee the quality of drinking water, various countries and the WHO have established different standards and water management practices. The majority of nations use a variety of criteria to evaluate the quality of water that is available globally, making it easier to supply potentially high-quality water based on economic benefits, environmental considerations, and health risks.

Country	Standard F^-.mg.L^-	References
Cambodia	1.5	Cambodia Drinking Water Quality Standard (2004)
Vietnam	1.5	Vietnam Drinking Water Quality Standards
India	1.5	Bureau of Indian Standard (2012)
S.Korea	1.5	Korean Drinking Water Standard (KDWS)
Thailand	1	Thailand Drinking Water Quality Standards
China	1	Chinese National Standard (2006)
Japan	0.8	Japan Drinking Water Quality Standards (2015)

Table 2: Various nation's drinking water standards

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1.4 Methods for Fluoride Detection

Understanding the benefits of fluoride in natural biotic and abiotic sources, also the associated toxicity, requires an understanding of fluoride detection and characterization. Both analytical and colorimetric methods are important for the detection and measurement of fluoride. Molecular absorption spectrometry (MAS), ion chromatography, electrochemical methods, and ion selective electrode (ISE) have been utilized as analytical techniques for fluoride determination.

1.5 Fluoride Removal Techniques

The only goal in removing fluoride from water is to treat it so that it meets drinking water standards and has fluoride levels below permissible bounds. The three primary methods of fluoride removal techniques are coagulation, adsorption, and membrane techniques.

1.6 Observation and Future Aspect of Review

Our perspective, which focuses on better management and suggests future modifications to be implemented, has been summarized below along with our observations from the review described above.The world's main supply of drinking water comes from groundwater. Deep rock contact has been found to be the primary cause of fluoride dissolution in groundwater. Volcanic activity, industrial emissions, and fertilizer used for agriculture are some other significant sources of fluoride in drinking water.

2. CONCLUSION

Given that fluoridated water continues to be a serious health risk, stronger environmental protection measures and stricter water management practices are needed.

Numerous methods can be used to determine the fluoride content of water. The well-known and optimal ion-selective electrode-based method remains the best for precise fluoride measurement on a lab scale, despite the development of numerous chemosensor-based receptors.

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SOL-GEL AUTO-IGNITION PROCESSING, STRUCTURAL AND PHOTO-CATALYTIC ACTIVITY STUDIES OF $ZNFE_2O_4$ NANOMATERIAL

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ABSTRACT
In this study, pure zinc ferrite nanocrystals were fabricated via facile sol-gel auto-combustion procedure. X-ray diffraction (XRD), transmission electron microscopy (TEM) and vibrating sample magnetometer (VSM) were utilized to illustrate the structural, micro-structural and magnetic characteristics respectively. The inspection of XRD diffractograms reveals the growth of cubic spinel phase geometry deprived of any contamination peak. The average crystallite diameter was found to be in nano regime dimensions and well analogues by TEM outcomes (~30 nm). Magnetic characteristics of the sample was accomplished using VSM at room temperature (300 K). Zinc ferrite nanocrystals exhibited exceptional oxidative degradation activity reaction for methyl orange azo dye which is extensively used in the textile industry and resistant to biodegradation. The obtained nanocrystals can be utilized for biomedical as well as catalytic applications.

Keywords: zinc ferrite, sol-gel, nanocrystals, catalyst.

1. INTRODUCTION
With developing passion and call for technological innovation in the late many year's spinel ferrites have arisen out as an area of considerable exploration. The striking features of spinel ferrite oxides viz. electric, dielectric, magnetic and catalytic characteristics make them valuable solids in several scientific applications [1, 2].

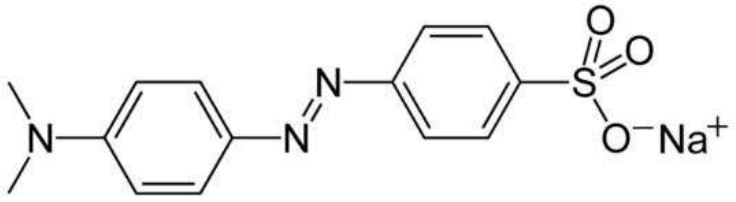
Ferrites are ceramic solids comprising of combinations of iron oxide with divalent metal ions. Ferrites have gained importance because they possess the combined dielectric and magnetic characteristics [3, 4]. They are used in advanced electronics owing to their multifunctional features and potential applications in magnetic storage devices, transducers, actuators, sensors, microwave and high frequency devices, transformer cores, magnetic resonance imaging, spintronics devices and many more [5-7].

Modifying the chemical composition of the spinel ferrite nanoparticles one can possibly control the electric, dielectric, magnetic and catalytic properties. The properties of spinel ferrites are reliant on several factors including the method of preparation, sintering temperature, sintering time and chemical composition. Mixed metal oxides of the stoichiometric $M^{2+}Fe_2^{3+}O4^{-2}$ (M = Co, Ni, Cu, Zn, Cd, etc.) having the spinel structure are amongst the most widely used magnetic materials [8]. They have attracted a great deal of interest because of their several applications in many fields. They are used for microwave devices, applications in radio frequency, transformer cores, antenna rods, memory chips etc. due to their high electric resistivity, low eddy current and dielectric losses and chemical stability [9].

Now a days, in various textiles, leather, plastics, leather, paper, cosmetic and food industries the synthetic organic dyes and pigments are extensively utilized [10]. Generally, these pigments and artificial organic dyes are non-biodegradable and henceforth cause a serious hazard to our ecosystem and human healthiness [11]. Amongst numerous types of dyes, the azo dyes characterize a foremost group of dyes and have been extensively exploited in textile industries on account of their comfort of synthesis, flexibility, and cost efficiency [12].

However, because of the strong harmfulness and the high solubility of these dyes, varieties of approaches are projected for the elimination of them such as adsorption, filtration, sedimentation, and catalytic process.

The practice of using dyes is maybe the most antique art of chemistry. Dyeing substances from plant, animal, or mineral sources has been acknowledged before written history. Methyl orange ($C_{14}H_{14}N_3NaO_3S$) MO is utilized in dyeing and printing textiles as a dyestuff [13].



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Methyl orange (MO)

(IUPAC name : sodium;4-[[4-(dimethylamino)phenyl]diazenyl]benzenesulfonate)

In the last era, unbelievable work has been reported on the photo-catalytic activity under UV light and visible light photons. Azo dyes are widely used in the textile industries which are highly toxic, mutagenic and carcinogenic in nature which causes adverse effects on the environment and human health. Therefore, degradation of these dyes is very essential before discharging thein to the environment. Degradation by photo-catalysis is one of the most effective methods to treat waste water [14].

Amongst the several degradation techniques, the catalytic degradation technique, supported with optical radiation or strong oxidizer, has been verified as one of the significant, advanced, and green technologies. In the catalytic degradation procedure, by means of semiconductors and multi-component oxides as the catalysts to degrade azo dye has fascinated widespread consideration. Though, the departure of these catalysts from treated water, specifically from a bulky volume of water, is expensive and time-consuming process, which restricted their utility in industrial fields. It is appreciated that introducing the magnetic catalysts is an upright choice to deal with the catalysts departure and recycle problems [15].

Between several of magnetic oxides, the ferrite with formula Me-Fe_2O_4 (where, Me = Zn, Co, Mn Mg, Ni, etc.) is a well-known cubic spinel material where oxygen forms a face-centered cubic (fcc) close packing, and Me^{2+} and Fe^{3+} occupy either tetrahedral or octahedral interstitial sites. Owing to its steady crystal structure and excellent magnetic characteristics, it has been extensively used in electronic devices, information storage, magnetic resonance imaging (MRI), and drug-delivery technology [16].

Zinc ferrite semiconductor photocatalyst has been applied widely to degrade the organic pollutants for the remediation of hazardous wastes, contaminated groundwater and the control of toxic air contaminants [17]. Zinc ferrite has potential applications in the conversion of sunlight and sensitive towards visible light. Spinel zinc ferrite has been reported as a semiconducting material with tetrahedral sites occupied by Zn^{2+} ions and octahedral sites by Fe^{3+} ions. The conduction mechanism in zinc ferrite is due to the Fe^{2+} and Fe^{3+} ions present in octahedral sites. Its chemical and thermal stability has made zinc ferrite important materials, such as magnetic materials, catalysts and absorbent materials, in the past decade [18].

Over the years, nanoferrites of spinel solids have been extensively studied by worldwide researchers because of its unique size dependent physical and chemical properties as compared to bulk counterpart material [19]. The nanoferrites are synthesized by the different methods such as chemical co-precipitation, hydrothermal, microemulsion, citrate-gel, etc. techniques [20, 21]. The wet chemical sol-gel technique is the utmost adaptable process to manufacture synthetic nanoparticles of spinel ferrites and having uncountable benefits over other methods for instance; requires low temperature, ecofriendly, desired nanoarchitecture, chemically stable product formation with desired morphology through modification of synthesis environments and parameters [22].

In the present study, nanocrystalline spinel type zinc ferrite was synthesized using sol-gel auto ignition technique. The structural, microstructural and catalytic characteristics were scientifically examined. Also, afterwards the fabricated ferrite nanocrystals were utilized as a catalyst to oxidative degrade of methyl orange (MO) in the aqueous solution.

2. RESEARCH METHODOLOGY

Synthesis of $ZnFe_2O_4$ Spinel Ferrite Nanocrystals

Materials: The analytical reagent grade (AR) zinc nitrate ($Zn(NO_3)_2.6H_2O$), ferric nitrate ($Fe(NO_3)_3.9H_2O$) and citric acid ($C_6H_8O_7$) were utilized as source materials (99% pure) and used without additional distillation.

Synthesis: Nanocrystalline $ZnFe_2O_4$ spinel ferrite was effectively produced using sol-gel auto ignition technique and citric acid as a fuel. The AR grade nitrate and citric acid (as a firing agent) were dissolved in 100 ml deionized water separately to attain a homogenous solution. The precursor metal nitrates were dissolved together with a least volume of deionized water required to attain a transparent solution. The reaction process was done in an air atmosphere without the protection of inert gases. The metal nitrates to fuel (citric acid) ratio was maintained as 1:3. Ammonia solution was added dropwise to preserve the pH to 7. The auto ignition reaction takes place in few hours with continuous heating of 110 ˚C to produce the required product. The un-calcinated powder sample was sintered at 800 ˚C for 5 hrs and afterward utilized for further examinations of structural, microstructural, magnetic and catalytic properties.

Characterizations: The XRD graphs were measured in the 2θ range of 20 º to 80º at room temperature with Cu-Kα radiation. The surface morphological and microstructural studies were performed using transmission

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electron microscopy (TEM, Philips CM200) technique. The UV-Vis light absorption spectrum of the methyl orange solution was analyzed UV-Vis spectrophotometer.

Catalytic Activity Test:

Firstly, 0.1 g of $ZnFe_2O_4$ nanoparticles were added to 200 ml methyl orange solution (30mg/L). Then, the aqueous suspension was stirred for 30 min to attain improved dispersion and adsorption performance prior to the degradation. The *pH* value of the methyl orange solution was adjusted to 3 by adding hydrochloric acid (HCl) dropwise and then 1 ml hydrogen peroxide (H_2O_2) was added as an oxidant. At degradation time intervals of 0.5 h, a small quantity of solution was taken from the test solution and analyzed by measuring the absorbance at 507 nm by a spectrophotometer. Subsequently, the degradation rate of methyl orange is estimated by:

$$D\ (in\ \%) = \frac{(C_i - C_t)}{C_i} \times 100 \qquad (1)$$

Where, D was the degradation rate of methyl orange, C_i is the initial concentration of methyl orange and C_t is the concentration of methyl orange at time *t*.

3. RESULTS AND DISCUSSION

Fig. 1 displays the powder XRD diffractogram of $ZnFe_2O_4$ spinel ferrite produced by the sol-gel combustion route. Entire reflections appeared in diffraction patterns agreeably indexed with monophasic cubic spinel structure with space group *Fd*-3*m* (JCPDS Card No. 82-1049) deprived of any contamination phase [23]. The observed Bragg's reflections for the sample are slightly broader confirming the added nanocrystalline nature of the formed sample. The occurrence of planes (220), (311), (222), (400), (422), (511), (440) and (533) in the XRD diffractograms disclosures the cubic spinel structure. It is also evident that all the reflection peaks are highly intense besides sharp-edged thus, the samples are single phase in nature.

The lattice constant (*a*) of the prepared ferrite was determined using the typical relation and their values are tabulated in Table 1 [24],

$$a = d\sqrt{(h^2 + k^2 + l^2)} \quad (2)$$

where, *d* is interplanar spacing; (*hkl*) is Miller Indices.

The result on lattice constant is analogous to reported data [25, 26].

The unit cell volume (*V*) was assessed by using lattice constant.

The X-ray density (d_x) value was estimated by using the relation (3) and values are summarized in Table 1 [27];

$$d_x = \frac{Z \times M}{V \times N_A} \qquad (3)$$

where, *Z* is the number of molecules per formula unit (*Z* = 8 for spinels), *M* is molecular mass of the sample, *V* is the unit cell volume, N_A is the Avogadro's number. The bulk density (d_B) of the fabricated pellet sample was found using the Archimedes principle using xylene as an immersion liquid [28]. The porosity (*%P*) value was determined using *dx* and d_B values and detected to be in the range of 15-16 % (Table 1) suggesting the porous nature of the synthesized sample due to evolution of substantive gases during the combustion synthesis.

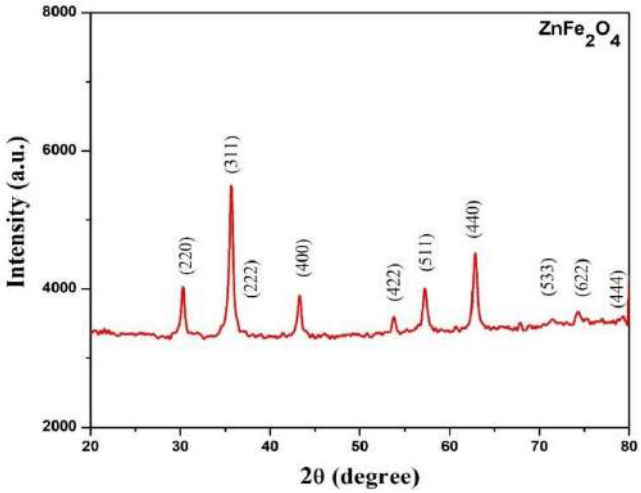

Fig.1. XRD pattern of zinc ferrite nanoparticles

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Table No.1: Lattice constant (*a*), unit cell volume (*V*), X-ray density (d_x), bulk density (d_B), porosity (*%P*), average particle size (*t*) from XRD and average particle size (*D*) from TEM of zinc spinel ferrite nanocrystals

Sample	*a* (Å)	*V* ($Å^3$)	d_x (g/cm^3)	d_B (g/cm^3)	*P* (%)	*t* nm	*D* (nm)
$ZnFe_2O_4$	8.4112	595.07	5.38	4.56	15.24	28.3	30.28

TEM study demonstrated (Fig. 2) that spherical shaped, uniform nanocrystalline powders were effectively synthesized. The grains exhibit the agglomerate spherical and cubical shape morphology for the prepared samples. The obtained average crystallite size (*D*) of the prepared nanoparticles from TEM was found to be 30 nm listed in Table 1.

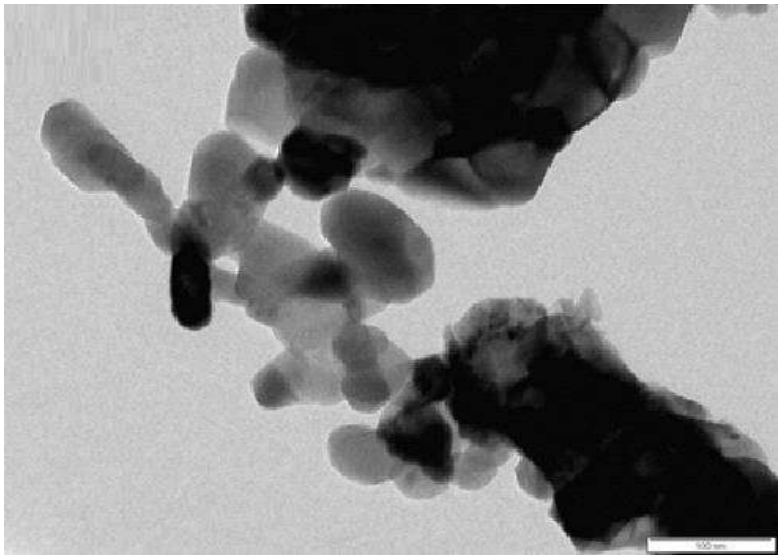

Fig.2. XRD pattern of zinc ferrite nanoparticles

Figure 3 (a) presents the UV-Vis spectra development and degradation efficiency of methyl orange in the presence of $ZnFe_2O_4$ nanocrystalline as a catalyst. With the catalytic activity reaction procedure, the intensity of the distinctive absorption peak of methyl orange diminished gradually. Subsequently ~4 hours, the peak practically vanished and there was no occurrence of any extra or new adsorption peaks and shifting of the substantial peak, it hints that nearly ~97% of methyl orange has been degraded successfully (as depicted in Fig, 3 b).

The significant catalytic activity may be accredited to the high specific surface area and the active absorbed oxygen species. Also, the ion transfer among diverse valences states of A and B site ions in the nanocrystals was beneficial for the degradation reaction process. Consequently, it might be suggested that the zinc ferrite nanocrystals displayed exceptional oxidative degradation activity reaction for methyl orange [32].

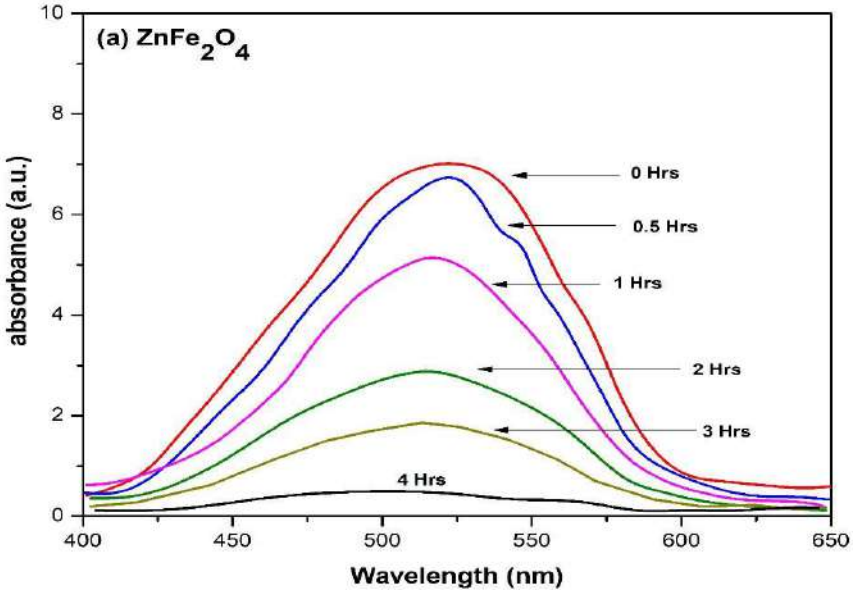

Fig. 3. (a): UV-Vis absorbance spectra of methyl orange solution with reaction time (zinc ferrite)

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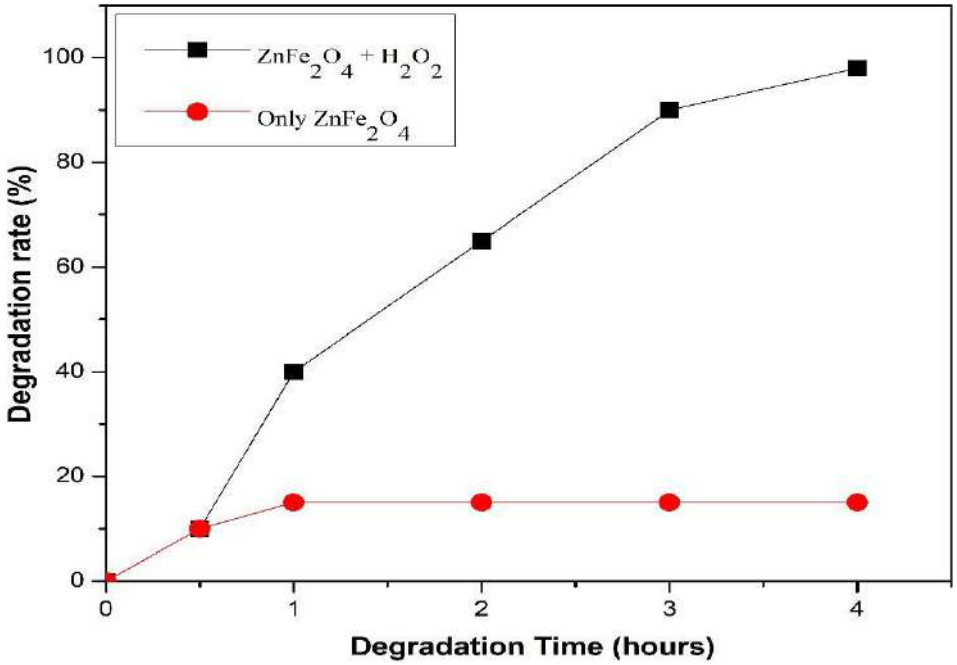

Fig. 3. (b): Degradation efficiency of methyl orange for $ZnFe_2O_4$ catalyst

4. CONCLUSION

In this paper, nanocrystals of $ZnFe_2O_4$ were effectively synthesized via sol-gel auto ignition technique and citric acid as a firing agent. Various structural, microstructural, optical, magnetic and catalytic characteristics of produced nano-ferrite was systematically investigated. The XRD study confirmed the formation of fine nanocrystals of cubic spinel structure with space group *Fd-3m* without any impurity phase. The average crystallite size of prepared nanocrystals was estimated by the Debye-Scherer relation which was obtained to be 28 nm. The lattice constant of the prepared solid was found in reported range. A TEM study demonstrated that spherical, uniform nanocrystalline powder was magnificently synthesized. TEM results also supported the approximate sizes of the nanoparticles (~30 nm) initially derived from XRD data. Subsequently, it might be suggested that the zinc ferrite nanocrystals displayed exceptional oxidative degradation activity reaction for methyl orange. The zinc ferrite nanocrystals exhibit superior degradation efficiency of ~98 %.

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STUDY OF CHANGE IN SPECKLE CONTRAST BY ROATATIONAL WIGGLING

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ABSTRACT
Electronic Speckle Pattern Interferometry (ESPI) is a widely used technique to measure full-field deformation of surfaces of multiple objects. This technique is based on phenomenon of interference. I have studied the rotating object using electronic speckle pattern interferometry. During rotation, any surface alterations were observed by recording the speckle correlation fringes. Both periodicity of rotation and periodic shift in the speckle contrasts of the images were noted. I have studied about fabricating an experimental setup for electronic speckle pattern interferometry to investigate rotating objects, followed by an experimental setup to determine the object's rotational period. The principles of electronic speckle pattern interferometry (ESPI) are studied, as well as how the difference of frames from two distinct rotating body positions yields the correlation fringes that are acquired as a result.

Keywords: Electronic Speckle Pattern Interferometry (ESPI), Speckle, Speckle Pattern

1. INTRODUCTION
It has been invented in 1970s by J. N. Butters and J. A. Leendertz [1]. Using this method various deformations on object can be measured such as mechanical deformation, thermal deformation, acoustical deformation etc. In addition to this ESPI is largely used in metrology as well as in medicine [2-4]. Deformation in object can be studied by correlating initial and final shape of an object. If the shape of object is changed, fringes are obtained which are corresponding to changes in the degree of correlation of the two speckle patterns. These fringes are called as speckle correlation fringes and they form a contour map of surface displacements and give the information about asymmetry [17].

1.1 Speckle
Speckle is a three-dimensional cigar shaped grain. Each speckle has the information which is reflected from the surface of the object. Speckle get moves from its mean position when surface has any deformation. Object illuminated by coherent light feature a characteristic phenomenon. This surface appears to have a granulated structure. These grains are called as speckle [5].

The Image of a typical speckle pattern is as shown in the figure 1.1.

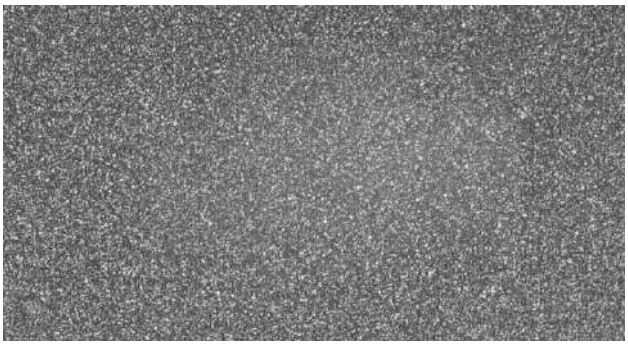

Fig.1.1: Speckle Pattern

1.2Speckle Interferometry
A speckle pattern interferometer is a two-beam interferometer with at least one of the interfering beams being a speckle pattern. A speckle pattern is produced by scattering of light by an optically rough surface when a coherent light beam illuminates it.

In speckle interferometry a coherent light from the source is split into two beams. One of the beams illuminates the test object which generates a speckle object beam and the other can be used directly as a smooth reference beam. The object beam and reference beam are superimposed according to the principle of interferometry which produces a speckle interferogram. Speckle interferograms corresponding to two object positions, one before and another after the displacement are recorded on a photographic plate to measure the displacement of a test object.

Thus, resultant speckle pattern distribution contains speckle fringes, which are called correlation fringes. The contrast of these fringes depends on the phase difference between the speckle patterns corresponding to two different positions of the object.

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1.2 Electronic Speckle Pattern Interferometry

A speckle interferometer which uses a video (digital) camera for the detection of correlation fringes is called an electronic (digital) speckle pattern interferometer (ESPI/DSPI). In an ESPI system generally the correlation fringes are generated by subtraction of speckle interferograms corresponding to two different positions of the object [6].

1.2 History of Electronic Speckle Pattern Interferometry (ESPI)

E. Archbold in 1969 developed Speckle interferometer. He has design using telescope to observe surface deformation. He shows that speckle pattern is produce when there is a deformation of surface. After this in 1991 Katherine Creath describe the different techniques of non-destructive testing in her research papers, in this ESPI uses an optical setup and result is displayed on monitor [12]

I have previously conducted research on the speckle correlation fringes for a single cycle with K.M. Alti, P.P. Padghan, and myself, and we have drawn conclusions for a single cycle. However, I've now analyzed rotational wiggling for the next three cycles and for different object of different material and diameter [17].

1. Experimental Setup and Theory

The fabrication and experimental setup of electronic speckle pattern interferometry setup for studying rotating object and then fabrication and experimental setup for measurement of rotational period of object.

The following figure depicts the schematic diagram of the electronic speckle pattern interferometry experimental setup used to analyse wiggling of objects.

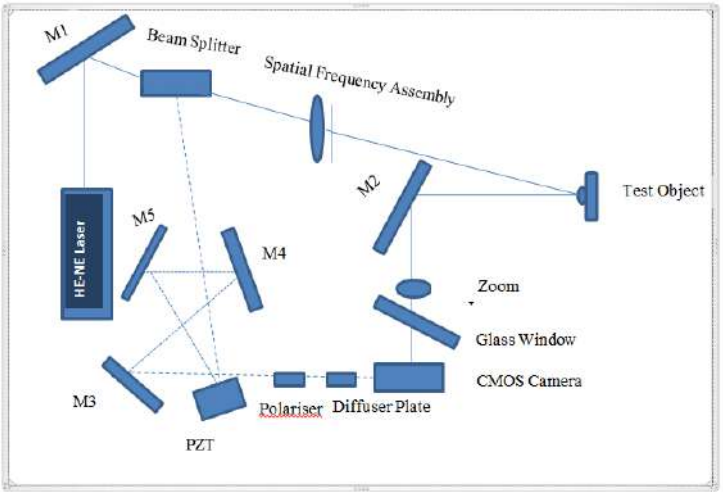

Fig.2.1: Schematic diagram

The light source for the ESPI interferometer technique is a He-Ne laser with an output power of 5 mW at wavelength of 632.8 nm. A beam splitter divides a laser beam into reference and object beams. Object beam illuminates a central part of object. This indicates that it is impossible to investigate the impact of a hole made at an object's edge. The speckle pattern provides surface information about the object. The CMOS camera receives an additional beam from the same source, referred to as the reference beam, via a beam splitter. The object's speckle pattern is created by the superposition of the object beam and reference beams. The zoom lens gathers the speckle pattern, which the CMOS camera displays.

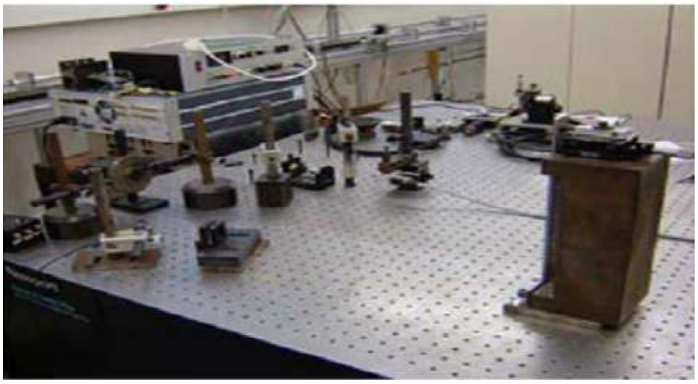

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Fig. 2.2: a) Original Photograph of ESPI to study rotating object [18]. b) Rotating Object

Experimental set up for measuring rotational period of the object using laser.

The object is connected to motor for rotation. Motor is connected to power supply. The object is illuminated using He-Ne laser in a middle portion. So that the effect of the hole made at the edge of object cannot be studied. In order to detect a laser light passing through a hole in a circular metal plate, the photo detector is positioned behind the metal plate. A photo detector circuit connects the photo detector to a power source. DSO is used to calculate the rotational time period. A CMOS camera is used to record the speckle pattern that results from the superposition of the reference and object beams. The virtualDub-1.10.4 program transforms this movie into frames or pictures. The rotation may be shown to be wriggling by comparing the next photographs. A graph is produced between the rotational time period and the contrast of this frame. The time needed to finish one spin may be found on this graph. This graph is also known as interferograph.

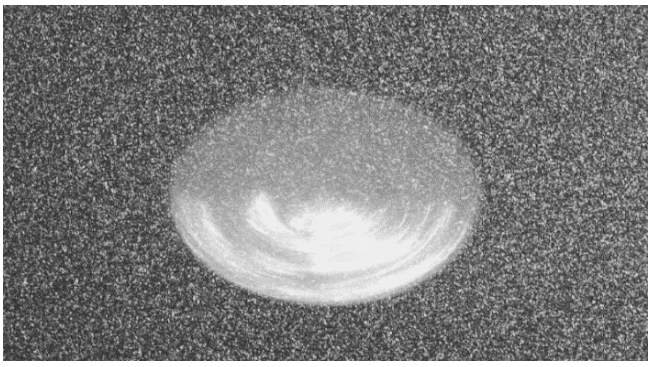

Fig. 2.3: Object illuminated by laser light

Fig. 2.3 is the typical image of an object when illuminated by laser light. We have to get a difference of these type of images to get correlation fringes and by correlation fringes we drawn a graph of speckle contrast and time.

3.1 Measurement of Rotational Period of the Object

The ESPI set up is used to measure rotational period of the object. The circular metal plate of 4 cm radius has taken. The circular metal plate is rotate by supplying power to motor. The object is kept in front of laser light. The photo detector is kept behind the object which detects the light. The photo detector is connected to power supply and DSO through photo detector circuit. The time period is obtained using DSO. The time period is found to be 0.9 sec. So, for one complete cycle or one rotation, the time period is found to be 0.9 sec. This period is compared with camera speed available to us. Camera speed depends on number of frames per minute. Maximum frame rate in our case was 8 frames per second. Therefore, in one complete cycle of rotation we could able to take 8 pictures of the rotating object.

3.2 Study of Rotating Object Using ESPI

Eight speckle patterns were recorded and compared to each other. After comparing if the results are null then it implies to no wiggle. In case of wiggle in rotation the sub images upon subtraction shows non zero values. The Two cycles are taken to get in consideration. Which are described below.

3.3.1 For First Cycle

for 1st cycle time period is 0.9 Sec. Therefore, there are total 8 frames in 0.9 Sec from frame 1-8. The difference of frames can be taken out for one cycle. The recorded experimental correlation fringes (difference images) using electronic speckle pattern interferometry are as shown in the figure.

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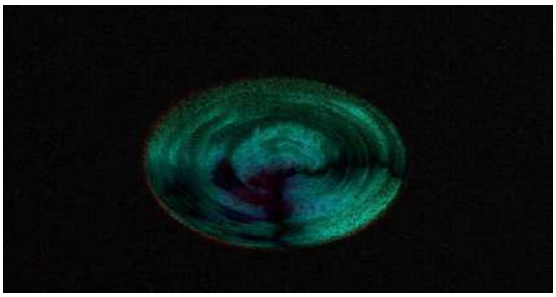
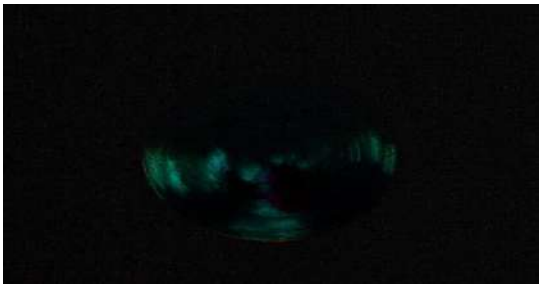
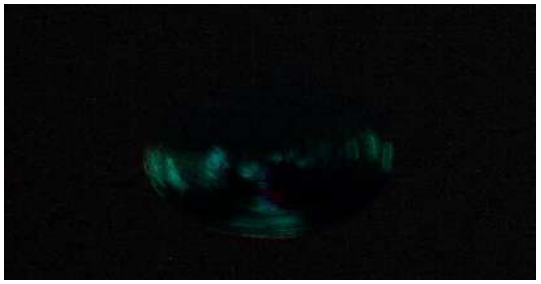


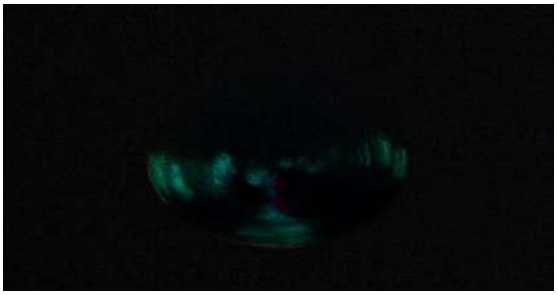
Difference of images 1 and 8



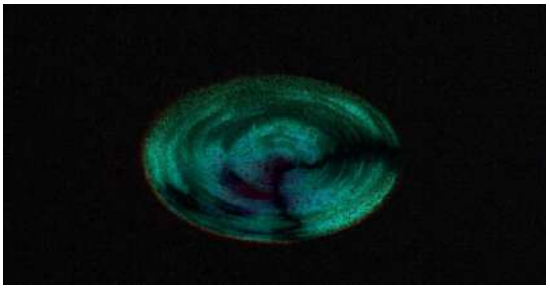
Difference of images 2 and 7



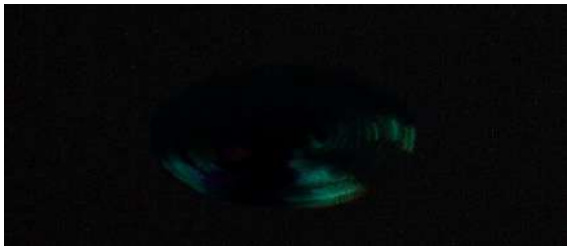
Difference of images 3 and 6



Difference of images 4 and 5



Difference of images 5 and 4



Difference of images 6 and 3

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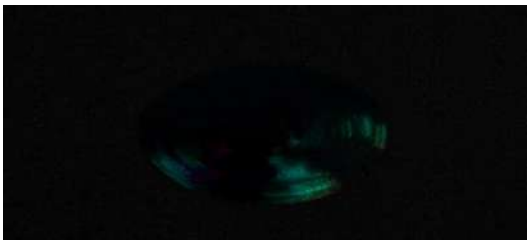


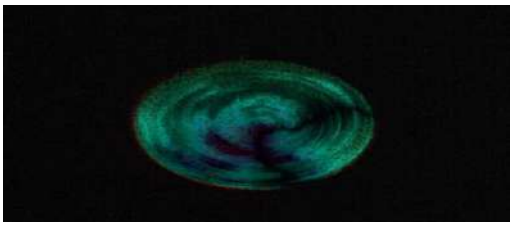
Difference of images 7 and 2

Figure 3.3.1 For First Cycle

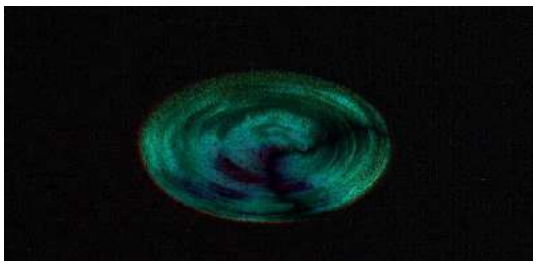
Figure 3.3.1 shows the recorded experimental correlation fringes for a first cycle**.**

3.2 For Second Cycle

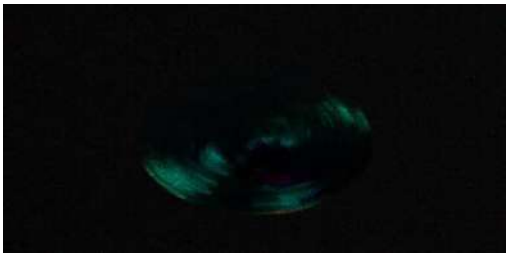
Similarly for 2nd cycle time period is 0.9 Sec. Therefore, there are total 8 frames in 0.9 Sec from frame 9-16.



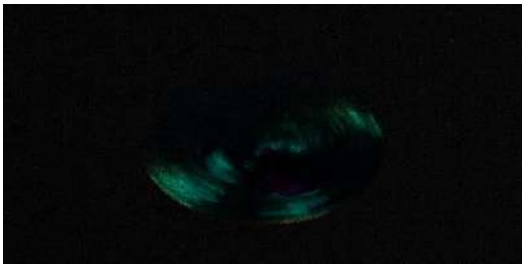
Difference of images 9 and 16



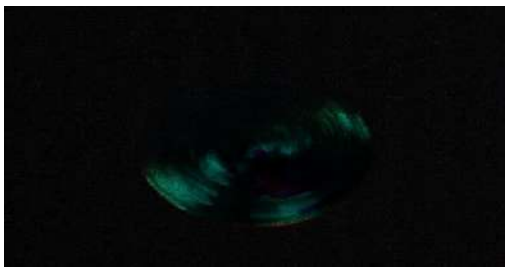
Difference of images 10 and 15



Difference of images 11 and 14



Difference of images 12 and 13



Difference of images 13 and 12

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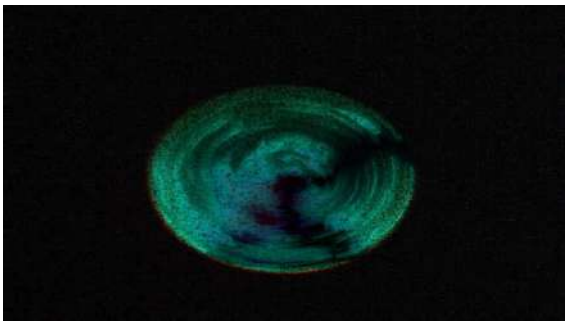
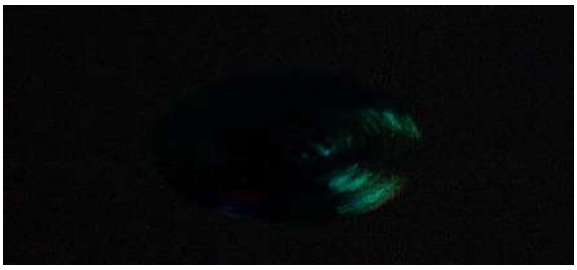


Difference of images 14 and 11

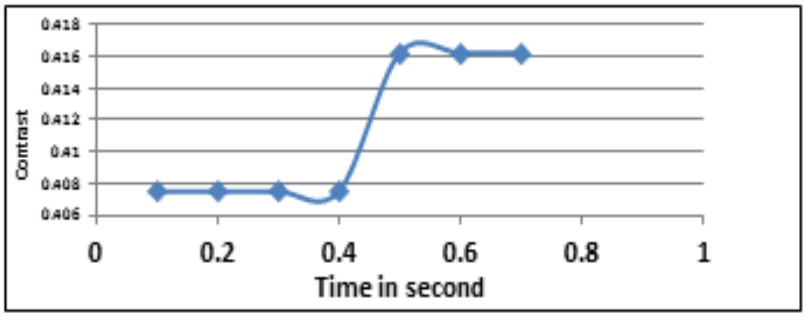


Difference of images 15 and 10

Figure 3.3.2

Figure 3.3.2 shows the recorded experimental correlation fringes for second cycle.

3.4 Graph of correlation fringes (Difference images).



For the first cycle

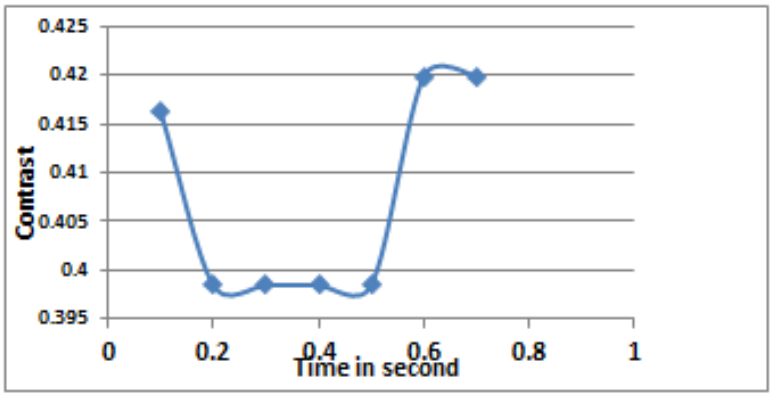


Fig. 3.4

The graph of the time (in sec) and contrast of images is shown in fig. 3.4. By observing the graph, it has seen that there is a periodic change in the speckle contrast. Amplitude is not same for all images. It less for some images and high for some images.

3.5 Summary

I have studied the rotating object. This will help to study the wiggles in rotation. The time required for complete one rotation is found to be 0.9 sec obtain by using DSO. The cycle is repeated after each 0.9 sec. Interesting periodic changes were seen in the speckle contrast with rotation**.**

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CONCLUSION

We have use speckle interferometry to study the rotating object. Speckle correlation fringes were recorded of a rotating object. In each complete rotation, eight speckle patterns were recorded and compared to each other. After comparing if the results are null then it implies to no wiggle. In case of wiggle in rotation the subsequent images upon subtraction shows non zero values which clearly visible in the images described in the previous chapter. Interesting periodic variation of speckle contrast was observed.

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A REVIEW OF INTRODUCTION, PROPERTIES ANDAPPLICATIONS OF LAPLACE TRANSFORM

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ABSTRACT
The need for mathematics in today's world is growing. Researchers from all scientific disciplines employ a variety of mathematical procedures, tools, and models to explain and support their study findings. One technique that scientists and researchers utilize to solve their difficulties is the Laplace transform. In this paper we will discuss about the properties and applications of Laplace transform. The time domain function is solved via the application of Laplace transformation, which transforms it into the frequency domain. Here, we've used the Laplace transform to solve a number of ordinary equations with variable coefficients and linear ordinary differential equations with constant coefficients. Laplace transformation simplifies differential equation solutions and makes problems in engineering applications easier to solve. This paper aims to provide a scientific overview of the properties and uses of the Laplace transform.

Keywords: Laplace Transform, Properties, Applications

INTRODUCTION

In mathematics, Laplace transformations deal with converting one function to another, possibly outside of the same domain [5]. One particular kind of integral transform is the Laplace Transform. When a function $f(t)$ is considered, its corresponding Laplace Transform is represented as $L\{f(t)\}$, where L is the operator applied to the function f(t) in the time domain. A function's Laplace Transform yields a new function with complex frequency s. The Laplace transform is used to solve differential and integral equations, just like the Fourier transform [2]. Complex integral function solutions require the application of Laplace transformation. Finding nth order linear differential equations with constant coefficients typically requires the application of the Laplace transformation method [6].

The term "Laplace transformation" refers to the unique kind of integral transform that French mathematician Pierre-Simon Laplace introduced in his research. Laplace transformation was methodically developed by the British physicist Oliver Heaviside. It is the most often utilized integral transform among the many. This transformation approach is inspired by its simplicity inlearning and application. Laplace transformation is used to obtain the general solution in many issues.

The main function of the Laplace transform as a useful tool is to determine the appropriate mathematical model for solving equations. The function f(t) is transformed from its time domainto its frequency domain $\bar{f}(s)$ by the Laplace transform. The modified frequency domain $\bar{f}(s)$ is then transferred into the time domain via an inverse Laplace transformation. To put it briefly, the Laplace transform transforms integral or differential equations into algebraic equations. The wide range of applications for Laplace transform renders it an effective instrument for analyzingthe features of engineering challenges [1].

Definition of Laplace Transform:

Consider a function of time f(t). If this function satisfies certain conditions and then if the integral,

$$\bar{f}(s) = \int_0^\infty e^{-st} f(t)dt \text{ ……. } (1)$$

Exists, then $\bar{f}(s)$ represents the Laplace Transform of $f(t)$,

i.e.

$$L\{f(t)\} = \int_0^\infty e^{-st} f(t)dt \text{ ……. } (2)$$

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Laplace transformation of elementary function:

1) $L\{1\} = \frac{1}{s}, s > 0$

2) $L\{f(t)\} = L\{t^n\} = \frac{n!}{s^{n+1}}$, $where\ n\ =\ 0,1,2,3 \ldots \ldots \ldots$

3) $L\{e^{at}\} = \frac{1}{s-a}$, $s > a$

4) $L\{sinat\} = \frac{a}{s^2+a^2}$, $s > 0$

5) $L\{sinhat\} = \frac{a}{s^2-a^2}$, $s\ >\ |a|$

6) $L\{cosat\} = \frac{s}{s^2+a^2}$, $s > 0$

7) $L\{coshat\} = \frac{s}{s^2-a^2}$, $s\ >\ |a|$ [7]

Inverse Laplace Transform:

If $L\{f(t)\} = \bar{f}(s)$ then $f(t)$ is called Inverse Laplace Transform of $\bar{f}(s)$.

i.e. $L^{-1}\ \{\ \bar{f}(s)\ \} = f(t)$ [8]

PROPERTIES OF LAPLACE TRANSFORM:

1) Linearity Property:

If $L\{f(t)\} = \bar{f}(s)\ \&\ L\{g(t)\} = \bar{g}(s)\ then$

$L\{af(t) + bg(t)\} = aL\{f(t)\} + bL\{g(t)\}\ where\ a\ and\ b\ are\ arbitrary\ constants.$

2) First Shifting Property:

If $L\{f(t)\} = \bar{f}(s)$ then $L\{e^{at} f(t)\} = \bar{f}(s-a)$ [4]

3) Second Shifting Theorem :

The Second Shifting Theorem of Laplace Transform states that if

$L\{f(t)\} = \bar{f}(s)$, *then the Laplace Transform of the following function,*

$g(t) = f(t-a)\ when\ t > a$

$= 0\ when\ t < a$ [2]

4) Multiplication by t^n :

$If\ L\{f(t)\} = \bar{f}(s)$,$then$

$$L\{t^n f(t)\} = \frac{(-1)^n d^n}{ds^n}\left(\bar{f}(s)\right)$$

5) Division by t:

$If\ L\{f(t)\} = \bar{f}(s)$,$then$

$$L\left\{\frac{f(t)}{t}\right\} = \int_s^\infty \bar{f}(s)\,\mathrm{ds}$$

6) Laplace transform of Integrals:

$If\ L\{f(t)\} = \bar{f}(s)$,$then\ L\{\int_0^t f(u)du\ \} = \frac{1}{s}\ \bar{f}(s)$

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7) Convolution Theorem:

$If\ L^{-1}\{\bar{f}(s)\} = f(t)\ \&\ L^{-1}[\bar{g}(s)] = g(t)\ then$

$$L^{-1}\left[\bar{f}(s).\bar{g}(s)\right] = \int_0^t f(u)g(t-u)du \quad [4]$$

8) Laplace Transform of Derivative:

$If\ L\{f(t)\} = \bar{f}(s)\ , then$

$$L\{f^n(t)\} = s^n\,\bar{f}(s) - s^{n-1}f(0) - s^{n-2}f'(0) - s^{n-3}f''(0) - \ \ldots - f^{n-1}(0)\ [3].$$

Applications of Laplace Transform in Science and Engineering fields:

The following scientific and engineering fields make extensive use of the Laplace Transform:

1. Analysis of Electronic Circuits:
Electronic engineers frequently utilize the Laplace Transform to swiftly solve differential equations that arise during the examination of electronic circuits.

2. System Modeling:
The Laplace Transform is a useful tool in system modelling to streamline calculations involving several differential equations.

3. Digital Signal Processing:
Without using the Laplace transform, it is impossible to solve problems involving digital signalprocessing.

4. Nuclear Physics:
To obtain the actual form of radioactive decay, one uses a Laplace transform. It facilitates theeasy learning of the analytical aspects of nuclear physics.

5. Process Control:
Process controls make use of the Laplace Transform. Analyzing the variables that, whenchanged, result in the intended manipulations of the outcome, is helpful [3].

Application of Laplace Transform to solve Differential Equation:
The Laplace Transform method makes it simple to solve ordinary differential equations without the need for arbitrary constants or the general answer [3].

Example: - Solve $\frac{dy}{dt} + 2y + \int_0^t ydt = sint\ , given\ y(0) = 1\ using\ Laplace\ Transform.$

Solution: - Given LDE is,

$$\frac{dy}{dt} + 2y + \int_0^t ydt = sint$$

Taking Laplace Transformation on both sides

$$L\left\{\frac{dy}{dt}\right\} + 2L\{y\} + L\{\int_0^t ydt\} = L\{sint\}, assume\ L\{y\} = \bar{y}$$

By using the properties: division by t and Laplace transform of integral, we get

$$s\bar{y} - y(0) + 2\bar{y} + \frac{\bar{y}}{s} = \frac{1}{s^2+1}$$

Given $y(0) = 1$

$$\left(s + 2 + \frac{1}{s}\right)\bar{y} = \frac{1}{s^2+1} + 1$$

i.e. $\frac{s^2+2s+1}{s}\bar{y} = \frac{1}{s^2+1} + 1$

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$$\bar{y} = \frac{s}{[(s^2+1)(s+1)^2]} + \frac{s}{(s+1)^2}$$

By resolving into partial fractions, we get

$$\bar{y} = \frac{1}{2}\frac{1}{s^2+1} - \frac{\frac{1}{2}}{(s+1)^2} + \frac{1}{s+1} - \frac{1}{(s+1)^2}$$

$$\bar{y} = \frac{1}{2}\frac{1}{s^2+1} - \frac{\frac{3}{2}}{(s+1)^2} + \frac{1}{s+1}$$

Taking Inverse Laplace Transform on both sides, we get

$y(t) = \frac{1}{2}sint - \frac{3}{2}e^{-t}t + e^{-t}$ [8]

CONCLUSION

As a result, this paper included a succinct description of the Laplace transform and its applications. Laplace transformation is primarily used to convert time domain functions into frequency domain functions. The study on the characteristics and uses of this Laplace transformation technique demonstrates how it can be helpful in solving a variety of issues. Laplace transform is very useful tool for most scientific and engineering fields to solve verycomplex problems.

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EXPLORING MODIFIED GRAVITY THEORIES AND THEIR IMPLICATIONS ON NAKED SINGULARITIES: A COMPREHENSIVE REVIEW

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ABSTRACT:
The study of gravitational physics has been a cornerstone of modern theoretical physics. General relativity, proposed by Einstein, has withstood numerous tests and experiments. However, certain phenomena, such as the existence and nature of singularities, challenge our current understanding of gravity. This research paper delves into the realm of modified gravity theories, focusing on their potential to resolve the enigmatic concept of naked singularities.

Keywords: Modified theory, Black hole, Naked singularity, CCH, Quantum gravity.

INTRODUCTION

Gravitational physics, as described by Einstein's General Theory of Relativity, has been a cornerstone of modern physics for over a century [1]. While this theory has successfully explained a wide array of astronomical phenomena and experimental results, it encounters significant challenges in extreme environments, particularly around singularities, where gravitational forces become infinitely strong, and our current understanding of physics breaks down [2].

One of the intriguing aspects of singularities is the concept of "naked singularities" – singularities not hidden within event horizons of black holes, thus visible to distant observers [3]. The existence and behavior of naked singularities remain enigmatic and are a subject of intense theoretical scrutiny and debate. Understanding these singularities is crucial, as they might hold the key to resolving some of the most profound questions in theoretical physics, including the nature of space-time and the unification of fundamental forces.

This paper delves into the intriguing interplay between modified gravity theories and the existence of naked singularities. Modified gravity theories, which extend or modify Einstein's theory, offer potential solutions to the singularities conundrum. By altering the fundamental equations of gravity, these theories might allow for the existence of naked singularities, challenging the traditional understanding of cosmic censorship and black hole formation [4].

This exploration is not merely theoretical speculation; it holds practical significance in the realm of astrophysics and cosmology. Observational evidence, including gravitational wave detections and black hole shadow imaging, presents opportunities to test the predictions of modified gravity theories in the strong gravity regime [5]. Understanding the implications of these theories on the existence and detect ability of naked singularities is crucial for interpreting observational data and refining our understanding of the fundamental laws governing the universe.

In this paper, we provide a comprehensive review of various modified gravity theories, ranging from scalar-tensor theories to brane-world scenarios and quantum gravity approaches. We investigate their implications on the formation, stability, and observability of naked singularities. Through detailed case studies and a critical analysis of observational and experimental data, we aim to shed light on the intriguing connection between modified gravity theories and the mysterious nature of naked singularities.

I Exploring the Depths of Singularities in General Relativity:

In the context of general relativity, singularities are points in spacetime where certain physical quantities become infinite. Singularities play a significant role in our understanding of the universe, especially in the study of black holes and the Big Bang cosmological model.

In general relativity, singularities can occur under specific conditions:

Black Hole Singularities: Inside a black hole, the curvature of spacetime becomes infinitely strong at the singularity, which is located at the center of the black hole. Singularities inside black holes are often classified into two types: **curvature singularities**, where spacetime curvature becomes infinite, and **conical singularities**, where there is a deficit or excess of solid angle [6]

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Big Bang Singularity: According to the standard cosmological model, the universe began from an initial singularity, commonly known as the Big Bang singularity. At this point, the entire universe was infinitely hot, dense, and small.[2]

Cosmic Censorship Hypothesis: Proposed by Roger Penrose, this hypothesis suggests that all singularities (except the Big Bang singularity) are hidden within black holes, shielded from the outside universe by event horizons.[8]

Singularities, points where physical quantities become infinite, are a pervasive feature in our understanding of the universe, particularly in the context of general relativity. While singularities within black holes are typically hidden from our view by event horizons, some theoretical solutions suggest the existence of "naked singularities" - singularities not obscured by horizons, potentially visible to distant observers. The concept of naked singularities challenges our understanding of the laws of physics and the structure of spacetime.

1. **Black Hole Singularities:** Within black holes, singularities are shielded by event horizons, preventing direct observation. These singularities are essential components of general relativity's predictions but remain hidden from the universe.[2]
2. **Naked Singularities:** In contrast, naked singularities are unshielded, allowing information to escape. Their existence raises profound questions about cosmic censorship and the predictability of general relativity in extreme conditions.[8]

Implications and Challenges:

1. **Cosmic Censorship Hypothesis:** Proposed by Roger Penrose, this hypothesis suggests that naked singularities are always cloaked, ensuring the predictability of physics. However, theoretical constructs challenge this idea, hinting at the possibility of uncovered singularities.[9]
2. **Quantum Gravity:** The behavior of singularities at the quantum level, an area of active research, might provide insights into the nature of spacetime at its most fundamental scale, potentially resolving the naked singularity paradox.[10]

II. Modified Gravity Theories:

2.1 Scalars-Tensor Theories:

Scalar-Tensor Theories (STTs) represent a class of modified gravity theories where the gravitational interaction is mediated by both a scalar field ϕ and the metric tensor $g_{\mu\vartheta}$. The action for a general scalar-tensor theory can be written as:

$$S = d^4x\sqrt{-g}\,\frac{1}{16\pi G}f(\emptyset, R) + L_{matter}(\varphi_{m,}g_{\mu\vartheta}),$$

where G is the gravitational constant, R is the Ricci scalar, L_{matter} represents the matter Lagrangian, and $f(\emptyset, R)$ is a function describing the coupling between the scalar field and the curvature. The equations of motion for this theory can be derived from the variation of the action with respect to the metric tensor $g_{\mu\vartheta}$ and the scalar field ϕ. These equations take the form:

$$G_{\mu\vartheta} + \frac{1}{f_\emptyset}\nabla_\mu\nabla_\vartheta - g_{\mu\vartheta}\nabla^2 f_\emptyset = \frac{1}{f_\emptyset}T^{matter}_{\mu\vartheta},$$

$$\nabla^2\emptyset - V_\emptyset - \frac{f_R}{2f}R = \frac{1}{2f}T^{matter},$$

Where $f_\emptyset = \frac{\partial f}{\partial \emptyset}$, $f_R = \frac{\partial f}{\partial R}$, $V(\emptyset)$ is the scalar field potential, and $T^{matter}_{\mu\vartheta}$ and T^{matter} are the matter stress-energy tensor components. Scalar-tensor theories have been extensively studied in the context of black hole solutions and singularities[11]. These theories offer interesting solutions that can lead to the formation of naked singularities under certain conditions, challenging cosmic censorship conjectures and our understanding of gravitational collapse.

2.2 Brane-World Scenarios

Brane-world scenarios are extensions of standard General Relativity where our universe is a four-dimensional hypersurface, or "brane," embedded in a higher-dimensional spacetime. In these scenarios, gravity can leak into extra dimensions, offering a new perspective on the hierarchy problem and providing potential solutions to the cosmological constant problem. One of the prominent brane-world models is the Randall-Sundrum (RS) model.

The action for the RSII brane-world model can be written as [12]:

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$$S = \int d^4x dy \sqrt{-g} \left[\frac{1}{16\pi G_5} (R + 2\Lambda_5) - \lambda\delta(y) - L_{matter}(\varphi_m, g_{\mu\vartheta}) \right],$$

where G_5 is the five-dimensional gravitational constant, Λ_5 is the bulk cosmological constant, λ is the brane tension, and $\delta(y)$ represents the delta function localized on the brane at y=0.

The gravitational field equations on the brane in the RSII model are given by [13]:

$$G_{\mu\vartheta} = \frac{8\pi G_4}{\lambda} T_{\mu\vartheta}^{matter} - E_{\mu\vartheta} + \Lambda_4 g_{\mu\vartheta},$$

where $G_{\mu\vartheta}$ is the four-dimensional Einstein tensor, G_4 is the four-dimensional Newton's constant, $T_{\mu\vartheta}^{matter}$ is the matter stress-energy tensor on the brane, $E_{\mu\vartheta}$ represents the effects of the extra dimension, and Λ_4 is the effective cosmological constant on the brane.

Brane-world scenarios, especially the RS model, have been extensively studied in the context of black holes and naked singularities [14]. These models provide insights into the behavior of gravity at both cosmological and astrophysical scales, offering potential solutions to long-standing problems in theoretical physics.

III. Naked Singularities in Modified Gravity

3.1 Detection of Naked Singularities in Modified Gravity Theories

Detecting naked singularities represents a significant challenge due to their peculiar nature. In the context of scalar-tensor theories, the presence of a naked singularity can lead to observable deviations from general relativity's predictions. One observable signature is the gravitational wave signal emitted during the coalescence of compact binary systems. In modified gravity theories, the waveform can deviate from the general relativity prediction due to the influence of the scalar field. The deviation can be quantified using waveform templates tailored for specific scalar-tensor models [15]

Another detection method involves precision measurements of the orbits of stars around massive black holes. In modified gravity scenarios, the scalar field can affect the gravitational potential around the black hole, leading to observable discrepancies in the orbits of stars close to the event horizon. High-resolution observations using instruments like the Event Horizon Telescope can potentially reveal these deviations [16]

3.2 Observational Signatures of Naked Singularities

Naked singularities can imprint unique signatures on the surrounding spacetime, observable through electromagnetic radiation. In scalar-tensor theories, the scalar field's behavior near the singularity can lead to distinctive electromagnetic emissions. The luminosity and spectral characteristics of these emissions differ from those of black holes, providing a potential observational signature. Advanced telescopes and detectors, such as the Chandra X-ray Observatory and the upcoming Square Kilometre Array, could detect these anomalous emissions and contribute to identifying naked singularities in the universe [17].

3.3 Stability and Cosmic Censorship Conjecture

The stability of solutions in modified gravity theories and the Cosmic Censorship Conjecture, which posits that singularities are always hidden within event horizons, are fundamental issues in gravitational physics. These concepts can be examined within the framework of modified gravity theories.

3.3.1 Stability Analysis

Stability analysis of solutions in modified gravity theories involves examining the behavior of perturbations around a given background solution. For example, in scalar-tensor theories, the stability of black hole solutions can be assessed by analyzing the effective potential for scalar perturbations. The stability criterion is given by the Breitenlohner-Freedman (BF) bound [18]

$$m^2 \geq \left. \frac{d^2 V_{eff}}{d\emptyset^2} \right|_{\emptyset=\emptyset_0}$$

where m is the mass of the scalar perturbation, $\emptyset_0$ is the background scalar field value, and V_{eff} is the effective potential for scalar perturbations. Stable solutions require m^2 to be non-negative to avoid tachyonic instabilities.

3.3.2 Cosmic Censorship Conjecture

The Cosmic Censorship Conjecture (CCC) states that all singularities occurring in our universe are shielded from the view of distant observers by event horizons. In modified gravity theories, deviations from CCC can occur if the equations of motion admit solutions with naked singularities, which are not hidden within event horizons.

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Consider a metric $g_{\mu\vartheta}$ and a scalar field ϕ described by the action [19]

$$S = d^4x\sqrt{-g}\,\frac{1}{16\pi G}f(\emptyset, R) + \frac{1}{2}(\nabla\emptyset)^2 - V(\emptyset)$$

The occurrence of a naked singularity can be determined by analyzing the behavior of geodesics and curvature invariants. Violations of the CCC in modified gravity theories challenge our understanding of the nature of singularities and the role of event horizons in their resolution.

IV CONCLUSION

In this comprehensive review, we have explored the intriguing intersection of modified gravity theories and the enigmatic concept of naked singularities. Modified gravity theories, such as scalar-tensor theories, brane-world scenarios, and f(R) gravity, offer alternative frameworks to Einstein's General Relativity, challenging our understanding of gravitational physics.

The implications of these theories on naked singularities have been a focal point of our investigation. We have seen how modifications to gravity can lead to deviations from the cosmic censorship conjecture, allowing for the existence of singularities visible to distant observers. Such violations of cosmic censorship have profound implications for our understanding of gravitational collapse and the nature of spacetime singularities.

Observational and experimental signatures of modified gravity theories, including gravitational wave phenomena, cosmological tests, and black hole shadow imaging, play a pivotal role in testing these theories and providing constraints on their parameters. These tests are essential in distinguishing between modified gravity theories and General Relativity, and they provide a framework for exploring the limits of gravitational physics.

While the exploration of modified gravity theories and naked singularities remains a field of ongoing research, this review sheds light on the current state of knowledge and the open questions that persist. As we continue to advance our understanding of the fundamental forces shaping the cosmos, the relationship between modified gravity theories and the existence of naked singularities promises to remain a fascinating and evolving topic of study, holding the potential to redefine our understanding of the universe itself.

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SYNTHESIS AND LUMINESCENCE PROPERTIES OF CE DOPED LICAPO$_4$ PHOSPHOR FOR RADIATION DOSIMETRY

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ABSTRACTS
The LiCaPO$_4$:Ce phosphor was synthesized via combustion method. The crystallinity of the phosphor was investigated by using X-ray diffraction (XRD). The LiCaPO$_4$:Ce phosphor has been investigated for its photoluminescence (PL) and thermoluminescence (TL) studied. PL spectra showed the characteristic emission of Ce ion at 381 nm when excited by 313 nm.

Keywords: LiCaPO$_4$: Ce Phosphor; combustion method; Radiation Dosimetry and TL.

INTRODUCTION

The compounds with ABPO$_4$ formula (A and B are mono- and divalent cations, respectively) compose a large family of mono-phosphates with the different structure types depending on the relative size of the A and B ions [1]. The luminescence and thermal stabilities of all of these compounds are highly depended on the crystal structure and the coordination environment of the activators [2].

The thermoluminescence (TL) and optically stimulated luminescence (OSL) techniques are a now well-developed for its application in radiation dosimetry. But as compared to thermoluminescence (TL) technique, optically stimulated luminescence (OSL) is becoming more popular in radiation dosimetry because of their advantages [3]. Antonov-Romanovskii *et al was* first suggested OSL for personal dosimetry [4].

To our knowledge, TL properties of Ce doped LiCaPO$_4$ phosphor under beta irradiation has not been reported in the literature. Hence, the synthesis of LiCaPO$_4$: Ce by using combustion method was done and its luminescence properties (PL, and TL) were investigated.

Experimental

LiCaPO$_4$:Ce phosphors was synthesized by using combustion method. Phase purity of LiCaPO$_4$:Ce phosphor was checked by means of X-ray powder diffraction (PXRD) using a Rigaku miniflex II diffractometer. The TL measurement was carried out using an automatic Risø TL/OSL-DA-15 reader system at RPAD divison BARC (Mumbai). PL and PL excitation (PLE) spectra were measured on (Hitachi F-7000) fluorescence spectrophotometer.

3. RESULTS AND DISCUSSIONS

3.1 XRD-Pattern

The XRD pattern of the as synthesised LiCaPO$_4$:Ce phosphor was represent in Fig. 1. XRD patterns was fully matched with the Internatonal center for diffaction data (ICDD) file with card no 01-079-1396.

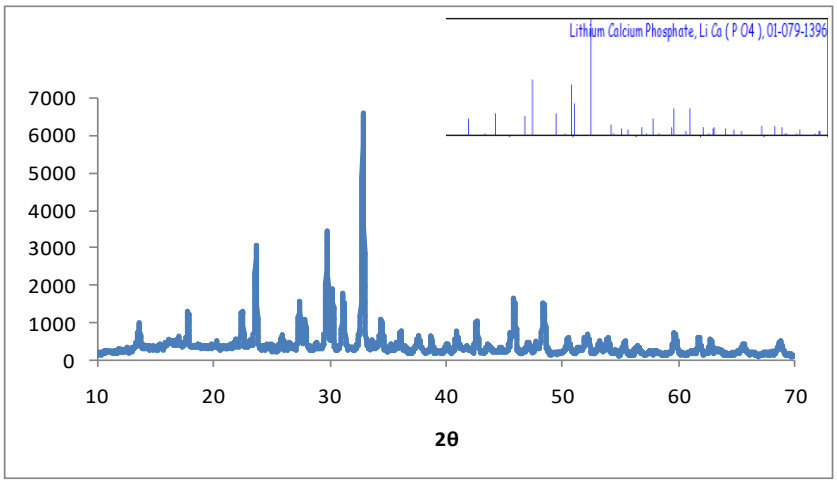

Fig. 1 XRD pattern of the LiCaPO$_4$:Ce sample and match with the Internation Center for Diffaction Data & Card No-01-079-1396.

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Photoluminescence (PL)

Fig. 2 shows the PL excitation and emission spectra of $LiCaPO_4$:Ce phosphor. The excitation and emission spectra of $LiCaPO_4$:Ce phosphor was observed under 381 and 313 nm respectively. The excitation spectra consists broad band in range 200-350 nm and maximum intensity observed at 313 nm.

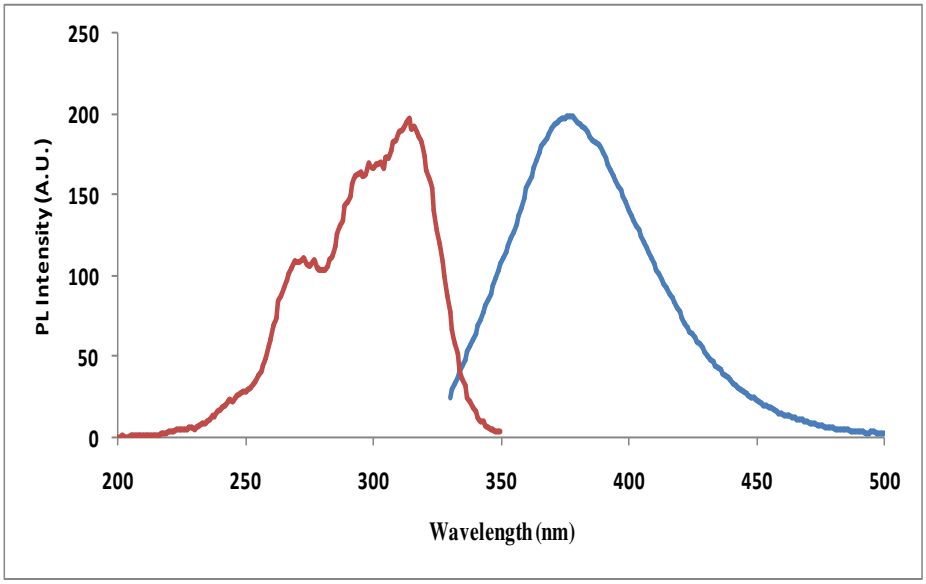

Fig. 2: Excitation and Emission spectra of $LiCaPO_4$: Ce phosphor under UV excitation

The emission spectra consist broad in range 325-500 nm and maximum intensity observed at 381 nm correspond to 5d-4f ($^2F_{5/2}$) transitions of Ce [5].

Thermoluminescence studies (TL)

The TL glow curves are mainly vital indicators of whether a material can be used for TL dosimetry purposes or not. Usually it is desired that the glow curve gives a simple, if possible single peak at around 180-200°C [6]. Fig. 3 shows that TL glow cure of $LiCaPO_4$: Ce phosphors under β irradiation (500mGy). The main TL is at around 199 °C on glow curves of $LiCaPO_4$: Ce phosphor. The TL glow curves consist overlapping peaks system and one peak is around 124°C another prominent peak is observed at around 199°C and this peak is higher temperature can be considered for the dosimetric applications. .

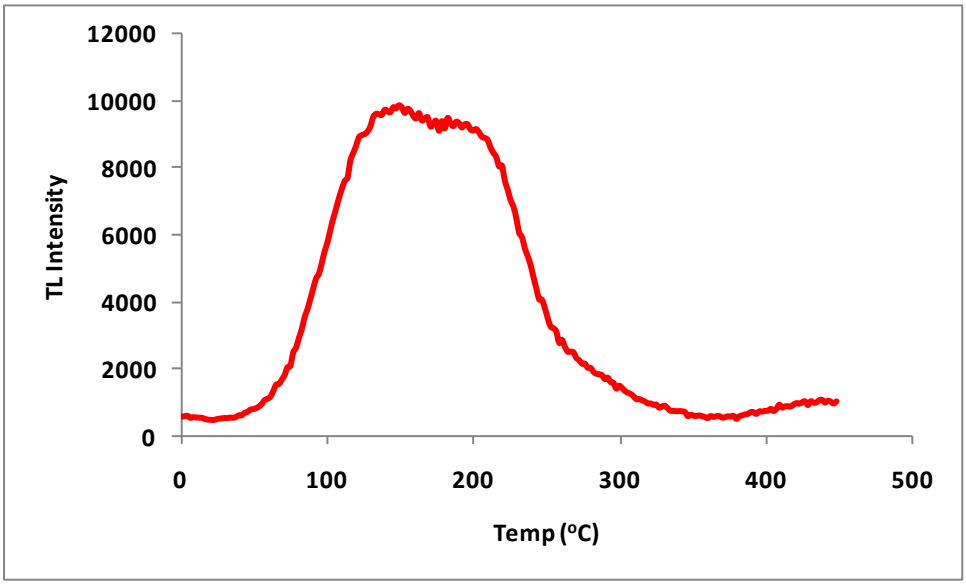

Fig. 3: TL glow curve of $LiCaPO_4$: Ce phosphor under β irradiation (heating rate 4 °C/s^{-1}).

4. CONCLUSIONS

Polycrystalline sample of $LiCaPO_4$: Ce phosphor was synthesized by the simple Combustion method. The XRD pattern of $LiCaPO_4$: Ce was in good agreement with the ICDD data file with card no 01-079-1396. The TL glow curves are mainly vital indicators of whether a material can be used for TL dosimetry purposes or not. The TL glow cure of $LiCaPO_4$: Ce phosphors measure under β irradiation (500mGy). The main TL is at around 199 °C

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on glow curves of $LiCaPO_4$: Ce phosphor. The TL glow curves consist overlapping peaks system and one peak is around 124°C another prominent peak is observed at around 199°C. The excitation and emission spectra of $LiCaPO_4$:Ce phosphor was observed under 381 and 313 nm respectively. The excitation spectra consists broad band in range 200-350 nm and maximum intensity observed at 313 nm. The $LiCaPO_4$:Ce phosphor was sensitive in TL mode and this phosphor can be proposed as a suitable candidate for radiation dosimetry, after further progress in the study.

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INTEGRATED APPROACH FOR WASTE WATER TREATMENT: AN OVERVIEW

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ABSTRACT
Due to various demands of human needs, there is an increased pressure on the ground water resources without much of recharging. The water consumption for various purposes results in generation of waste water. One of the greater challenges of water and waste water treatment technologies is the use of combined processes to get the most advantages of each process alone. The choice of the process and/or integration of the processes depend on strongly waste water characteristics, concentrations, and the desired efficiencies. It has been observed by many investigators that the coupling of a bio reactor and advanced oxidation processes could reduce the final concentration of the effluent of the desired values. In most case studies, it has been shown that the integration processes were more efficient than individual processes. Slight changes in the bioreactor design, temperature, pH, treatment time, concentration of oxidants and microorganism colonies could lead to a great deviation in results. In the present work, the developments and trends on the integration of photochemical and biological processes for the degradation of organic pollutants in water and waste water will be reviewed. This paper also includes the aspect for recycling and reuse of the treated waste water.

Keywords: Integrated approach, Biological process, Waste water, Degradation, Treatment.

INTRODUCTION
Increasing population, industrialization and colossal misuse of water have led to a constant decrease in the per capita availability of water. The need of the hour is conservation of water. With an advent of waste water treatment technologies, toxic pollutants and also pathogens still exist in treated water and waste water and as a result they are not removed satisfactorily. This is even true for highly developed nations that the receiving water, surviving in many cases as drinking water resources, are contaminated with pathogens[1]. The problems of environmental pollutants in water and waste water are worldwide. A surge of new industries and growth centre is likely to be emerged as a result of recent development of liberal economic policy adopted by Government of India. But even at the onset of next millennium, environmental engineers and scientists, are still in a fray of finding appropriate options of industrial water treatment, which is cost effective and technically feasible. Except, recalcitrant and metallic waste, biological treatment is always welcomed by the technologist for its various benefits. Although many organic molecules are readily biodegradable, many other synthetic and naturally existing organic molecules are bio recalcitrant. In such cases, biological processes alone are not capable of reaching the effluents to a standard level for the discharge in to municipal sewer or in to surface water, therefore, a chemical or photochemical pre-treatment or post treatment is required to treat such waste water[2-4]. For readily biodegradable organic components in water, one of the cheapest technique has been the conventional biological treatment such as activated sludge or most effective biological reactor for waste water treatment is sequential batch reactor(SBR) which can efficiently treat variety of industrial waste waters. In some cases, SBR may be better alternative than convential activated sludge process. It has been reported by Irvine[5],that SBR technology is 20 % more economically attractive than conventional activated sludge plant yielding same efficiency of organic removal. Unfortunately, due to the increasing human activities, more non-biodegradable and bio-resistant components are entering in water streams and are also produced by industrial activities, eventually polluting the environment. As a result, biological treatment is not an appropriate method of treatment for such bio-resistant and non degradable pollutants. Another drawback of the biological process is also its long reaction time. For example, the aqueous anaerobic half life of 1,4 dioxane is 2688-17280h, while its half-life in aerobic degradation is 672-4320h[6].Therefore, alternative process such as Advanced Oxidation Technologies(AOTs) have shown promise to degrade almost all organics regardless of their biodegradability[7-9].

Advanced oxidation processes are generators of free radicals such as hydroxyl radicals(OH). Conventional biological processes are well known, economically feasible, and much cheaper than advanced oxidation technologies and have low energy consumption. On the other hand, these conventional biological processes have drawbacks such as they are very slow in their bioreactions and not effective for non-biodegradable and/or toxic substances.They may require compounds to be pre-treated by other chemical processes, and some treatment processes produce excess sludge for waste disposal. Waste water treatment processes using advanced

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oxidation technologies are very fast and capable to degrade almost all organic compounds in water and waste water. They reduce toxicity of compounds so that they can be treated biologically. On the otherhand, advanced oxidation processes have some drawbacks. They are relatively expensive in operating and capital costs.Some photochemical reactions may produce more toxic chemicals. These are still cost effective approaches to optimize water and waste water treatment plants by combining different chemical, photochemical and conventional biological processes. Finally there is also a need for recycling and reuse of treated water and waste water rather disposing it. Some of the industries are adopting the advanced technologies of tertiary treatment for recycling and reuse of treated waste water in the plant premises. Reverse osmosis is an excellent option for the recycling and reuse of the treated waste water[10].

Present Scenario of Combined Processes for the Treatment of Waste Water :

Different researchers used various combined processes for the treatment of water and waste water[11-12]. Chemical, photochemical, and biological processes could be used as either pre or post treatment. The arrangement and type of treatment techniques used in the integrated processes depend on the biodegradability of the parent and intermediate compounds, the type of chemical or photochemical techniques,the type and capability of biological treatment, the economical feasibility of the overall processes, the flow rate of water and waste water, the quality of desired effluent, and the characteristics of water and waste water such as the initial concentrations of the organic pollutants, pH, turbidity, total organic carbon, COD and BOD. The main objective of the combined processes for the treatment of water and waste water is to maximize the removal efficiency of the overall processes keeping in view of total cost to be minimum.

Individual treatment process is not sufficiently effective on its own. Waste waters which are toxic, inhibitory, non-biodegradable, or refractory to biological cultures can be treated chemically or photochemically to produce biogenic intermediates. Then biological treatment is used to treat biogenic and biodegradable contaminants to reduce total cost of the operation. The choice of correct combination system must be carried out considering both technical and economical aspects. In case of technical aspects, treatment efficiency, plant simplicity and flexibility must be considered. On the other hand for economical aspects, capital and operating costs including energy consumption, sludge disposal, maintenance, land cost and land requirement should be taken in consideration. The integration of the treatment processes require to optimize the total cost of the operation. Therefore, an appropriate design of the coupling processes is needed to reduce not only the concentration of organic pollutants, but also try to get the designed results in a cost effective manner. The period of existence of each process in the integrated system, kinetic rates, and the capital and operating costs of each play significant role for total cost of the treatment.

CONCLUSIONS

The need of maximizing the overall efficiency, while minimizing the total cost of the system is obvious in water and waste water treatment processes. Various arrangements like chemical or photochemical followed by biological processes, biological treatment followed by chemical or photochemical processes, and so on are possible. These arrangements depend on characteristics, biodegradability, inhibitory, refractory components in water and waste water and types of treatment processes applied. There is an increased pressure on the ground water resources globally. The need of the hour is recycling of waste water to conserve ground water resources. The treated and/or partially treated waste water can be used for gardening purposes to reduce the need of fresh ground water resources. The purpose of recycling can be economical if the sewage and sludge are separated and estimated for its end use.

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METHOD OF SOLVING LINEAR DIFFERENTIAL EQUATIONS WITH CONSTANT COEFFICIENTS AND ITS APPLICATION: A REVIEW

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ABSTRACT
An extensive summary of the strategies and procedures for resolving linear differential equations with constant coefficients is given in this article. The standard form of a linear differential equation and the idea of linear differential equation constant coefficients are introduced at the outset of the essay. The article then goes on to discuss the complete solution or general solution of linear differential equation. The article concludes with a brief discussion of application of linear differential equation with constant coefficients

Keywords: Linear differential equation, Linear differential equation with constant coefficients, Complete solution, complementary function, particular integral, application of linear differential equation.

INTRODUCTION

Higher order differential equation appear in problem involving deflection of loaded beams, mechanical spring system, series of electrical circuit containing several loops.

It is commonly known that the "linear differential equation with constant coefficients" is an equation that is different and has a constant coefficient [2].

It is commonly known that functional analysis has been used to resolve and finish the well-posed issue for the linear differential equations. However, until the explicit solutions are developed, the concepts will not be very helpful. They are able to explain the systems' finer points [3].
The linear differential equation, which is a homogeneous linear equation with constant coefficients throughout, is first shown in its Standardized format.

They might also aid in extending the answers' presence, uniqueness, and regularity qualities that come from qualitative analysis [3]. We define constant coefficients and discuss their significance in the solution of these equations. The characteristic equation and its roots, which reveal details about the makeup of the solutions, are next presented. We talk about the two scenarios that could occur: complex and real conjugate roots [1].

In real it may be distinct, repeated twice or repeated thrice and so on.Similarly in complex conjugate we may have one complex pair, two complex pair and so on.

We derive the general solution for each scenario and offer examples to show how the method might be applied [1]. Then we discuss the application of linear differential equation with constant coefficients.

Linear Differential Equation with Constant Coefficient:
Definition: The differential equation which contains the differential coefficients and dependent variable in the first degree and they are not multiplied together is called linear differential equation.

The standard form is

$$P_0 \frac{d^n y}{dx^n} + P_1 \frac{d^{n-1} y}{dx^{n-1}} + \cdots + P_n\, y = F(x)$$

Where $P_0, P_1, \ldots, P_n$ and F(x) are functions of x only.

If $P_0, P_1, \ldots, P_n$ are constants, say $K_0, K_1, \ldots, K_n$ respectively then

$$K_0 \frac{d^n y}{dx^n} + K_1 \frac{d^{n-1} y}{dx^{n-1}} + \cdots + K_n\, y = F(x)$$

is called a linear differential equation with constant coefficients

$$\rightarrow \quad (K_0 D^n + K_1 D^{n-1} + \cdots + K_n)y = F(x), \qquad D = \frac{d}{dx}$$

$$\rightarrow \quad f(D)y = F(x)$$

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Complete Solution of Linear Differential Equation with Constant Coefficients:
The complete solution or general solution of $f(D)y = F(x)$ is $y = y_c + y_p$ where $y_c$complementary function (CF) is and y_p is particular integral (PI).

$i.e\ CS = CF + PI$

If $f(x) = 0$ then $F(D)y = 0$ is called homogeneous equation and its solution is$y = y_p$.

Rules for finding CF:

Consider $f(D) = F(x)$

$\rightarrow \quad (K_0\ D^n + K_1\ D^{n-1} + \cdots + K_n\ )y = F(x)$

Put $D = m$, then auxiliary equation is given by $f(m) = 0$

It has n-roots $m = m_1, m_2, \ldots, m_n$.

Case-I: When all roots are real.

(i) If all roots $m_1, m_2, \ldots, m_n$ are real and distinct then

$CS = c_1e^{m_1x} + c_2e^{m_2x} + \cdots + c_ne^{m_nx}$

(ii) If one root m_1 repeated twice say $m_1, m_1, m_3, \ldots, m_n$ then

$CS = e^{m_1x}(c_1 + c_2x) + c_3e^{m_3x} + \cdots + c_ne^{m_nx}$

(iii) If one root m_1 repeated three times say $m_1, m_1, m_1, m_4, \ldots, m_n$ then

$CS = (c_1 + c_2x + c_3x^2)e^{m_1x} + c_4e^{m_4x} + \cdots + c_ne^{m_nx}$

Similarly we may have the cases when the real root repeated four times and so on.

Case II:

(i) If auxiliary equation has a pair of imaginary roots $\alpha \pm i\beta$ i.e. $m_1 = \alpha + i\beta$, $m_2 = \alpha - i\beta$ and $m_3, \ldots, m_n$ are real then $CS = e^{\alpha x}[(c_1cos\beta x + c_2sin\beta x] + c_3e^{m_3x} + \cdots + c_ne^{m_nx}$.

(ii)If AE has two pair of imaginary roots i.e. $m_1 = m_2 = \alpha + i\beta$, $m_3 = m_4 = \alpha - i\beta$ and $m_5, \ldots, m_n$ are real then

$CS = e^{\propto x}[(c_1 + c_2x)cos\beta x + (c_3 + c_4x)sin\beta x] + c_5e^{m_5x} + \cdots + c_ne^{m_nx}$.

Rules for finding PI:

Particular integral of $f(D)y = F(x)$ is $PI = \frac{1}{f(D)}F(x)$

Clearly $PI = 0$ if $F(x) = 0$. PI is depends on the nature of F(x).

Case I: When $F(x) = e^{ax}$

Then $PI = \frac{1}{f(D)}e^{ax} = \frac{1}{f(a)}e^{ax}$, $f(a) \neq 0$

In case of failure,$f(a) = 0$

$PI = x\frac{1}{f'(D)}e^{ax} = x\frac{1}{f'(a)}e^{ax}$, $f'(a) \neq 0$

If $f'(a) = 0$ then

$PI = x\frac{1}{f''(D)}e^{ax} = x\frac{1}{f''(a)}e^{ax}$, $f''(a) \neq 0$ and so on.

Example: $\frac{d^3y}{dx^3} + y = 3 + e^{-x} + 5e^{2x}$

$\rightarrow (D^3 + 1)y = 3 + e^{-x} + 5e^{2x}$

Then $CS = CF + PI$

To find CF: Let $(D^3 + 1)y = 0$

Its AE is $m^3 + 1 = 0$

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$\rightarrow (m+1)(m^2-m+1)=0$

$\rightarrow m=-1, m=\frac{1}{2}\pm\frac{i\sqrt{3}}{2}$

$\therefore CF=c_1e^{-3x}+e^{\frac{x}{2}}(c_2\cos\frac{\sqrt{3}}{2}+c_3\sin\frac{\sqrt{3}}{2})$

To find PI: $PI=\frac{1}{D^3+1}(3+e^{-x}+5e^{2x})$

$=3\frac{1}{D^3+1}e^0+\frac{1}{D^3+1}e^{-x}+5\frac{1}{D^3+1}e^{2x}$

$=3\frac{1}{0+1}e^{0x}+x\frac{1}{3D^2}e^{-x}+5\frac{1}{8+1}e^{2x}$

$=3+\frac{xe^{-x}}{3}+\frac{5}{9}e^{2x}$

$\therefore CS=CF+PI=c_1e^{-3x}+e^{\frac{x}{2}}(c_2\cos\frac{\sqrt{3}}{2}+c_3\sin\frac{\sqrt{3}}{2})+3+\frac{xe^{-x}}{3}+\frac{5}{9}e^{2x}.$

Case II: When $F(x)=\sin(ax+b)\ or\ \cos(ax+b)$

Then $PI=\frac{1}{f(D)}\sin(ax+b)$

Express $f(D)$ as a function of D^2.Suppose it is $\emptyset(D^2)$ and Put $D^2=-a^2$

$PI=\frac{1}{\emptyset(D^2)}\sin(ax+b)=\frac{1}{\emptyset(-a^2)}\sin(ax+b)\ ,\emptyset(-a^2)\neq 0.$

In case of failure If $\emptyset'(-a^2)=0$ then

$PI=\frac{1}{\emptyset'(D^2)}\sin(ax+b)=\frac{1}{\emptyset'(-a^2)}\sin(ax+b)\ ,\emptyset'(-a^2)\neq 0.$

If $\emptyset''(-a^2)=0$ then

$PI=\frac{1}{\emptyset''(D^2)}\sin(ax+b)=\frac{1}{\emptyset''(-a^2)}\sin(ax+b)\ ,\emptyset''(a^2)\neq 0$ and so on.

Similarly for $\cos(ax+b)$.

Example: $(D^3+D)y=cosx$

Then $CS=CF+PI$

To find CF: Let $(D^3+D)y=0$

Its AE is $m^3+m=0$

$\rightarrow m(m+1)=0$

$\rightarrow m=0,\pm i$

$\therefore CF=c_1+c_2\ cosx+c_3sinx$

To find PI : $PI=\frac{1}{D^3+D}cosx=\frac{1}{D(D^2+1)}cosx=\frac{1}{3D^2+1}cosx=\frac{1}{3(-1)+1}cosx=-\frac{x}{2}cosx.$

$\therefore\ CS=CF+PI=\ c_1+c_2\ cosx+c_3sinx\pm\frac{x}{2}cosx.$

Case III: When $F(x)=x^n$

Then $PI=\frac{1}{f(D)}x^m$

1.Take out lowest degree term outside from $f(D)$ to get an expression of the term form $\{1+\emptyset(D)\}$ in the denominator and take it to numerator to become $\{1+\emptyset(D)\}^{-1}$.

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2. Expand $\{1+\emptyset(D)\}^{-1}$ using bionomial theorem upto nth degree as (n+1)th derivative of $x^m$is zero.

3.Operate on the numerator term by term, by taking $D=\frac{d}{dx}$.

Following expansion will be useful to expand $\{1+\emptyset(D)\}^{-1}$ in ascending powers of n.

$(1+x)^{-1}=1-x+x^2-x^3+\cdots$

$(1-x)^{-1}=1+x+x^2+x^3+\cdots$

$(1+x)^{-2}=1-2x+3x^2-4x^3+\cdots$

$(1-x)^{-2}=1+2x+3x^2+4x^3+\cdots$

Example: $(D^4-2D^3+D^2)y=x^3$

Then $CS=CF+PI$

To find CF: Let $(D^4-2D^3+D^2)y=0$

Its AE is $m^4-2m^3+m^2=0$

$\rightarrow m^2(m^2-2m+1)=0$

$\rightarrow m^2(m-1)^2=0$

$\rightarrow m=0,0,1,1$

$\therefore CF=(c_1+c_2x)+(c_3+c_4x)e^x$

To find PI : $PI=\frac{1}{(D^4-2D^3+D^2)}x^3=\frac{1}{D^2(D^2-2D+1)}x^3=\frac{1}{D^3}\{1+(D^2-2D)\}^{-1}x^3$

$=\frac{1}{D^2}\{1-(D^2-2D)+(D^2-2D)^2-(D^2-2D)^3+\cdots\}$

$=\frac{1}{D^2}\{1-D^2+2D+D^4-4D^3+4D^2-D^6-12D^4+6D^5-8D^3+\cdots\}x^3$

$=\frac{1}{D^2}\{1+2D+3D^2-4D^3+\cdots\}x^3$

$=\frac{1}{D^2}\{x^3+6x^2+18x-24\}$

$=\frac{x^5}{20}+6\frac{x^4}{3\times4}+18\frac{x^3}{2\times3}-24\frac{x^2}{2}$

$PI=\frac{x^5}{20}+\frac{x^4}{2}+3x^3-12x^2.$

$\therefore CS=CF+PI=(c_1+c_2x)+(c_3+c_4x)e^x+\frac{x^5}{20}+\frac{x^4}{2}+3x^3-12x^2$

Case IV: When $F(x)=e^{ax}V(x)$,where V(x) being a function of x.

Then $PI=\frac{1}{f(D)}e^{ax}V(x)=e^{ax}\frac{1}{f(D+a)}V(x)$, then Proceed as in case I, II or III.

Example: $\frac{d^3y}{dx^3}-7\frac{dy}{dx}-6y=e^{2x}(1+x)$

$\rightarrow (D^3-7D-6)y=e^{2x}(1+x)$

Then $CS=CF+PI$

To find CF: Let $(D^3-7D-6)y=0$

Its AE is $m^3-7m-6=0$

$\rightarrow (m+1)(m^2-m-6)=0$

$\rightarrow (m+1)(m+2)(m-3)=0$

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$\rightarrow m = -1, -2, 3$

$\therefore CF = c_1 e^{-x} + c_2 e^{-2x} + c_3 e^{3x}.$

To find PI : $PI = \frac{1}{(D^3-7D-6)} e^{2x}(1+x) = e^{2x} \frac{1}{[(D+2)^3-7(D+2)-6]}(1+x)$

$$= e^{2x} \frac{1}{D^3 + 12D + 6D^2 + 8 - 7D - 14 - 6}(1+x) = e^{2x} \frac{1}{D^3 + 6D^2 + 5D - 12}(1+x)$$

$$= e^{2x} \frac{1}{\left((-12)\left\{1 + \left(\frac{D^3 + 6D^2 + 5D}{12}\right)\right\}\right\}}(1+x)$$

$$= -\frac{e^{2x}}{12}\left\{1 + \left(\frac{D^3 + 6D^2 + 5D}{12}\right)\right\}^{-1}(1+x)$$

$$= -\frac{e^{2x}}{12}\{1 + 5D + \cdots\}(1+x) = -\frac{e^{2x}}{12}\left\{(1+x) + \frac{5}{12}.1\right\} = -e^{2x}\left(x + \frac{17}{12}\right)$$

$\therefore CS = CF + PI = c_1 e^{-x} + c_2 e^{-2x} + c_3 e^{3x} - e^{2x}\left(x + \frac{17}{12}\right)$

Case V: When $F(x) = \sin hax \; or \; \cos hax$

Then $PI = \frac{1}{f(D)} \sin hax$

Express $f(D)$ as a function of D^2.Suppose it is $\emptyset(D^2)$ and Put $D^2 = a^2$

$PI = \frac{1}{\emptyset(D^2)} \sin hax = \frac{1}{\emptyset(a^2)} \sin hax \;, \emptyset(a^2) \neq 0.$

If $\emptyset'(a^2) = 0$ then

$PI = \frac{1}{\emptyset'(D^2)} \sin hax = \frac{1}{\emptyset'(a^2)} \sin hax, \emptyset'(a^2) \neq 0.$

If $\emptyset''(a^2) = 0$ then

$PI = \frac{1}{\emptyset''(D^2)} \sin hax = \frac{1}{\emptyset''(a^2)} \sin hax \;, \emptyset''(a^2) \neq 0$ and so on.

Similarly for $\cos hax$.

Example: $(D^3 + 3D)y = cosh2x \; sinh3x$

Then $CS = CF + PI$

To find CF: Let $(D^3 + 3D)y = 0$

Its AE is $m^3 - 3m = 0$

$\rightarrow m(m-3) = 0$

$\rightarrow m = 0, \pm i\sqrt{3}$

$\therefore CF = c_1 + c_2 \; cos\sqrt{3x} + c_3 \; sin\sqrt{3x}$

To find PI :

$$PI = \frac{1}{D^3 + 3D} cosh2x \; sinh3x = \frac{1}{2}\frac{1}{D^3 + 3D} 2sinh3x \; cosh2x$$

$$= \frac{1}{2}\frac{1}{D^3 + 3D}(sinh5x + \; sinhx)$$

$$= \frac{1}{2}\frac{1}{D^2 D + 3D} sinh5x + \frac{1}{2}\frac{1}{D^2 D + 3D} sinhx$$

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$= \frac{1}{2}\ \frac{1}{25D+3D} sinh5x + \frac{1}{2}\ \frac{1}{1D+3D} sinhx$

$= \frac{1}{56}\ \frac{1}{D} sinh5x + \frac{1}{8}\ \frac{1}{D} sinhx = \frac{1}{56}\frac{cosh5x}{5} + \frac{1}{8}\ coshx = \frac{1}{280} cosh5x + \frac{1}{8} coshx$

$\therefore CS = CF + PI = \ c_1 + c_2\ cos\sqrt{3x} + c_3\ sin\sqrt{3x} + \frac{1}{280} cosh5x + \frac{1}{8} coshx$

Case VI: When $F(x) = x^m cosax\ or\ x^m sinax$

We know that $e^{iax} = cosax + isinax$, $cosax =$ Real part of e^{iax} and $sinax =$ imaginary part of e^{iax}

$\therefore PI = \frac{1}{f(D)} x^m cosax = RP \frac{1}{f(D)} x^m e^{iax} = RP\ e^{iax} \frac{1}{f(D+ia)}\ x^m$,then proceed as in case III.

Similarly fir $x^m sinax$

$\therefore PI = \frac{1}{f(D)} x^m sinax = IP \frac{1}{f(D)} x^m e^{iax} = IP\ e^{iax} \frac{1}{f(D+ia)}\ x^m$

Example: $\frac{d^4y}{dx^4} + 2\frac{d^2y}{dx^2} + y = x^2 cosx$

$\rightarrow (D^4 + 2D^2 + 1)y = x^2 cosx$

$\rightarrow (D^2 + 1)^2 y = x^2 cosx$

Then $CS = CF + PI$

To find CF : Let $(D^2 + 1)^2 y = 0$

Its AE is $(m^2 + 1)^2 = 0$

$\rightarrow m = \pm i, \pm i$

$\therefore CS = (c1 + c2x)cosx + (c3 + c4x)sinx$

To find PI : $PI = \frac{1}{(D^2+1)^2} x^2 cosx = RP\ \frac{1}{(D^2+1)^2} x^2 e^{ix} = RP\ e^{ix}\ \frac{1}{((D+i)^2+1)^2} x^2$

$= RP\ e^{ix} \frac{1}{(D^2 + 2iD + i^2 + 1)^2} x^2 = \ RP\ e^{ix} \frac{1}{(D^2 + 2iD)^2} x^2$

$= RP\ e^{ix} \frac{1}{(-4D^2)\left\{1 + \frac{D}{2i}\right\}^2} x^2 = -\frac{1}{4}\ RP\ e^{ix} \frac{1}{D^2} \left\{1 + \frac{D}{2i}\right\}^{-2} x^2$

$= -\frac{1}{4}\ RP\ e^{ix} \frac{1}{D^2} \left\{1 - 2\frac{D}{2i} + 3\frac{D^2}{(2i)^2} - \cdots\right\} x^2$

$= -\frac{1}{4}\ RP\ e^{ix} \frac{1}{D^2} \left\{x^2 + i2x - \frac{3}{4}(2)\right\} = -\frac{1}{4}\ RP\ (cosx + isinx) \left\{\left(\frac{x^4}{12} - \frac{3x^2}{4}\right) + i\frac{x^3}{3}\right\}$

$PI = -\frac{1}{4}\left(\frac{x^4}{12} - \frac{3x^2}{4}\right) cosx + \frac{x^3}{12} sinx$

$\therefore CS = CF + PI = (c_1 + c_2x)cosx + (c_3 + c_4x)sinx - \frac{1}{4}\left(\frac{x^4}{12} - \frac{3x^2}{4}\right) cosx + \frac{x^3}{12} sinx.$

Case VII: When $F(x)$ is any function of x.

Note: $\frac{1}{D-a} X = e^{ax} \int e^{-ax} X dx.$

$PI = \frac{1}{f(D)} F(x)$

Resolve $\frac{1}{f(D)}$ into partial fractions, $\frac{1}{f(D)} = \frac{1}{[\{D-m1)(D-m2)\ldots(D-mn)]} = \frac{A_1}{D-m_1} + \frac{A_2}{D-m_2} + \cdots + \frac{A_n}{D-m_n}$

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$$\therefore PI = \left[\frac{A_1}{D-m_1} + \frac{A_2}{D-m_2} + \cdots + \frac{A_n}{D-m_n}\right] F(x)$$

$$= \frac{A_1}{D-m_1}F(x) + \frac{A_2}{D-m_2}F(x) + \cdots + \frac{A_n}{D-m_n}F(x)$$

$$= e^{m_1 x}\int e^{-m_1 x}F(x)dx + e^{m_2 x}\int e^{-m_2 x}F(x)dx + \cdots + e^{m_n x}\int e^{-m_n x}F(x)dx$$

This method is a general one and can, therefore be employed to obtain a particular integral in any given case.

Mostly this case used to find PI whose $F(x) = e^{e^x}, sine^x, cose^x, logx, tanx, cotx, secx, cosecx$ i.e. any function which is not solve from case I to VI.

Example: $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = e^{e^x}$

$\rightarrow (D^2 + 3D + 2)y = e^{e^x}$

Then $CS = CF + PI$

To find CF: Let $(D^2 + 3D + 2)y = 0$

Its AE is $m^2 + 3m + 2 = 0$

$\rightarrow (m+1)(m+2) = 0$

$\rightarrow m = -1, -2$

$\therefore CF = c1e^{-x} + c2\, e^{-2x}$

To find PI :

$$PI = \frac{1}{D^2+3D+2}\, e^{e^x} = \frac{1}{(D+1)(D+2)}\, e^{e^x} = \left(\frac{1}{D+1} - \frac{1}{D+2}\right)e^{e^x}$$

$$= \frac{1}{D+1}e^{e^x} + \frac{1}{D+2}e^{e^x} = e^{-x}\int e^x\, e^{e^x}dx + e^{-2x}\int e^{2x}\, e^{e^x}dx$$

Put $e^x = t$ in the integral $\rightarrow e^x dx = dt$

$$\therefore PI = e^{-x}\int e^t dt + e^{-2x}\int e^t\, .tdt$$

$$= e^{-x}.e^t - e^{-2x}(t.e^t - e^t) = e^{-x}.e^{e^x} - e^{-2x}\left(e^x.e^{e^x} - e^{e^x}\right)$$

$$= e^{-x}.e^{e^x} - e^{-x}.e^{e^x} = e^{-2x}.e^{e^x}$$

$$\therefore CS = CF + PI = c_1e^{-x} + c_2\, e^{-2x} + e^{-2x}.e^{e^x}$$

Application of Linear Differential Equation with Constant Coefficients:

1) Simple harmonic motion
2) Simple pendulum, Gain and loss of oscillations
3) Oscillations of a spring
4) Oscillatory electrical circuits
5) Electro-Mechanical analogy
6) Deflection of beams
7) Whirling of shafts.
8) Free, damped motion
9) Kirchhoff's Voltage law
10) Forced motion

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CONCLUSION

The solution of Higher Order linear ODEs with constant coefficients holds significant importance in the fields of mathematics, physics, and engineering. A thorough and complete summary of the techniques utilised to solve these equations, including the characteristic equation and its roots as well as the two possible cases real roots, complex conjugate roots, have all been covered in this article. The linear differential equations has many applications in physical systems and appears in many different field of research. For scholars and students interested in this subject, this article serves as a useful resource.

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RELATION OF LAPLACE TRANSFORM AND Z TRANSFORM & THEIR APPLICATIONS: A GENERIC REVIEW

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ABSTRACT
The article aims to present an overview of the Laplace transforms and Z transforms, highlighting their similarities, differences and their applications. Laplace transform and Z transform are crucial concepts in engineering mathematics. When it comes to digital signal processing, system controls, and differential equation solving, difference equation solving, both types of transform methods are useful. We discuss several useful standard formulae of many elementary functions, properties & applications of Laplace transform and Z transform.

Keywords: Laplace Transforms, Inverse Laplace Transforms, Z Transform, Inverse Z Transform, Convolution, Region of Convergence

INTRODUCTION

Transformation is an extremely powerful mathematical tool so using it in mathematical treatment of an issue is emerging in many applications. The Laplace transforms a commonly utilized integral transform with many applications in engineering mathematics [1]. It is a linear operator of a function $f(t)$ with a real argument $t(t \geq 0)$ that transforms it to a function $F(s)$ with a complex argument s, Denoted $L\{f(t)\}$. For most practical purposes, this transformation is essentially a bijective; the corresponding pairs of $f(t)$ and $F(s)$ is matched in tables. The Laplace transform is advantageous in that a great deal of relationships and operations over the originals $f(t)$ map to more simple connections and operations over the images $F(s)$. Pierre-Simon Laplace, who popularized the transform in his work on probability theory, is honored by the name of the transformation.

Z-transform origins can be traced to De Moivre's in 1730 introduction of "generating functions" to probability theory. W. Hurewicz defined a transform of a sampled signal or sequence in 1947 as a tractable method of solving linear constant-coefficient difference equations. The transformation named "Z-transform" by Ragazzini and Lotfi Zadeh in the sampled-data control group at Columbia University in 1952. The Z-transform is a generalization of the discrete Fourier transform and is a transformation for discrete data that is comparable to the Laplace transform of continuous data. The Z-transform has applications in a variety of applied mathematics domains, including control theory, economics, and digital signal processing [2].

The Laplace transforms and Z transforms are mathematical operators applied to solve differential equations & difference equations, respectively. The Laplace transform turns integral equations & differential equations to polynomial equations, whereas the Z transform turns difference equations to ordinary algebraic equation, these algebraic & polynomial equations are much easier to solve by the standard algebraic identities. Also Z transform is a method to convert a complicated or simple sequence into its proper frequency domain equivalent [4].

In this thesis, we present Laplace transform & Z-transform - definition, standard formulae of many elementary functions & properties with their applications, finding their inverse and some examples on them. Many applications of both transforms are discussed as solving some kinds of linear difference equations & difference equation by Laplace transform and Z transform respectively. The mathematical formulation of the Laplace Transform and Z Transform also differs from one another.

Laplace Transform

A mathematical tool called the Laplace Transform is frequently used to analyze linear time-invariant systems, including control, electrical, and mechanical circuits. It changes a time function into a complex variable function.

The real-valued function $f(t)$, the two-sided or bilateral Laplace transform $\bar{f}(s)$ of $f(t)$ is defined by & the Laplace Transform equation is expressed as follows:

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$$\bar{f}(s) = L\{f(t)\} = \int_{-\infty}^{\infty} f(t)e^{-st}dt \ldots\ldots\ldots (1)$$

where s is a complex variable. The one-sided or unilateral Laplace transforms of $f(t)$ is defined by

$$\bar{f}(s) = L\{f(t)\} = \int_{0}^{\infty} f(t)e^{-st}dt \ldots\ldots\ldots (2)$$

Note that if $f(t) = 0$ for all $t < 0$, the one-sided and two-sided Laplace transform of $f(t)$ is identical. In engineering, the one-sided Laplace transform is primarily used, and thus we discussed on only the one-sided Laplace transform, which is referred to as the Laplace transform [11].

Given a function $f(t)$, the set of all complex numbers s such that the integral in equation 2 exists is called the region of convergence of the Laplace transform of $f(t)$. For example, if $f(t)$ is the unit step function $u(t)$ is given by $u(t) = 1$ for $t \geq 0$ and $u(t) = 0$ for $t < 0$, the integral equation 2 exists for any $s = \sigma + j\omega$ with real part $\sigma > 0$. Hence, the region of convergence is the set of all complex numbers s with positive real part and for any such s, the transform of the unit-step function $u(t)$ is equal to $1/s$

The inverse Laplace transform operator is often denoted by L^{-1}, and is given by

$$L^{-1}\left\{\bar{f}(s)\right\} = f(t) = \frac{1}{2\pi j}\int_{c-j\infty}^{c+j\infty} \bar{f}(s)e^{st}ds \ldots\ldots (3)$$

Where c is any real number for which the path $c + j\infty$ lies in the region of convergence of the transform $\bar{f}(s)$ [5].

Z Transform

A mathematical method called the Z Transform is mostly applied to system controls and digital signal processing. Converting a discrete-time signal into a complex frequency domain representation is its main purpose. We must examine the Z Transform's fundamental equation in order to comprehend it completely.

The function $f(k)$, the two-sided or bilateral Z transform $F(z)$ of $f(k)$ is defined by & the Z Transform formula is expressed as follows:

$$F(z) = \sum_{k=-\infty}^{\infty} f(k)z^{-k} \ldots\ldots\ldots (4)$$

Here z is a complex variable. The one-sided or unilateral Z transforms of $f(k)$ is defined by

$$F(z) = \sum_{k=0}^{\infty} f(k)z^{-k} \ldots\ldots\ldots (5)$$

Note that if $f(k) = 0$ for, the one-sided and two-sided z-transform of $f(k)$ are the same. As is the case with Laplace transform, in controls engineering the one-sided version is the most useful, thus we discussed on only the one-sided Z transform. Given $f(k)$, the set of all complex numbers z such that the summation in equation 5 exits is called the region of convergence of the Z transform of $f(k)$. The Z transform defined by equation 5 can be used as an operator, denoted by $F(z) = Z[f(k)]$, that maps a discrete-time function $f(k)$ into the function $F(z)$ of the complex variable z. The inverse Z transform operation is denoted by $f(k) = Z^{-1}[F(z)]$ [11].

Relation between Laplace Transform and Z-Transform

Let $x(t)$ is a continuous time signal. The discrete time version of this signal is $x^*(t)$ and the signal $x^*(t)$ is obtained by sampling $x(t)$ with a sampling period of T second, in other words, the sequence $x^*(t)$ is obtained by multiplying the signal $x(t)$ with a sequence of impulses which are T seconds apart,

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$$x^*(t) = \sum_{n=0}^{\infty} x(nT)\delta(t-nT)$$

Taking the Laplace Transform on both sides, we get,

$$L\left[x^*(t)\right] = X^*(s) = L\left[\sum_{n=0}^{\infty} x(nT)\delta(t-nT)\right]$$

$$\Rightarrow X^*(s) = \sum_{n=0}^{\infty} x(nT)L\left[\delta(t-nT)\right]$$

$$\Rightarrow L[x^*(t)] = X^*(s) = \sum_{n=0}^{\infty} x(nT)e^{-nsT}$$

Now, the Z Transform of the sequence $x(nT)$ is given by,

$$Z[x(nT)] = Z[x^*(t)] = \sum_{n=0}^{\infty} x(nT)z^{-n}$$

From equations, we have,

$$L[x^*(t)] = \left[\sum_{n=0}^{\infty} x(nT)z^{-n}\right]_{z=e^{sT}}$$

Therefore, the relation between the Laplace transform and Z transform is given by,

$$L[x^*(t)] = Z[x^*(t)]_{z=e^{sT}}$$ [5].

Entry	**Laplace Domain**	**Time Domain** ***(Note)***	**Z Domain** (t=kT)
unit impulse	1	$\delta(t)$ unit impulse	1
unit step	$\Gamma(s) = \frac{1}{s}$	$\gamma(t)$ *(Note)*	$\frac{z}{z-1}$
ramp	$\frac{1}{s^2}$	t	$T\frac{z}{(z-1)^2}$
parabola	$\frac{2}{s^3}$	t^2	$T^2\frac{z(z+1)}{(z-1)^3}$
t^n (n is integer)	$\frac{n!}{s^{(n+1)}}$	t^n	
exponential	$\frac{1}{s+a}$	e^{-at}	$\frac{z}{z-e^{-aT}}$
power		$b^k \quad (b = e^{-aT})$	$\frac{z}{z-b}$
time multiplied exponential	$\frac{1}{(s+a)^2}$	te^{-at}	$T\frac{ze^{-aT}}{(z-e^{-aT})^2}$
Asymptotic exponential	$\frac{1}{s(s+a)}$	$\frac{1}{a}(1-e^{-at})$	$\frac{z(1-e^{-aT})}{a(z-1)(z-e^{-aT})}$

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double exponential	$\frac{1}{(s+a)(s+b)}$	$\frac{e^{-at}-e^{-bt}}{(b-a)}$	$\frac{z(e^{-aT}-e^{-bT})}{(b-a)(z-e^{-aT})(z-e^{-bT})}$
asymptotic critically damped	$\frac{1}{s(s+a)^2}$	$\frac{1}{a^2}(1-e^{-at}-ate^{-at})$	$\frac{(1-e^{-Ta}(1+Ta))z^2+e^{-Ta}(Ta-1+e^{-Ta})z}{a^2(z-e^{-Ta})^2(z-1)}$
differentiated critically damped	$\frac{s}{(s+a)^2}$	$(1-at)e^{-at}$	$\frac{z(z-(Ta+1)e^{-Ta})}{(z-e^{-Ta})^2}$
sine	$\frac{\omega_0}{s^2+\omega_0^2}$	$\sin(\omega_0 t)$	$\frac{z\sin(\omega_0 T)}{z^2-2z\cos(\omega_0 T)+1}$
cosine	$\frac{s}{s^2+\omega_0^2}$	$\cos(\omega_0 t)$	$\frac{z(z-\cos(\omega_0 T))}{z^2-2z\cos(\omega_0 T)+1}$
decaying sine	$\frac{\omega_d}{(s+a)^2+\omega_d^2}$	$e^{-at}\sin(\omega_d t)$	$\frac{ze^{-aT}\sin(\omega_d T)}{z^2-2ze^{-aT}\cos(\omega_d T)+e^{-2aT}}$
decaying cosine	$\frac{s+a}{(s+a)^2+\omega_d^2}$	$e^{-at}\cos(\omega_d t)$	$\frac{z(z-e^{-aT}\cos(\omega_d T))}{z^2-2ze^{-aT}\cos(\omega_d T)+e^{-2aT}}$

[9].

Laplace Transform - Property Name	Illustration
Definition	$f(t) \overset{\mathcal{L}}{\leftrightarrow} F(s)$ $\quad f(t) \overset{\mathcal{L}}{\leftrightarrow} F(s)$ $F(s)=\int_{0^-}^{\infty} f(t)e^{-st}dt$ $F(s)=\int_{0^-}^{\infty} f(t)e^{-st}dt$
Linearity	$Af_1(t)+Bf_2(t) \overset{\mathcal{L}}{\leftrightarrow} AF_1(s)+BF_2(s)$
First Derivative	$\frac{df(t)}{dt} \overset{\mathcal{L}}{\leftrightarrow} sF(s)-f(0^-)$
Second Derivative	$\frac{d^2f(t)}{dt^2} \overset{\mathcal{L}}{\leftrightarrow} s^2F(s)-sf(0^-)-\dot{f}(0^-)$
n^{th} Derivative	$\frac{d^nf(t)}{dt^n} \overset{\mathcal{L}}{\leftrightarrow} s^nF(s)-\sum_{i=1}^{n} s^{n-i}f^{(i-1)}(0^-)$
Integration	$\int_0^t f(\lambda)d\lambda \overset{\mathcal{L}}{\leftrightarrow} \frac{1}{s}F(s)$
Multiplication by time	$tf(t) \overset{\mathcal{L}}{\leftrightarrow} -\frac{dF(s)}{ds}$
Time Shift	$f(t-a)\gamma(t-a) \overset{\mathcal{L}}{\leftrightarrow} e^{-as}F(s)$ ($\gamma(t)$ = unit step function)
Complex Shift	$f(t)e^{-at} \overset{\mathcal{L}}{\leftrightarrow} F(s+a)$
Time Scaling	$f\left(\frac{t}{a}\right) \overset{\mathcal{L}}{\leftrightarrow} aF(as)$
Convolution ('*' denotes convolution of functions)	$f_1(t)*f_2(t) \overset{\mathcal{L}}{\leftrightarrow} F_1(s)F_2(s)$
Initial Value Theorem (if F(s) is a strictly proper fraction)	$\lim_{t\to 0^+} f(t)=\lim_{s\to\infty} sF(s)$
Final Value Theorem (if final value exists,e.g., decaying exponentials)	$\lim_{t\to\infty} f(t)=\lim_{s\to 0} sF(s)$ [9]

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Z Transform - Property Name	Illustration
Linearity	$af_1[k]+bf_2[k] \xleftrightarrow{\mathcal{Z}} aF_1(z)+bF_2(z)$
Shift Left by 1	$f[k+1] \xleftrightarrow{\mathcal{Z}} zF(z)-zf[0]$
Shift Left by 2	$f[k+2] \xleftrightarrow{\mathcal{Z}} z^2F(z)-z^2f[0]-zf[1]$
Shift Left by n	$f[k+n] \xleftrightarrow{\mathcal{Z}} z^nF(z)-z^n\sum_{k=0}^{n-1}f[k]z^{-k}$ $= z^n\left(F(z)-\sum_{k=0}^{n-1}f[k]z^{-k}\right)$
Shift Right by n	$f[k-n] \xleftrightarrow{\mathcal{Z}} z^{-n}F(z)$
Multiplication by time	$kf[k] \xleftrightarrow{\mathcal{Z}} -z\frac{dF(z)}{dz}$
Convolution	$f_1[k]*f_2[k] \xleftrightarrow{\mathcal{Z}} F_1(z)F_2(z)$
Initial Value Theorem	$f[0]=\lim_{z\to\infty}F(z)$
Final Value Theorem	$\lim_{k\to\infty}f[k]=\lim_{z\to1}(z-1)F(z)$ [9].

Difference Between Laplace Transform and Z Transform

Laplace Transform	Z Transform
The Laplace transform is used to analyses the continuous-time LTI systems.	The Z-transform is used to analyses the discrete-time LTI (also called LSI - Linear Shift Invariant) systems.
The LT converts the time domain differential equations into the algebraic equations in s-domain.	The ZT converts the time-domain difference equations into the algebraic equations in z-domain.
LT may also be of two types viz. one-sided (or unilateral) and two-sided (or bilateral).	ZT may be of two types viz. one-sided (or unilateral) and two-sided (or bilateral).
The LT is also a simple and systematic method and the complete solution can be obtained in one step. Also, the initial conditions can be introduced in the beginning of the process.	The ZT is a simple and systematic method and the complete solution can be obtained in one step. Also, the initial conditions can be introduced in the beginning of the process.
The set of points in s-plane for which the function X(s) converges is called the ROC of X(s).	The set of points in z-plane for which the function X(z) converges is called the ROC of X(z).
The ROC of LT X(s) consists of strip parallel to jω-axis in s-plane.	The ROC of the Z-transform X(z) consists of a ring in z-plane centered at the origin.
When the real part of the variable's' is equal to zero, i.e., σ = 0, then the LT becomes the continuous-time Fourier transform (CTFT).	When the magnitude of z is unity, i.e., $\|z\| = 1$, then the ZT becomes discrete-time Fourier transform (DTFT).
Convolution in time-domain is also equal to multiplication in *s*-domain.	Convolution in time-domain is equal to multiplication in z-domain

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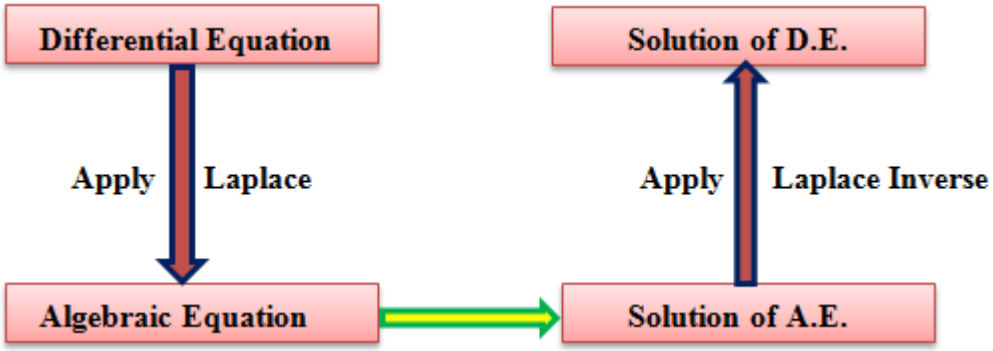
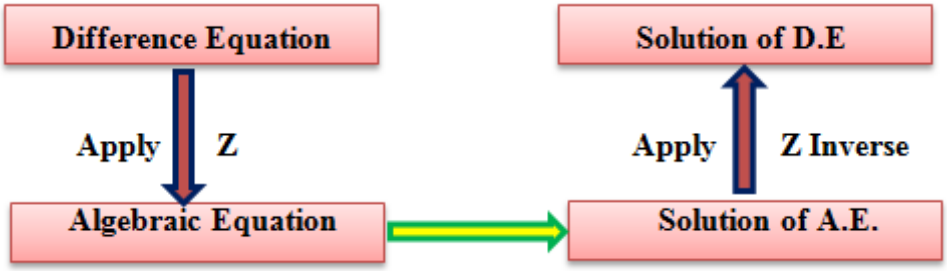
Laplace transform is used to solve differential equations:



Z transform is used to solve difference equations:



Application of Laplace Transform

1) Simulation of impulse response of electric machines.
2) General nonlinear modal representation of large scale power system.
3) Analytical techniques for broadband multi electro chemical piezo electric bimorph beams with multi frequency power harvesting.
4) Generalized variational principles for heat conduction models based on Laplace transforms.
5) Classification of geological structure using ground penetration radar and Laplace transform artificial neural networks.
6) Wave propagation and transient response of a fluid filled FGM cylinder with rigid core using the inverse Laplace transform.
7) Analytical solution of Abel integral equation arising in astrophysics via Laplace transforms.
8) Analysis for pressure transient of coalbed methane reservoir based on Laplace transforms finite differential method.
9) Medical application for the flow of carbon-nanotube suspended nanofluids in the presence of convective condition using Laplace transform.
10) Solutions for fractional order electrical circuits in Laplace transform an nonstandard finite difference method

Application of Z Transform

1) To analysis of digital filters
2) For automatic controlling telecommunication
3) It helps the system design and check the stability of the system
4) Examine the linear discrete system
5) Analysis of discrete signal.

CONCLUSION

This paper leads us to the conclusion that Z Transforms and Laplace Transforms are closely related. An overview of Laplace Transform and Z Transform & their relation, properties, applications was presented in this paper. While the Laplace Transform is continuous, the Z Transform's distinct properties make it crucial for

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analyzing discrete signals. The comparison of Laplace and Z-transform also explained in paper. It is possible to inherit a transform from another by altering the format of the variables "s" or "z."

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EFFECTS OF FRICTION STIR WELDING PARAMETERS ON AA 6101 AND PURE CU WELD JOINT TENSILE STRENGTH AND ELECTRICAL RESISTIVITY

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ABSTRACT
Nowadays, a green solid state welding technique Friction stir welding (FSW) is used for welding of similar as well as dissimilar materials in various industries like aerospace, marine, and nuclear. In this research paper, FSW of AA 6101-T64 with pure Cu was conducted for fulfilling the objectives of evolution of weld joint tensile strength (σ) and electrical resistivity (ρ). The FSW process parameters (tool rotational speed, welding speed, and tool pin offset) were optimized for forming sound weld joint. During experimentation the tool rotational speed was 840, 1045, and 1300 rpm. The welding speed was 25, 35, and 45 mm/min. The tool pin was offset towards Al side by 0.6, 0.8, and 1 mm respectively. A H13 tool steel material tool with 58 HRC hardness was used for experimentation. The experimentation was conducted by considering three key input process parameters. Three levels of the parameters were as per the Box-Behnken design matrix of response surface methodology (RSM). The tensile strength was obtained from 167 MPa to 201 MPa. Whereas, an electrical resistivity of the weld joint was measured from 0.027 μΩm to 0.039 μΩm.

Keywords: Friction stir welding (FSW), tensile strength, and electrical resistivity.

1. INTRODUCTION

Welding process is classified in two classes i.e. fusion welding and solid state welding. Solid state welding consists of friction welding, friction stir welding, forge welding etc. Friction stir welding (FSW) was invented by the welding institute (TWI) in 1991. It's an environment friendly solid state joining process to fulfill the increasing demand for efficient and lightweight structures to save the total cost and the weight [1]. It was primarily used to join aluminum alloys. Nowadays it is used for joining of similar as well as dissimilar materials [2]. Copper (Cu) is widely used in electrical and structural industries as it posses good strength, electrical and thermal conductivities. But Cu is a dense material and costly so it is essential to find partial replacement material with Cu to lower the density and cost [3]. Aluminium (Al) exhibits similar properties as Cu. Replacement of Cu by Al will give same properties with lower price and density [1]. It is difficult to create a high quality dissimilar Al- Cu FSW joint by fusion welding due to the difference in melting points, development of brittle intermetallic compounds (IMCs), porosity, and crack formation [1]. It not only affects the mechanical properties, but electrical resistivity and heat conduction also [4]. The FSW process can effectively eliminates the said defects and joins dissimilar Al-Cu in a solid state where the secondary phase is absent since the process temperature is below the melting point temperature of the base material plates [5]. Non-consumable tool with special designed tool is used in this process. As the tool rotates, it is inserted in between the neighbouring edges of the plates to be joined. The tool is plunges for some time and then it traversed along the centreline [2]. The schematic diagram of FSW process is shown in Fig. 2. During the process, heat is generated within the workpiece by frictional contact between the rotating tool pin & shoulder and by plastic deformation happens of the workpiece during welding process. The material around the tool pin gets softened due to localised heating. The material gets mixed with the rotation of the tool and it leads to transfer of material from the front side to the back side of the FSW tool pin [2].

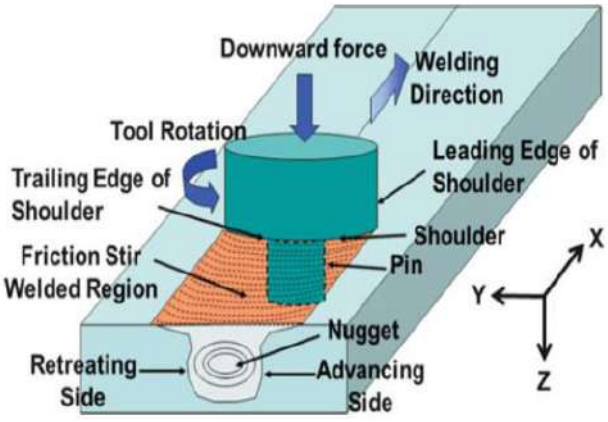

Fig.1. Friction stir welding schematic [2].

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During FSW process, the weld joint quality is affected by the welding process parameters, tool material type & characteristics, tool feature geometry, tool tilt angle, tool pin offset, tool rotational speed, and positioning of the base material plate [2]. Very limited literature is available on FSW of electrical grade aluminum alloy and pure Cu [6]. In the view of research gap, the present experimentation is conducted on AA 6101 electrical grade aluminum alloy and pure Cu to for the analysis of the effects of FSW process parameters on tensile strength and electrical resistivity of the weld joint.

2. EXPERIMENTAL WORK

The both base material plates used were of 150 x 75 x 4 mm size. The plates were butt welded with 20 mm shoulder diameter tapered cylindrical tool. The shoulder surface was featureless. Larger diameter of taper pin was 5 mm and smaller diameter was 4 mm. Shoulder to pin diameter ratio was 4:1. The pin length was 3.8 mm. The tool pin was offset towards Al side [1]. The tool shoulder was plunged by 0.1 mm with dwell time of 10s. The Cu plate was placed at the advancing side whereas; Al plate was placed at the retreating side. The experimentation was carried out on Cincinnati vertical milling machine. The top surfaces of the base material plates were polished and cleaned for the sound weld joint formation. The UTS specimens were cut as per ASTM – E8 standard by WEDM shown in Fig.2. The specimen prepared for electrical resistivity measurement is shown in Fig3.

The process parameters used for the experimentation and their range is shown in Table 1. The sequence of the welding process experimental runs was followed as per Box-Behnken design matrix of response surface methodology shown in Table 2. The output results of tensile strength and electrical resistivity is shown in Table 3.

Table 1: FSW process parameters and their levels selected for experimentation.

Sr. No.	Input parameters	Notation	Unit	Levels		
				-1	0	1
1	Tool rotational speed	A	rpm	840	1045	1300
2	Welding speed	B	mm/min	25	45	65
3	Tool pin offset	C	mm	0.6	1	1.4

Table 2: Box-Behkan design matrix

Trial run	A	B	C
1	0	0	0
2	0	1	-1
3	1	1	0
4	0	0	0
5	0	-1	-1
6	0	1	1
7	-1	0	1
8	-1	0	-1
9	1	0	1
10	-1	-1	0
11	0	0	0
12	1	0	-1
13	1	-1	0
14	0	-1	1
15	-1	1	0

Table 3 Tensile strength and electrical resistivity.

Trial run	A (rpm)	B (mm/min)	C (mm)	σ (MPa)	ρ (μΩm)
1	1045	35	0.8	201	0.030
2	1045	45	0.6	197	0.031
3	1300	45	0.8	180	0.033
4	1045	35	0.8	201	0.030
5	1045	25	0.6	198	0.032
6	1045	45	1	199	0.029
7	840	35	1	171	0.027

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8	840	35	0.6	168	0.029
9	1300	35	1	182	0.034
10	840	25	0.8	167	0.029
11	1045	35	0.8	201	0.030
12	1300	35	0.6	177	0.037
13	1300	25	0.8	177	0.039
14	1045	25	1	199	0.030
15	840	45	0	168	0.027

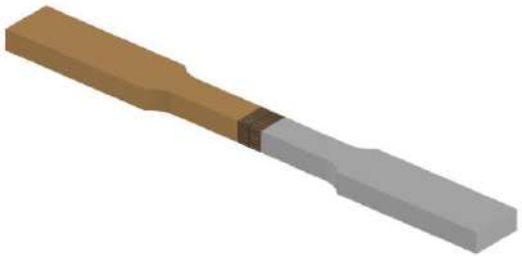

Fig.2 ASTM E8 sample for tensile test [13].

Fig.3 Specimen prepared for electrical resistivity test [13].

Table 4: Validation test for tensile strength

Run no	Input parameters			σ_s (MPa)		Error σ_s %
	A	B	C	Experimental	Predicted	
1	1100	51	1.20	160.10	162.6390	1.57 %

Table 5: Validation test for electrical resistivity

Run no	Input parameters			ρ (μΩm)		Error ρ %
	A	B	C	Experimental	Predicted	
1	1045	65	1.20	0.029	0.0284	2.11 %

3. EFFECT OF PROCESS PARAMETERS ON TENSILE STRENGTH

The tensile test was carried out for the evaluation of FSW weld joint strength and the effect of process parameters is also analysed. The validation test results are shown in Table 4. The surface plots of effects of process parameters on tensile strength are shown in Fig. 4.

Effect of Tool Rotational Speed:

Relatively at the lower tool rotational speed lower tensile strength of the weld joint was observed. It was because of insufficient mixing of the Cu particles in Al matrix. The tensile strength of the joint was increasingly growing with the increase in the tool rotational speed. Whereas, the maximum tensile strength 207 MPa was obtained at 1045 rpm speed as at this speed satisfactory mixing of Cu in Al matrix. It was also found that from 1045 rpm the tensile strength was decreasing. This was happen as more contact time between the base material Al-CU plates and tool shoulder face so more heat is produce. This widely stimulates the thickening of IMCs in the stir zone of the weld joint [7]. Decrease in tensile strength was seen when the increase in the IMCs in the stir zone of the weld joint.

Effect of Welding Speed:

Lower tensile strength was seen at lower welding speed of 25 mm/min as there was excessive heating and flow stress difference between base material plates. The turbulent material flow gives lower strength. At high heat input the micro crack forms and initiates failure of the weld joint. Also thick brittle intermetallic compounds formed which reduced the tensile strength. As the welding speed increased to 35 mm/min, the required heat input gives increased tensile strength. At this state the decrease in recrystallized fine grain size was occurred. It

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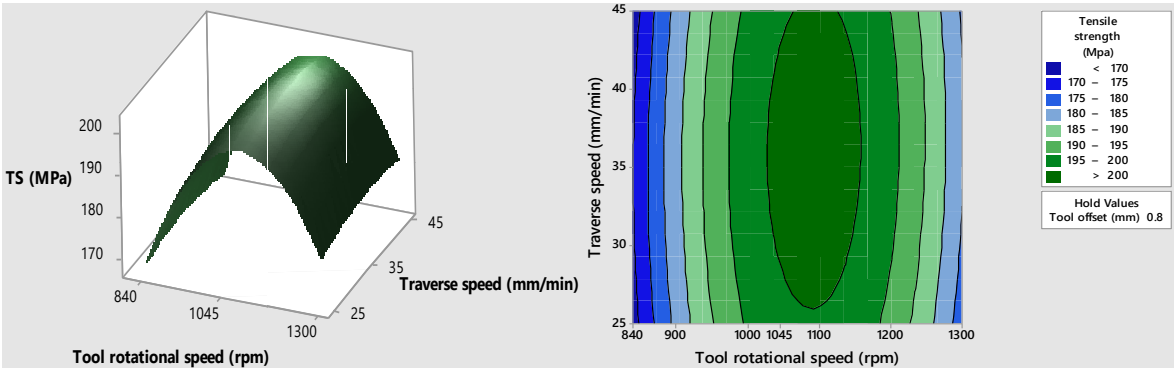
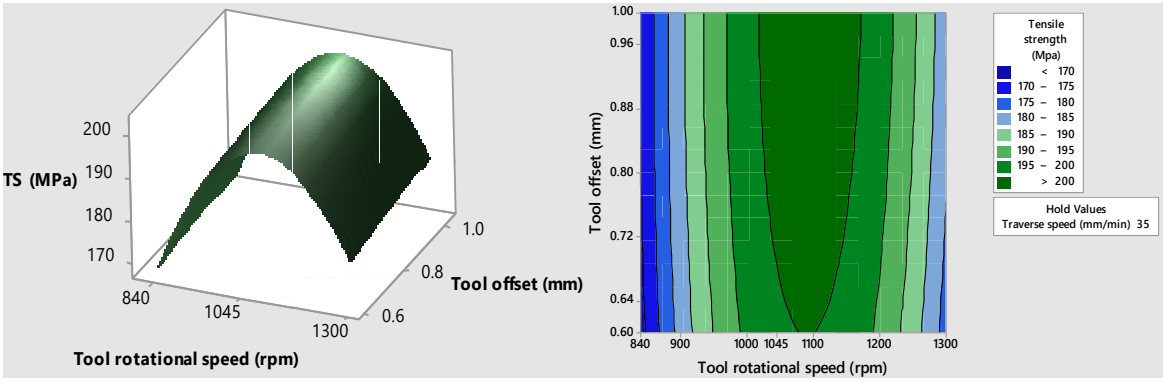
growths the grain boundary. The turbulent flow also gets normalized. When the welding speed was raised further to 45 mm/min, the heat input reduces. It reduces the rate of plastic deformation and inappropriate mixing of the material. So the joints failed at lower tensile strength.

Effect of Tool Offset:

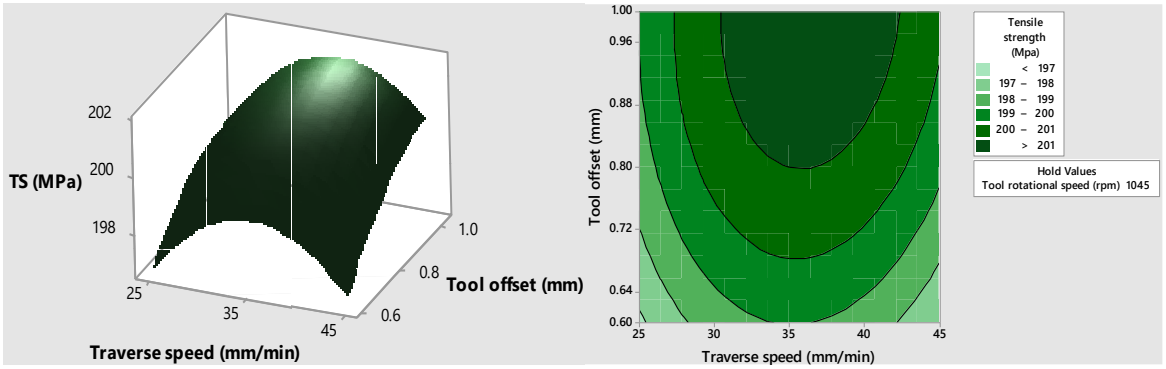
Tool pin offset towards Al side by 0.6 mm showed lower ultimate tensile strength. It gives poor bonding and void defect. More Cu atoms are in stir zone and produced brittle IMC. These IMCs lowered the tensile strength. As the tool offset increased to 0.8 and 1 mm towards Al side, improvement in the tensile strength was seen. Less amount of Cu atoms are in the stir zone reacts with Al atoms. So less IMCs formation and increased tensile strength [Progress 8, 9, 10, 11]



a. Interface effect plots of tool rotational speed and welding speed on tensile strength.



b. Interface effect plots of tool rotational speed and tool pin offset on tensile strength.



b. Interface effect plots of welding speed and tool pin offset on tensile strength.

Fig. 4 Response surface and contour plots for tensile strength.

4. Effect of Process Parameters on Electrical Resistivity

The weld joint's electrical resistivity was seen in the range of 0.027 μΩm to 0.039 μΩm. Variation in electrical resistivity was seen because of different heat input, material mixing during welding. The validation test results are shown in Table 5. The response surface and contour plots for tensile strength for tensile strength are shown in Fig. 5.

Effect of Tool Rotational Speed:

It is seen that at the higher tool rotational speed the higher electrical resistivity present. At this temperature because of excessive heat input, thickening of IMCs occur increased electrical resistance [12]. The lowest

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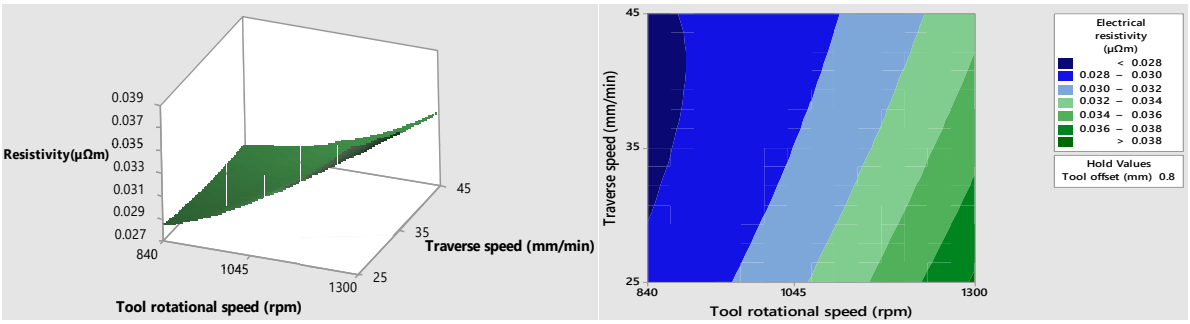
electrical resistivity was found at lowest tool rotational speed as minimum heat supplied and the thickness of the IMCs was not increased significantly in the stir zone. Effect of welding speed: Effect of welding speed was also found significant like too rotational speed as it also defines the amount of heat input during welding. Higher electrical resistance was observed at the lowest welding speed. Excessive thickening of IMCs occurred at this temperature [12]. In contrast at the higher welding speed during FSW lowers electrical resistivity as heat input reduces and the size of IMCs is also become smaller.

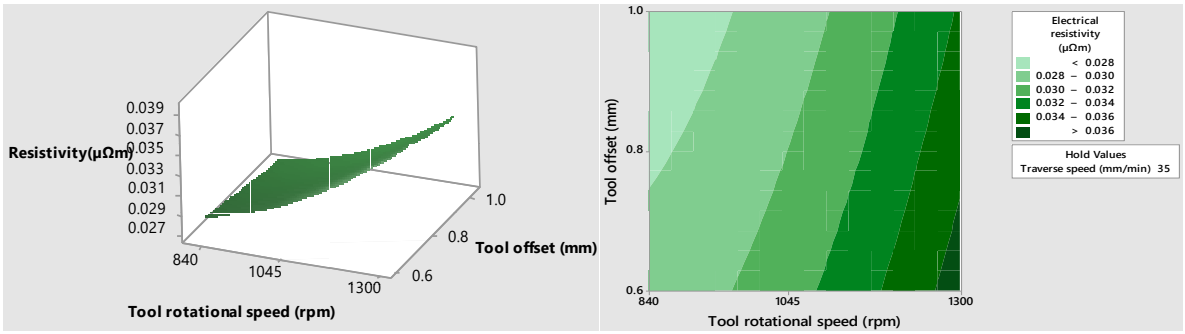
Effect of Tool Offset:

At the minor tool pin offset towards Al side base material, more Cu particles mixes with Al matrix and forms thick and hard IMCs.

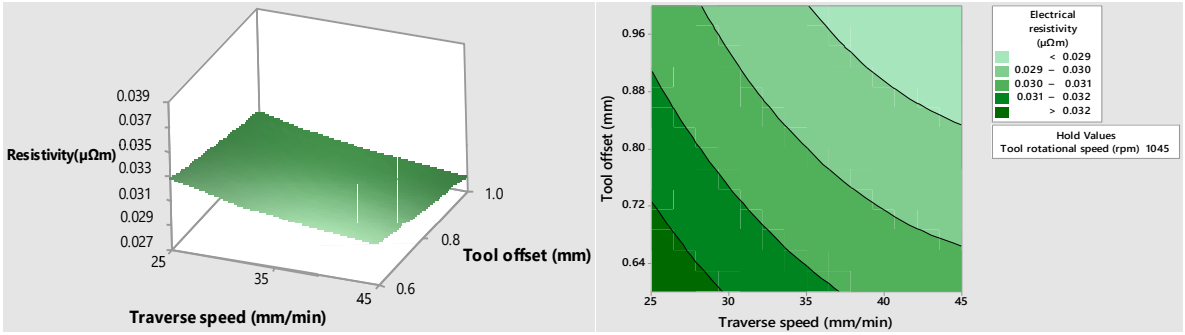
The result of it showed higher resistivity. As the tool pin offset increased, the small amount of Cu particle elements mixes in the Al matrix and results in smaller size IMCs formation and reduced in resistivity.



a. Interface effect plots of tool rotational speed and welding speed on electrical resistivity.



b. Interface effect plots of tool rotational speed and tool pin offset on electrical resistivity.



c. Interface effect plots s of welding speed and tool pin offset on electrical resistivity.

Fig.5 Response surface and contour plots for electrical resistivity

5. CONCLUSIONS

(1) The minimum and maximum tensile strength obtained was 167 to 201 MPa.

(2) The minimum and maximum resistance obtained was 0.027 to 39 μΩm respectively.

(3) The optimum set of input process parameters obtained for tensile strength was as: tool rotational speed- 1100 rpm, welding speed- 51mm/min, and tool pin offset-1.20mm.

(4) The optimum set of input process parameters obtained for electrical resistivity was as: tool rotational speed- 1045 rpm, welding speed- 65 mm/min, and tool pin offset-1.20mm.

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(5) Higher the tool rotational speed and lower the welding speed causes high heat input and formation of thick IMCs. It lowers the tensile strength and increases the electrical resistivity of the weld joint.

(6) Lower tool rotational speed and higher welding speed causes lower heat input and creates small thickness IMCs. Less tensile strength weld joint with lower electrical resistance was obtained.

(7) The tool offset towards Al side provides sound weld joint formation. The tensile strength and electrical resistivity are depending upon the amount of tool offset towards Al side.

(8) Lower tool pin offset gives more Cu elements to mix with the stir zone Al matrix and forms brittle, thicker IMCs which degrade the properties. On the other hand at higher tool offset small amount of Cu particles mixes in Al matrix. So fewer amounts of IMCs formed.

(9) Sound weld joint prepared by placing Al at retreating side.

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SCOPE OF EXTRACTION UNIT FOR MEDICAL AND AGRICULTURAL PURPOSE BY STEAM DISTILLATION PROCESS

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ABSTRACT
Steam distillation is a departure process which contains in distilling water together with other volatile and non-volatile components. The steam from the boiling water carries the vapors of the volatiles to a condenser, where together are cooled and return to the liquid or solid state; while the non-volatile residues remain overdue in the boiling container. If the volatiles are liquids not mixable with water, they will spontaneously form a distinct phase after condensation, allowing them to be detached by decantation or with a strainer funnel. In that situation, a Clevenger apparatus may be used to return the condensed water to the boiling flask, while the distillation is in advancement. Otherwise, the condensed mixture can be administered with small distillation or some other separation technique. Steam distillation can be used when the boiling point of the matter to be extracted is higher than that of water, and the starting solid cannot be impassioned to that infection since of rottenness or other unsolicited reactions. It may also be useful when the quantity of the desired substance is small compared to that of the non-volatile residues. It is often used to separate volatile essential oils from plant substantial. It is however much humbler and low-priced than those substitutions, and remains significant in certain manufacturing sectors.

Keywords: mixture, distillation, Fertilizer

INTRODUCTION
Steam distillation is a special type of distillation or a separation process for temperature sensitive materials like oils, resins, hydrocarbons, etc. which are insoluble in water and may decompose at their boiling point. The important nature of steam distillation is that it enables a compound or mixture of compounds to be distilled at a disease substantially below that of the boiling point(s) of the individual constituent(s). Vital oils contain substances with boiling points up to 200°C or higher temperatures. In the presence of steam or boiling water, however, these substances are volatilized at a temperature close to 100°C, at atmospheric heaviness. Fresh, or sometimes dried, botanic material is placed in the plant chamber of the still and the steam is allows to pass through the herb material under heaviness which softens the cells and allows the Indispensable Oil to escape in vapor form. The temperature of the steam must be high adequate to vaporize the oil present, yet not so high that it destroys the plants or burns the Important Oils. Besides the steam tiny droplets of Essential Oil evaporates and travel through a tube into the still's condensation chamber. Here Essential Oil vapors condense with the steam. The indispensable oil forms a film on the surface of the water. To separate the Essential Oil from the water, the film is then decanted or speed-read off the top. The remaining water, a byproduct of distillation, is called floral water, distillate, or hydrosol. It retains many of the beneficial properties of the plant, making it valuable in covering care for facial mists and toners (A solution containing chemicals that can change the color of a photographic print). In certain situations, floral water may be preferable to be pure essential oil, such as when treating a sensitive individual or a child, or when a more diluted.

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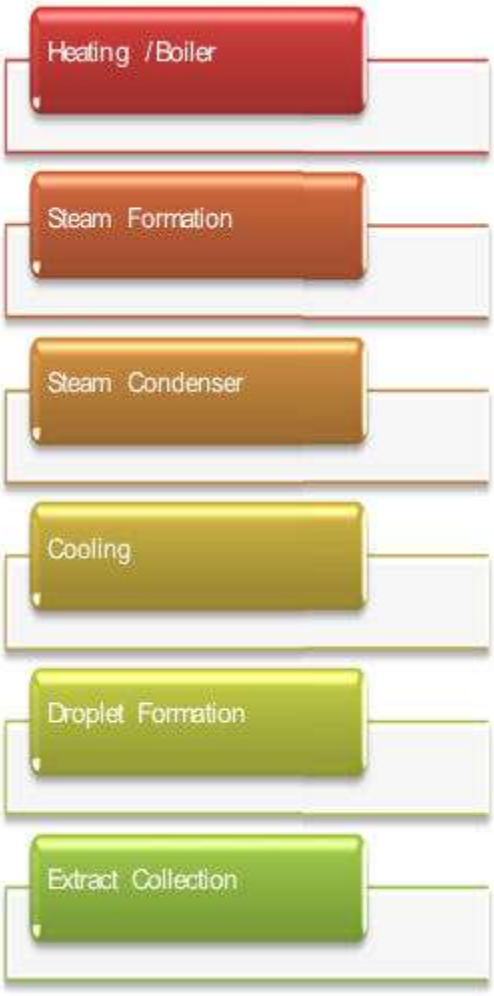

LITERATURE SURVEY

Mr. V.V. S. Sassan
Assistant Professor Anil Neurocordal Institute of Technology and Sciences

May 29, 2018

The promise of data-driven decision-making is now being recognized broadly, and there is growing enthusiasm for the notion of "Big Data. While the promise of Big Data is real – for example, it is estimated that Google alone contributed 54 billion dollars to the US economy in 2009 – there is currently a wide gap between its potential and its realization. Heterogeneity, scale, timeliness, complexity, and privacy difficulties with Big Data impede progress at all phases of the pipeline that can create value from data. The problems start right away during statistics acquisition, when the data tsunami requires us to make decisions, currently in an ad hoc manner, about what data to keep and what to discard, and how to store what we keep reliably with the right metadata. Considerably data today is not natively in structured format; for example, tweets and diaries are weakly structured pieces of text, while images and video are structured for storage and display, but not for semantic content. The value of data explodes when it can be linked with other data, thus data socializing is a major creator of value. Since most data is directly generated in digital format today, we have the opportunity and the challenge both to inspiration the creation to simplify later linkage and to automatically link previously created data. Data analysis, organization, retrieval, and molding are other foundational challenges. Data analysis is a clear bottleneck in many applications, both due to lack of scalability of the fundamental procedures and due to the complexity of the data that needs to be analyzed. Finally, exhibition of the results and its interpretation by nontechnical domain experts is crucial to extracting actionable knowledge. During the last 35 years, data management principles such as physical and logical independence, declarative inquiring and cost-based optimization have led, during the last 35 years, to a multi-billion dollar industry. More importantly, these technical advances have enabled the first round of business intelligence applications and laid the substance for handling and examining Big Data today.

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PROBLEMS:

- Farmers are facing a problem how they will prepare plants extract in large quantity in very short time.
- Earlier various works has been carried out for extract of plants. The process and instrument was very costly, hazardous, acquiring large space, having lots of disadvantages.

SOLUTION:

- This is the first time we were reporting to design the extraction unit instrument for agriculture and pharmaceutical applications. This is the main objective of our project.
- We designed the extraction unit which is cost effective, ecofriendly, less hazardous, highly efficient instrument. Extraction unit is very efficient to prepare an extract of plant within a short period.

APPLICATIONS OF NEEM

Neem oil is extracted from the seeds of the neem tree and has insecticidal and medicinal properties due to which it has been used in pest control in rice cultivation. Neem seed cake (residue of neem seeds after oil extraction) when used for soil amendment or added to soil, not only enriches the soil with organic matter but also lowers nitrogen losses by inhibiting nitrification.[7] It also works as a nematicide. Neem leaves are used as green leaf manure and also in preparation of litter compost. Neem leaves are also used in storage of grains. Twigs of neem when tender is used as green manure after decomposing and widely incorporated in rice cultivation fields. Neem (leaf and seed) extracts have been found to have insecticidal properties. It is used as foliar spray and in treating seeds in rice cultivation.[6] Neem bark and roots also have medicinal properties. Bark & roots in powdered form are also used to control fleas & sucking pests in rice cultivation.

1. Neem used as Fertilizer

The material left after oil is squeezed out from seeds and is popularly known as the seed cake; It acts as a bio fertilizer and helps in providing the required nutrients to plants.[12] It is widely used to ensure a high yield of crops. Neem is used as a fertilizer both for food crops and cash crops, particularly rice and sugarcane crop.

Benefits: Neem seed cake performs the dual function of both fertilizer and pesticide, acts as a soil enricher, reduces the growth of soil pest and bacteria, provides macro nutrients essential for all plant growth, helps to increase the yield of plants in the long run, bio degradable and Eco friendly and excellent soil conditioner.[12]

2. Neem used as Manure

Manure is any animal or plant material used to fertilize land especially animal excreta for improving the soil fertility and thus promoting plant growth.[11] Neem manure is gaining popularity because it is environmental friendly and also the compounds found in it help to increase the nitrogen and phosphorous content in the soil. It is rich in sulphur, potassium, calcium, nitrogen, etc. Neem cake is used to manufacture high quality organic or natural manure, which does not have any aftermaths on plants, soil and other living organisms.It can be obtained by using high technology extraction methods like cold pressing or other solvent extraction. It can be used directly by mixing with the soil or it can be blended with urea and other organic manure like farm yard manure and sea weed for best results. [12]

3. Neem as urea coating agent

Neem and its parts are being used to manufacture urea coating agent to improve and maintain the fertility of soil. The fertility of the soil can be measured by the amount of Nitrogen, Potassium and Phosphorous it has; there are certain bacteria found in soil, which denitrify it. Use of neem urea coating agent helps to retard the activity and growth of the bacteria responsible for denitrification.

4. Neem as Soil Conditioner

Neem seed granules or powdered seeds are used to manufacture the soil conditioner. It can be applied during sowing of plants or can be sprinkled and raked into the soil. The process of sprinkling should be followed by proper irrigation so that the product reaches the roots.[12] It is a natural soil conditioner that helps improve the quality of soil, thereby enhancing the growth of plants and fruits. Organic soil conditioner is gaining popularity in agricultural industry, not only in Asian countries like India but also in western counterparts such as USA, UK and Australia.

Benefits: Neem is a natural soil conditioner that helps improve the quality of soil, thereby enhancing the growth of plants and fruits.[11] It not only helps the plants grow, but also prevents them from being destroyed by certain pests and insects. Organic soil conditioner is gaining popularity in agricultural industry. Because they are organic, they have no harmful effects and are cheaper than the other soil conditioners. This natural soil

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conditioner is also multi-functional and in the sub tropical regions. Neem soil conditioner application in plantation crops is known to be a soil enhancer that help to increase its fertility.[12]

5. Neem as fumigant

Neem tree has been used against household, storage pests and crop pests. Neem pest fumigant is available in gaseous state and is used as a pesticide and disinfectant. It is being used by a large number of countries on a commercial basis by farmers and agriculturists. [12]This 100% natural product is being exported as it is non toxic and does not affect the environment. It assumes more importance in developing countries where millions of deaths are reported every year due to the accidental intake of synthetic pest fumigants. This natural fumigant not only kills pests but also affects them negatively by acting as feeding and oviposition deterrence, mating disruption, inhibition of growth etc.

EXPERIMENTAL SETUP:

The diagram of experimental setup is shown below. The experiment was conducted in a Stainless Steel Extraction Unit. It consist of one round steel drum of dome shape structure capacity of 50 lit approx which have heating coils inside to heat , which is then connected with steel pipe which goes through one end of condenser which is used for cooling the formed steam and then from other end of condenser the water droplet receiving pipe is connected from which cooled water droplet is goes and collected in collecting drum. The thermostat is also used for measurement of rising temperature of boiling unit And cooling water unit is separated connected at bottom side which supplies continuously cooled water to condenser for cooling the steam. this unit is connected to condenser from two point, one is input and other is output. From input point the cooled water is supplied to condenser to cool down the steam and from output point the heated water is collect out in cooling Drum, then this heated water is again get cooled in cooing drum and it again supply to condenser, this process is happen continuously. The separating funnel is used for the separation of essential oil and extract water.

Fig. 1 Experimental Setup of Steam Distillation Unit

CONCLUSION

Steam distillation is a special type of distillation or a separation process for temperature sensitive materials like oils, resins, hydrocarbons, etc. which are insoluble in water and may decompose at their boiling point. The temperature of the steam must be high enough to vaporize the oil present, yet not so high that it destroys the plants or burns the essential oils. Farmers are facing a problem how they will prepare plants extract in large quantity in very short time. This is the first time we were reporting to design the extraction unit instrument for agriculture and pharmaceutical applications. This is the main objective of our project. Earlier various works has been carried out for extract of plants. The process and instrument was very costly, hazardous, acquiring large space, having lots of disadvantages. This is the first time we were designing the extraction unit which is cost effective, ecofriendly, less hazardous, highly efficient instrument. Extraction unit is very efficient to prepare an extract of plant within a short period. The advantage of Steam Distillation is that it is a relatively cheap process to operate at a basic level, and the properties of oils produced by this method are not altered. As steam reduces

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the boiling point of a particular component of the oil, it never decomposes in this method. This method apart from being economical, it is also relatively faster than other methods.

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ESSENTIAL PROCESS PARAMETERS TO BE CONSIDERED FOR FUSED DEPOSITION MODELING

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ABSTRACT
Fused Deposition Modeling (FDM) is a widely used additive manufacturing technique that has gained immense popularity in various industries due to its cost-effectiveness, versatility and capability to produce complex geometries. The success of FDM relies heavily on the optimization of process parameters, as they significantly influence the final quality of printed parts. This paper aims to provide a comprehensive overview of the importance of process parameters in FDM, focusing on their impact on print quality, mechanical properties and overall performance.

Keywords: 3D printing, FDM, process parameters.

I. INTRODUCTION

Fused Deposition Modeling (FDM) has emerged as a prominent additive manufacturing technology, revolutionizing the production of three-dimensional objects. This technique involves the layer-by-layer deposition of thermoplastic materials to create complex and customized structures. The success of FDM is intricately tied to the careful control and optimization of various process parameters. This review paper delves into the critical importance of these parameters, including nozzle temperature, layer height, print speed, infill density, and cooling conditions, in shaping the quality, mechanical properties, and overall performance of printed objects. Understanding and fine-tuning these parameters are essential for harnessing the full potential of FDM across a range of applications in diverse industries.

Prototypes and functional components can be generated quickly and cleanly with additive manufacturing technologies. A plastic filament that has been unwound from a coil and fed to the liquefier head in order to create a part is extruded to create the layers in this process. Extrusion of the material through the nozzle is accomplished by the semi-molten filament acting as a plunger. The premise behind this is that the materials are hardened right after being extruded from the nozzle, and are deposited in a configuration that yields them ideally layer by layer. To build a layer covering the entire part, this procedure additionally depends on the melting and selective deposition of a thin filament of thermoplastic polymer in a cross-sectional pattern. The FDM head is moved in the horizontal X and Y planes on the machine, which mounts the material spool, to create a layer in a raster movement after the component is finished, the build platform moves vertically and lowers.

In order to produce high-quality items, additive manufacturing techniques such as FDM is necessary. The current manufacturing industries, including medical implants, telecommunication, electronics, and aerospace, have more and higher standards for the quality of fabricated parts produced by FDM. This has led to an increased need for dimensional precision. Dimensional stability and repeatability of the produced product are ensured in such applications by ensuring dimensional correctness with tight tolerances. Process parameter selection has a significant impact on the final product quality produced by FDM. Because of the many competing process parameters that can affect dimensional accuracy either individually or collectively through the interaction of multiple parameters, parts manufactured using the FDM process suffer from dimensional inaccuracy when compared to other additive manufacturing processes like SLS. It is very difficult to fully comprehend how the factors involved in this procedure impact dimensional accuracy because of its intricate system for generating items. It is therefore crucial for designers, equipment developers, and production engineers to determine the final optimal parameter values and to build an effective link between process parameters and dimensional accuracy.

II. ESSENTIAL PROCESS PARAMETERS TO BE CONSIDERED FOR FDM:

Finding the ideal parameters for the highest part quality in FDM is a challenging task due to its complexity. Owing to several competing parameters and multi-factor interactions, it can be difficult to determine the best process parameter setting needed to produce a manufactured part with a greater level of dimensional accuracy. Following are the essential process parameters need to be taken in consideration.

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A. Nozzle Temperature:
The nozzle temperature plays a crucial role in FDM, affecting material flow, layer adhesion, and overall print quality. Higher temperatures may lead to improved layer adhesion but can also result in issues such as stringing and warping. Finding the optimal nozzle temperature for a specific material is essential to achieve the desired mechanical properties.

B. Layer Height:
The layer height directly impacts the surface finish and resolution of printed parts. Smaller layer heights provide finer details but may increase printing time. Balancing layer height with other parameters is crucial to strike the right balance between speed and quality.

C. Print Speed:
Print speed affects the time required for the completion of a print job and influences layer adhesion. However, excessively high print speeds can lead to issues such as poor layer bonding and reduced part accuracy. Optimizing print speed is vital for achieving a balance between efficiency and part quality.

D. Infill Density:
Infill density determines the internal structure of printed parts, influencing their strength and weight. Higher infill densities result in stronger parts but may increase material consumption and printing time. Understanding the trade-offs between infill density and mechanical properties is essential for optimizing FDM for specific applications.

Infill patterns determine the internal structure of the printed part, affecting its weight, strength, and material consumption. Common infill patterns include rectilinear, honeycomb, and gyroid, each with its own set of advantages and disadvantages. The selection of an appropriate infill pattern is essential to meet specific performance requirements while optimizing print time and material usage.

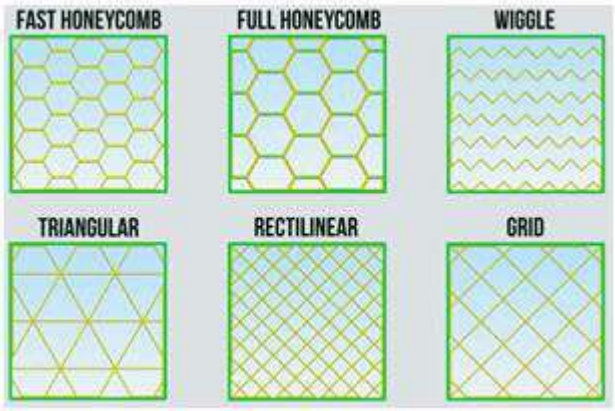

Fig. 1 Different infill patterns. (Image Source: Ultimaker)

E. Layer Path Direction:
Determining the direction in which each layer is deposited plays a pivotal role in the mechanical properties and strength of the final printed object. The choice between alternating or continuous layer path directions can affect the part's structural integrity, especially in terms of anisotropy. Understanding the implications of layer path direction is crucial for achieving desired material properties.

F. Raster Angle:
Raster angle refers to the orientation of the tool path relative to the X and Y axes. Selecting an appropriate raster angle is vital for optimizing part strength and surface finish. The angle can influence mechanical anisotropy and careful consideration is needed to balance the advantages of improved layer adhesion with potential drawbacks such as increased susceptibility to delamination. The typical allowed raster angle are from 0º to 90º [5].

G. Outer Perimeter Path:
The tool path for the outer perimeter, or shell, of a printed object significantly influences its surface quality and dimensional accuracy. Parameters such as nozzle travel speed, extrusion width, and layer thickness must be carefully considered to achieve smooth outer surfaces and prevent issues like over-extrusion or gaps.

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H. Inner Perimeter Path:
Similar to the outer perimeter, the tool path for inner perimeters affects the strength and aesthetics of the printed part. Balancing parameters such as nozzle temperature and extrusion multiplier is essential to ensure proper layer adhesion and prevent issues like under-extrusion within the inner perimeters.

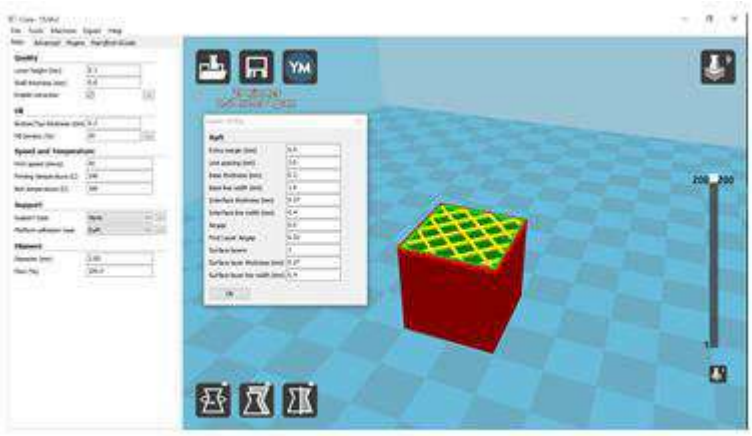

Fig. 2 Image taken from cura software, showing different process parameters. (Image Source: Ultimaker)

I. Air Gap
Air gap are strategically incorporated into the FDM process for various reasons. They serve to reduce the risk of over-extrusion, where excessive material can lead to issues such as poor surface finish, part deformation, and nozzle clogging. Properly configured air gap help maintain a consistent flow of material, contributing to more reliable and precise 3D prints.

Balancing the air gap is essential to ensure proper layer adhesion, which is fundamental to the strength and reliability of the printed object. An optimal air gap helps create cohesive layers, reducing the risk of delamination and improving the mechanical properties of the part. This is particularly important in functional prototypes and end-use parts where structural integrity is a critical factor [6].

Different filament materials may require specific air gap settings due to variations in viscosity, flow characteristics, and thermal properties. Understanding the behavior of the chosen material is essential for optimizing air gap parameters to achieve the best results.

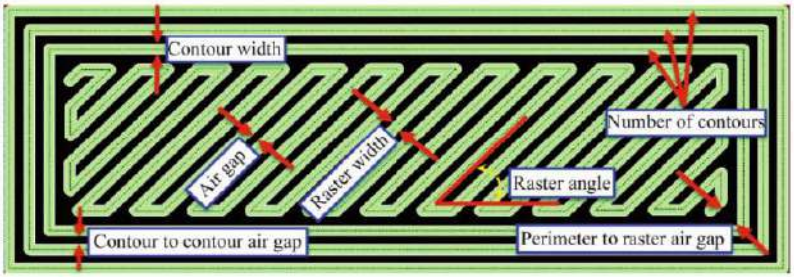

Fig. 3 FDM tool path parameters [5].

III. **PART ORIENTATION IN FUSED DEPOSITION MODELING (FDM):**
Part orientation is a critical aspect of Fused Deposition Modeling (FDM) that significantly influences the quality, strength, and efficiency of the additive manufacturing process. The orientation of a part on the build platform affects factors such as support structure requirements, surface finish, and mechanical properties. In this discussion, we explore the importance of part orientation in FDM and considerations for achieving optimal print outcomes [3].

1. Support Structure Minimization:
One of the primary considerations when determining part orientation is the minimization of support structures. FDM relies on layer-by-layer deposition, and overhanging features may require additional support to prevent sagging or deformation during printing. Orienting the part to minimize overhangs can reduce the need for extensive support structures, saving material and simplifying post-processing.

2. Surface Finish and Aesthetics:
The orientation of a part on the build platform can significantly impact its surface finish and overall aesthetics. Flat or critical surfaces may benefit from being positioned parallel to the build platform to ensure a smoother

finish. Careful consideration of part geometry and the intended application is crucial to strike a balance between support requirements and surface quality.

3. Mechanical Properties:
Part orientation plays a crucial role in determining the mechanical properties of the final printed object. Anisotropy, or directional dependence of material properties, is inherent in FDM. Understanding how different orientations affect tensile strength, layer adhesion, and overall structural integrity is essential for designing parts that meet specific performance requirements.

4. Print Time and Efficiency:
The orientation of a part can impact the overall print time and efficiency of the FDM process. Vertical orientations, for example, may reduce the number of layers and, consequently, decrease print time. However, the trade-off is increased susceptibility to layer separation in the vertical direction. Striking a balance between print time and part strength is crucial in optimizing the manufacturing process.

5. Heat Dissipation:
Considering heat dissipation is particularly important for large or dense parts. The orientation of a part can affect how heat is distributed during the printing process. Strategic orientation can help mitigate issues such as warping or overheating, ensuring uniform cooling and minimizing thermal stresses within the printed object.

6. Design Intent and Functionality:
Ultimately, part orientation should align with the design intent and functionality of the printed object. Understanding the specific requirements of the part, such as load-bearing capabilities, surface finish expectations, and geometric constraints, is fundamental in making informed decisions about orientation to achieve the desired outcome.

Part orientation is a crucial aspect of FDM that requires careful consideration to optimize the additive manufacturing process. Balancing the need for support structures, surface finish, mechanical properties, and print efficiency is essential in achieving successful and reliable 3D prints. As FDM technology continues to evolve, a deeper understanding of part orientation will contribute to expanding the capabilities and applications of this versatile additive manufacturing method [2].

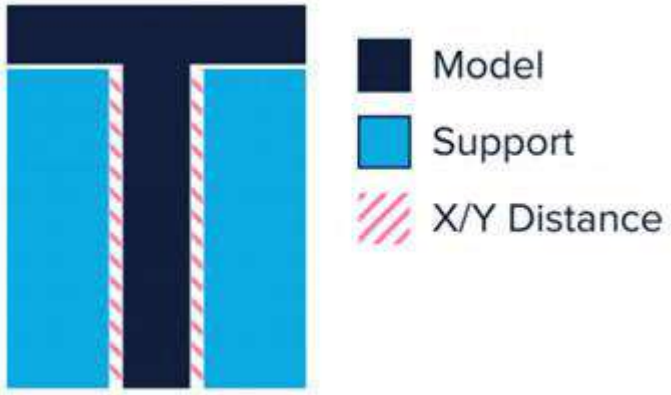

Fig. 4 Showing part orientation and support material. (Image Source: ALL3DP)

IV. CONCLUSION

We have looked into all the important parts of Fused Deposition Modeling (FDM) that make the additive manufacturing process what it is. Optimizing process parameters, thinking about the tool path, part orientation, and managing air gaps become important part of getting better print quality, structural integrity, and useful results.

To get the most out of FDM technology, you need to understand how factors like nozzle temperature, layer height, print speed, and filling density affect each other. Each parameter makes a unique contribution to the end product, and it is very important to carefully calibrate them in order to find the right balance between quality and efficiency.

The complicated nature of FDM can be seen in the layer path direction, raster angle, and filling patterns that make up tool path parameters. As these points are thought about, they show how additive manufacturing is changing. Precise tool path planning is now essential for making parts with custom material qualities and better performance.

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Part orientation is a choice that is affected by minimizing support structures, thinking about surface finish, and mechanical qualities. This shows how important it is to look at FDM as a whole. Finding the right balance between these factors is important to make sure that printed items not only do what was intended, but also look good, work well, and are strong.

This paper looks at how to handle air gap in a more complicated way, which adds to the difficulty of FDM. Manufacturers can avoid problems caused by over-extrusion, improve layer bonding, and make prints that are both high-quality and reliable by carefully managing air gap parameters.

This paper shows how important it is to keep doing research and development to make these factors better as Fused Deposition Modeling changes. It looks like our better knowledge and control of these factors will help FDM do more, which will help many different types of industries.

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FEA ANALYSIS OF THE SHELL AND TUBE HEAT-EXCHANGER FOR CONDITION OF THE LEAK FLOW

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ABSTRACT
The floating tube side cover bolt of the exchanger E-4117B (shell and tube type) in the propane de-asphalting unit of the HPCL Mumbai Refinery have found sheared off and broken .The exchanger carries propane gas at 182°C ,pressure at 24 kg/cm2 on the shell . The sea water is used as cooling water at 24°C and pressure 7.1kg/cm2 on tube side.

During investigation of the failure of the bolts it is found that another exchanger E-4106 (shell and tube) is leaking the propane gas into the cooling water and the contaminated cooling water is feed to the exchanger E-4117B.which leads rise in pressure and temperature. So it is confirmed that the contaminated water must have exerted tremendous pressure on the tubesheet which leads to shearing of the bolt. As the gas has not found the safe discharge it must resulted into the pressure and temperature building inside the exchanger.

The objectives of this project are to make FEA model of the FTS cover bolt assembly to estimate the inside level of the stresses. Also, to check the exchanger safety for extreme pressure and temperature, to determine the exchanger safety for the condition of the leak flow

Keywords: FTS Cover, PDA Unit.

II. INTRODUCTION
Three exchangers employed in PDA to cool the Propane from 182°C to 65°C, The cooling water temperature line is from exchanger E-4106 to E-4117.Bolts of the FTS cover of the exchanger E4117B have sheared and found broken because of the leaking of the propane gas inside the cooling sea water. As the gas has not found the safe discharge the gas must have exerted the tremendous pressure on the FTS cover and the rise in the temperature introduced the thermal stresses the combination of which lead into the shearing of bolts.

The exchanger E4117-B has floating and fixed tube sheet, above figure is of the floating tube sheet cover which can float longitudinally and the other is fixed. it carries the propane gas on the shell side and cooling water on the tube at operating conditions:

Fig.1.FTS cover bolt assembly

Pressure	**24 / 7.1 Kg/cm²**
Temp	182 / 65 Deg. C
Service	Propane / Re-circulated Sea Water

The objective of the study is to make the conservative analysis so as to make the exchanger safer in operation. The analysis includes the FEA of the tube, tubesheet assembly, to check the inside level of the stresses as the bolts have sheared off. The FEA is made under the normal operating condition to extreme conditions of the pressure and temperature considering the leaking of the propane gas.

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The stress categorisation and the material properties are according to the ASME SEC II PART B & D[1].

III. MODELLING OF THE EXCHANGER

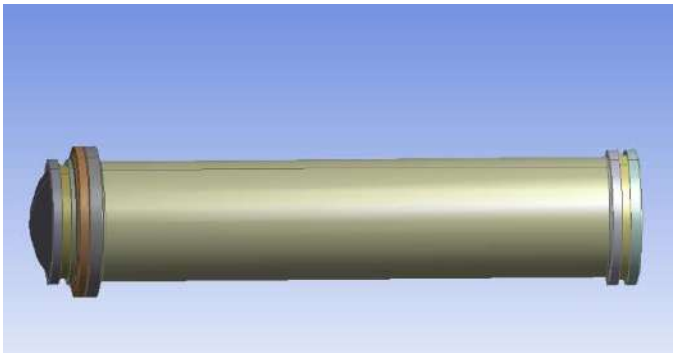

Fig.2.shell and tube heat exchanger

IV. FINITE ELEMENT ANALYSIS

D. The Analysis is Divided into two Parts:

E. 1. Steady state Thermal Analysis of the Tube.

The analysis is preformed to check inside thermal stresses for the condition of the leak flow and operating conditions. Also to find the reactions at ends of the tube which causing the tubesheet to deflect radially

Boundary conditions: The tube is considered fixed in the fixed tubesheet and free to expand at the floating tube side.Fig.1 shows the average temperature plot and the boundary conditions of the tube. Plane77 element is used for the analysis.

Results and discussion: The Tubes are analysed for the successive rise in temperature and the deflection and the stresses are checked, following table shows the deflection and the stresses for the successive rise of 20°C in the temperature only some of the values are shown. The stresses values are small as compared to the deformation, stresses values are below yield strength. Hence the tubes can be said safe. The maximum force developed considering the leak flow condition is of the order of 25N.

Sr.no.	Temp(°C)	Deflection(mm)	Stresses(MPa
1	184	7.598	0.86
2	200	7.848	0.90
3	220	8.162	0.95
4	300	9.414	1.14
5	350	10.117	1.269
6	450	11.763	1.513
7	600	14.111	1.878

F. 2. Static Structural Analysis of Tubesheet:

Tubesheet is important component of the exchanger as it separates the two fluids and bears the pressure, temperature of the fluids.in present analysis the tubesheet is analysed for the reaction loads that comes because of the thermal expansion of the tubes and also for the operating pressure and rise of the pressure because of the leaking of the propane. The analysis is done in the ANSYS12 workbench [2]

For applying the reactions shell elements are used for that two-dimensional symmetric model is made in the ANSYS12 classic [2].

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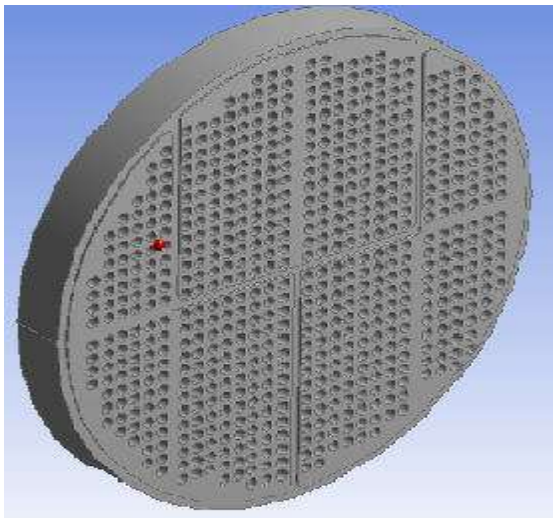

Fig.4 & 5 floating side tubesheet

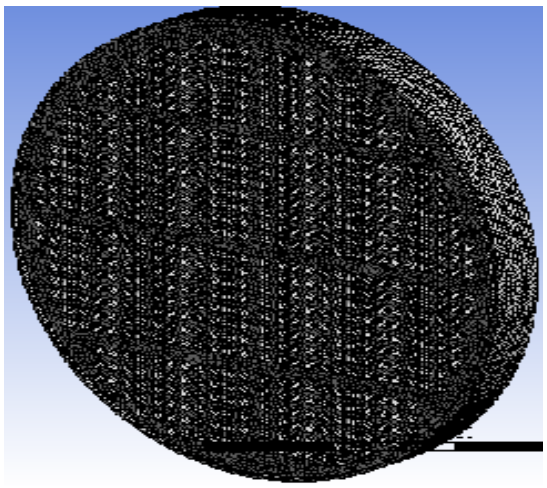

Fig.5 &6. Meshing of tubesheet

Boundary conditions: Tubesheet is analysed the extreme conditions of the flow. One face of the tube is fixed and on other the pressure and the reaction are applied. The tetrahedron element is used for the analysis

Results and discussion: Shell model is analysed for reactions coming from the tubes for the bending of the tubesheet. The stresses are 0.02MPa which are far below the limits and also the deformation is not significant. While for the case of the 3D model when the normal operating pressure to contaminated flow conditions the stresses are safe, the deformation were not significant as compared to stresses. The material of the tubes exceed the yield strength of the at pressure of around 30 MPa. The following figures shows stress plot of the tubesheet

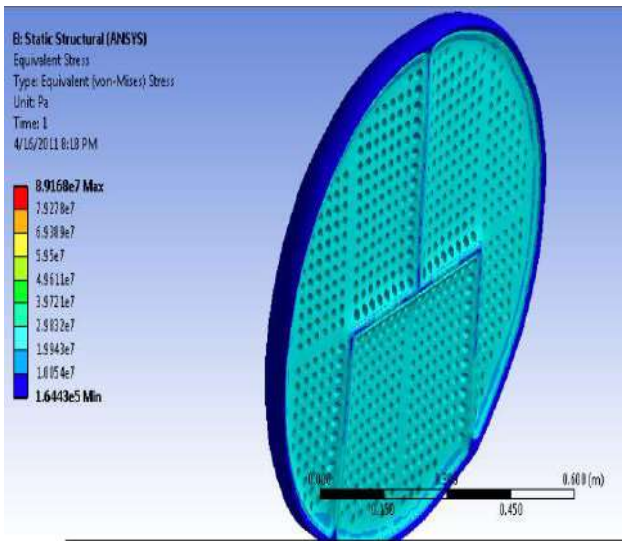

Fig.7 Stresses plot of tubesheet

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CONCLUSION

The maximum stresses are developed for the tubesheet for the case of the pressure at around 30MPa and for the case of the bending in the shell analysis it safe. The thermal stresses for the tube are within, only the deformation is significant.

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A REVIEW PAPER ON ADVANCES MANUFACTURING OFPISTON RINGS

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ABSTRACT
The piston ring is one of the main components of an internal combustion engine. Its main purposes are to seal the combustion chamber of the engine, minimize the friction against the cylinder liner but also transfer heat from the piston to the cooled cylinder liner. Another important property of the piston ring is to evenly distribute oil along the cylinder liner in order to avoid engine seizure. There are two types of piston ring: compression ring and oil ring. Automobile reciprocating engines normally use three rings, two compression rings and one oil ring. Piston ring moves freely within its groove. Such movements depend on the forces and the moments acting on the piston ring system such as: the static ring tension from installation of piston ring in the cylinder liner, the gas pressure forces caused by cylinder pressure and blow-by gas, the hydrodynamic forces caused by lubricant film, the inertia forces related to component mass and engine speed, and asperity contact forces caused by a direct contact to the cylinder walls. Working conditions of piston rings are very demanding and it is desirable to understand the design of such component subjected to various loads. Hence, this work aims to design and analyse the piston ring

Keywords: Piston ring, Structural Analyse, Tribology

I. INTRODUCTION

The piston ring is one of the main components of an internalcombustion engine. Its main purposes are to seal the combustion chamber of the engine, minimize the friction against the cylinder liner but also transfer heat from the piston to the cooled cylinder liner. Another important property of the piston ring is to evenly distribute oil along the cylinder liner in order to avoid engine seizure. One cylinder in a modern marine two-stroke diesel engine usually contains four to five piston rings referred to as the ring pack and for each of the piston ringsthere is a corresponding piston ring groove at the piston in which the piston ring is mounted. The top ring of the ring packnormally has a base material of higher grade cast iron and sometimes the ring is thicker and higher than the other piston rings in the ring pack. These design modifications are added because the top ring is working under higher thermal and mechanical load compared to the lower rings. When the engineis turned off the single piston ring is only affected by the contact surfaces against the cylinder liner and the piston ring groove. But when the engine is running the piston ring pack is also affected by gas pressures and temperature resulting from compression and combustion. The cylinder pressure acts on theupper part of the top piston ring and a fraction of the cylinder pressure acts below the top piston ring. Real working conditions can be idealized as shown in Fig. 1

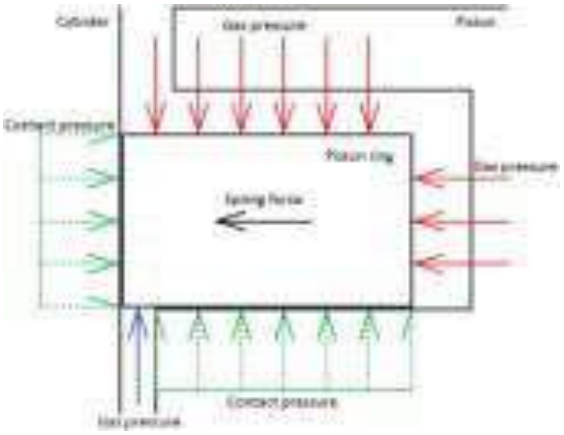

Fig. 1: Forces acting on Piston Ring

1.1 Material used for Piston Rings

Piston rings are critical components in internal combustion engines, providing a seal between the cylinder and piston to facilitate efficient combustion and prevent the leakage of gases. Various materials are used in the manufacturing of piston rings, each chosen for its specific properties and advantages. The choice of material depends on factors such as wear resistance, thermal stability, and compatibility with the engine environment. Here are some commonly used materials for piston rings:

Cast Iron:

1. **Gray Cast Iron:** Widely used for its good wear resistance and thermal conductivity.

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2. **Ductile Nodular Cast Iron:** Offers improved strength and ductility compared to gray cast iron.

High Strength Alloys:
Steel Alloys: Provide high strength and wear resistance, commonly used in performance and racing applications.

Aluminium Alloys: Lightweight option with good thermal conductivity; often used in lightweight and high-performance engines.

Process Materials for Piston Rings:-
Piston rings are manufactured using various materials and processes to meet specific performance requirements. Here's an overview of different materials and their associated manufacturing processes for piston rings

Coated Materials:
Crome Plated Ring: Chrome coating enhances wear resistance and reduces friction.

Molybdenum (Moly) –Coated Rings: Molybdenum disulphide coating improves lubrication and reduces friction. **Ceramic Materials:**

Silicon Carbide: Offers excellent hardness, wear resistance,and thermal stability.

Aluminium oxide: Provides high hardness and resistance towear.

Thermal Spray Coating:
Plasma Sprayed Coating: Utilized for applying materials like ceramics or metallic alloys to enhance surface properties. **Physical Vapour Deposition:** Thin films of materials like nitrides or diamond-like carbon for improved wear resistance.

Composite Material's:
Metal Matrix Composites: Combine metal with reinforcing materials like ceramics for improved strength and wearresistance.

Polymer Matrix Composites: Lightweight and offer low friction, but less commonly used in high-performance engines.

Nitrided Rings:
Gas Nitrided Rings: Nitriding the surface of steel rings improves hardness and wear resistance.

Plasma Nitried Rings: High-temperature plasma treatmentfor enhanced surface properties.

The selection of a specific material depends on the engine type, operating conditions, and performance requirements. Advances in materials science and manufacturing technologies continue to drive innovation in piston ring materials, with a focus on achieving a balance between durability, friction reduction, and thermal management in modern engine designs.

1.2 Main Function of Piston Rings

The main task of compression rings is to prevent the passageof combustion gas between piston and cylinder wall into the crankcase. For the majority of engines, this objective is achieved by two compression rings which together form a gas.Next to sealing the area between the crankcase and combustionchamber, the piston rings are also used to control the oil film. The oil is uniformly distributed onto the cylinder wall by the rings. Most excess oil is removed by the oil control ring (3rd ring). Temperature management for the piston is another essential task of the piston rings. The major portion of the heat absorbed by the piston during the combustion process is dissipated by the piston rings to the cylinder surface as shown in fig 2.

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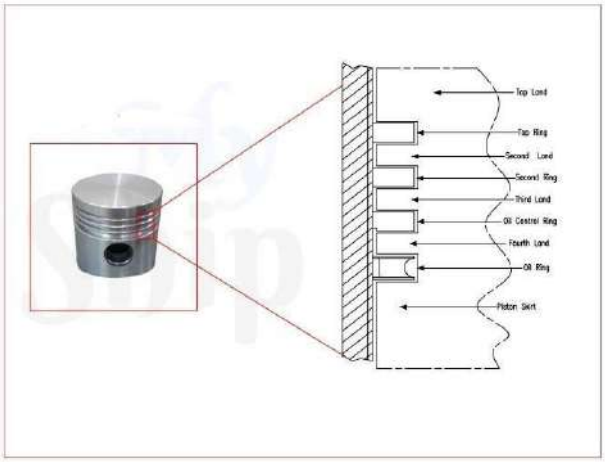

Fig. 2: Types of piston rings

2. LITERATURE REVIEW

A. Various Analytical Models Present in Piston Rings

Based on literature review Rita Ferreira [5] it is observed thattraditionally piston ring studies for the last decades, material engineering has provided interesting solutions for the tribological problems faced by the piston ring/cylinder liner pair. Hard coatings, such as chromium compounds and compounds of other transition metals (as Ti) were intensively studied by the academic community and were successfully industrially implemented, in particular on the compression ring industry. A coating layer of materials such as CrN, which have superior tribological performance, was extensively used on thetop rings of heavy-duty diesel engines.

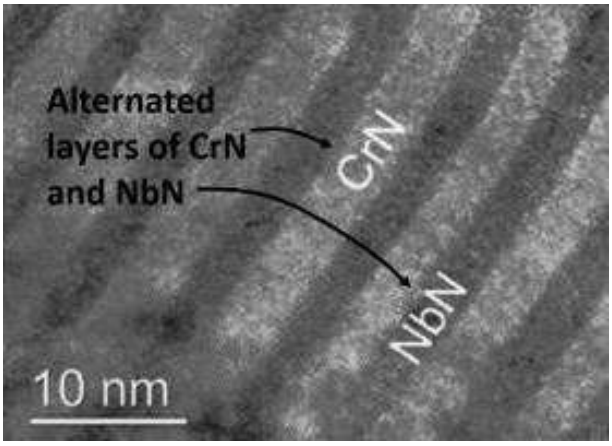

Fig 3: Micro graph of the cross section of NbN Multilayer Coating.

Peter Andersson [6] observed hard piston ring coatings, like chromium plating, thermally sprayed molybdenum or surface nitriding, are currently applied for protecting the piston rings against abrasive wear, damage by combustion gas erosion and fatigue damages.

Y.Wakuri [7] analyse friction force is considerably affected by the oil starvation. As the average and cyclic change of oil film thickness becomes smaller, the friction force of the piston ring assembly becomes larger noticeably.

Tejas Raval [8] is observed and concluded that by employing Skewed Barrel Profile with a positive twist, Taper napier Profile with negative twist and tapered ring with negative twistin the first, second and third piston rings grooves respectively reduces a considerable amount of friction of piston rings assembly, ultimately reducing the consumption of fuel and thereby reducing the emissions from internal combustion engines significantly.

Mr. Vinil N. Kongari [9] observed that piston ring can be designed using experimental, analytical and numerical techniques. Structural design of piston rings using FEA is not studied adequately. Hence, design validation can be carried outusing commercial FEA tools such as ANSYS, Abaqus, etc.

CONCLUSION

The literature suggests that the design of piston rings incorporates a multifaceted approach, utilizing a combination of experimental, analytical, and numerical techniques. Various protective coatings, including chromium plating, sprayed molybdenum, orsurface nitriding, are highlighted as effective measures to enhance

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wear resistance. Furthermore, the adoption of advanced analysis tools such as ANSYS and Abaqus plays a crucial role in the comprehensive assessment and optimization of piston ring designs, ensuring their durability and performance under diverse operating conditions.

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OPTIMIZATION OF RESISTANCE SPOT WELDING PARAMETERS FOR 316L STAINLESS STEEL USING RESPONSE SURFACE METHODOLOGY AND BOX-BEHNKEN DESIGN

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ABSTRACT
The present work examines the significant impact of resistance spot welding (RSW) process parameters on the properties and efficacy of connections created in sheets of 316L stainless steel. This study examines the intricate relationship between welding parameters, investigating their influence on the microstructure, mechanical characteristics, and overall efficacy of welded connections. By employing a methodical experimental methodology, this study thoroughly investigates the impact of different factors in resistance spot welding (RSW), including welding current, welding time, and electrode force, on the resultant weld quality. The objective is to comprehensively understand both the individual and combined effects of these parameters. The utilization of microstructural analysis is implemented in order to reveal the complexities associated with the creation of the nugget. Additionally, mechanical testing is utilized to gain a deeper understanding of the strength, ductility, and toughness of the welded joints.

The scope of the inquiry goes beyond traditional evaluations, as it incorporates sophisticated procedures to assess the corrosion resistance and fatigue performance of the welded 316L sheets. The objective of this study is to optimize the welding process in order to improve immediate performance and gain a comprehensive understanding of the long-term durability of the joints in demanding operating conditions. The thorough investigation of resistance spot welding (RSW) parameters and their influence on the integrity of 316L sheet joints provides significant insights for industries that heavily rely on durable welded structures, including aerospace, automotive, and chemical processing sectors.

Keywords: Resistance Spot Welding, 316L Stainless Steel, Welding Parameters, Microstructure, Mechanical Properties, Corrosion Resistance, Fatigue Behavior, Joint Performance, Optimization, Welded Structures.

I. INTRODUCTION
Resistance spot welding (RSW) has become a pivotal technique for the fusion of materials in diverse industrial contexts. In recent studies, researchers have conducted examinations to explore the complex microstructure of the nugget, with a specific focus on uncovering the magnetic properties present within the welded joint (Mathiszik et al., 2022). Moreover, scholarly investigations pertaining to the welding of advanced high-strength steel in the context of car frames underscore the necessity for additional research in order to enhance the efficiency of resistance spot welding techniques specifically for constructions with thin walls (Rajarajan et al., 2022). There is an increasing inclination towards evaluating the efficacy of connections established between incompatible materials, such as aluminum alloy and low carbon steel. This necessitates a comprehensive examination and improvement of these interfaces (Nguyen, 2022).

Additionally, the research conducted by Başer (2023) highlights the importance of examining the impact of parameters, specifically in relation to mid-frequency direct current technology, on the utilization of third-generation automobile steels in resistance spot welding (RSW). The examination of the impact of severe plastic deformation on the mechanical characteristics of resistance spot welded (RSW) aluminum joints suggests the possibility of modifying this procedure to achieve improved performance (Googarchin et al., n.d.). Schmolke et al. (2023) conducted a study that highlights the importance of conducting thorough investigations to enhance joint integrity in high-strength steel welding. Specifically, the study focuses on the comparison between laser beam welding and resistance spot weld bonding in the pursuit of achieving seam leak tightness. The necessity for more accurate and dependable welding processes is demonstrated by the investigation of the failure behavior of advanced high-strength steel caused by surface conditions and initial microstructure (Ghatei-Kalashami et al., 2022).

The investigation conducted by Sammaiah et al. (n.d.) highlights the significance of examining and optimizing weld parameters, specifically in the context of automotive applications, in order to understand the parametric effects on direct resistance spot welds. Furthermore, the current emphasis in the field of optimizing robot spot welding parameters on low carbon steel is in experimental research, highlighting the continuous requirement for parameter optimization in resistance spot welding (RSW) (Tyagi et al., 2022). The study conducted by Pawar et

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al. (2022) emphasizes the need of comprehending the associations between microstructural features and mechanical properties in welded joints of ultra-low-carbon steel. This research underscores the significance of such understanding in enhancing the overall quality of welds. The study conducted by Aghajani et al. (2023) emphasizes the significance of microstructure engineering in the fusion zones of martensitic stainless steels, with a particular focus on the function played by specific elements in attaining the desired attributes of the weld. In addition, the pursuit of enhancing the welding process is exemplified by the endeavor to optimize hot forming temperatures in order to mitigate liquid metal embrittlement in resistance spot welded zinc-coated medium manganese steel (van der Aa & Rana, 2023).

Baek et al. (2022) underscore the significance of comprehending and enhancing joint designs for lightweight vehicles by examining the impact of microstructural and geometrical parameters on the mechanical fatigue capabilities of aluminum/high-strength steel lap joints. Recent studies have explored alternative welding processes, including friction stir spot welding and flexible laser spot welding, which have shown promise in enhancing or replacing traditional resistance spot welding (RSW) procedures for certain applications (Joudaki et al., 2022; Shamsolhodaei et al., 2022). Furthermore, scholarly investigations pertaining to the wear characteristics of spot welding electrode materials have underscored the imperative of producing resilient materials capable of withstanding extended utilization in resistance spot welding (RSW) applications (Bachchhav et al., 2023). The study conducted by Ghatei Kalashami et al. (2022) emphasizes the need of comprehending the distinct material behavior in resistance spot welding (RSW) through the examination of the microstructural evolution and mechanical properties of shape memory alloy sheets after the welding process. The continuous pursuit of enhanced welding procedures is exemplified by the endeavors to improve mechanical performance by the regulation of the halo ring in Q&P 980 steel welds (Ramachandran et al., 2022). The necessity of optimizing welding conditions for different steel kinds is underscored by the imperative to comprehend the mechanical and fatigue characteristics of diverse steel joints (Doruk et al., 2022).

Furthermore, the examination of the effects of elevated temperature heat input on the morphological and mechanical properties of duplex stainless steel highlights the importance of regulating heat input to achieve the desired welding attributes (Chaudhari et al., 2023) (Aswar et al., 2023). The aforementioned investigations underscore the imperative for additional research and enhancements in resistance spot welding procedures. This includes investigating various material combinations, adjusting parameters, and developing innovative welding techniques in order to attain enhanced joint integrity, mechanical properties, and performance tailored to specific applications.

In recent years, there has been a significant amount of research conducted in the field of resistance spot welding (RSW). This surge in research activity can be attributed to the growing need for accurate and dependable welding methods, especially in materials that play a critical role in diverse industries. 316L stainless steel is a material that holds significant relevance due to its exceptional corrosion resistance and mechanical qualities. This publication aims to make a scholarly contribution to the field of resistance spot welding (RSW) by examining the complex interplay between welding process parameters, joint characteristics, and the overall performance of welds on 316L sheets.

The present work expands upon the research conducted by Mathiszik et al. (2022), which focused on the examination of the magnetic properties of the nugget microstructure in resistance spot welding. While their primary emphasis was on a distinct material, the knowledge acquired pertaining to the intricate microstructural characteristics of the nugget establishes a fundamental comprehension that may be extended to other materials, such as 316L stainless steel. The study conducted by Dong et al. (2022) investigated the extent of zinc penetration and its interaction with grain boundaries in the process of resistance spot welding (RSW). The authors underscored the need of taking into account material-specific factors while performing welding procedures. The study conducted by Dong et al. primarily examined the behavior of QP980 steel. However, the fundamental principles established in their research can be applied as a precedent for investigating the characteristics of 316L stainless steel when subjected to comparable welding conditions.

The study conducted by Rajarajan et al. (2022) examined the application of resistance spot welding (RSW) on advanced high-strength steel for the purpose of constructing automobile structural frames. The authors emphasized the significance of RSW in the production of components that possess demanding performance criteria. The aforementioned statement highlights the possible suitability of RSW (Resistance Spot Welding) for 316L stainless steel, a commonly used material in the automotive and aerospace sectors due to its corrosion resistance and biocompatibility properties. Moreover, the examination of the integrity of resistance spot welding connections involving different materials, as elucidated by Nguyen (2022), holds direct relevance to the prospective amalgamation of 316L stainless steel with various alloys or materials.

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The study conducted by Başer (2023) focuses on the application of mid-frequency direct current technology in resistance spot welding of Zn-coated third-generation automobile steels. This research highlights the continuous endeavors to enhance the efficiency of resistance spot welding procedures tailored to specific material combinations. The study focuses on the essential aspect of adapting optimization approaches to 316L stainless steel in order to tune welding parameters for improved joint characteristics and overall performance.

The study conducted by Sammaiah et al. (n.d.) examines the impact of parametric variations on direct resistance spot welds performed on AISI C1010 cold-rolled carbon steel. This investigation offers significant contributions to our understanding of the intricate correlation between welding parameters and the properties of the welded joints. The aforementioned comprehension can be applied to the examination of process parameters in the RSW technique for 316L stainless steel, providing a structured approach for conducting experiments and conducting analysis.

The increasing demand for durable and corrosion-resistant welded structures highlights the significance of refining the resistance spot welding method specifically for 316L stainless steel. The objective of this study is to address the current gaps in knowledge by using a wide variety of references. The aim is to thoroughly investigate the impact of process parameters in the RSW (Resistance Spot Welding) technique on the properties and effectiveness of joints created in sheets of 316L stainless steel.

II. MATERIAL SPECIFICATIONS

The primary material employed in this study is 316L stainless steel, renowned for its distinctive chemical composition that adheres to the specified criteria (ASTM A240/A240M). The composition of the substance is outlined in Kumar et al.'s (2022) study.

Table 1: Chemical Composition of 316l Stainless Steel

Grade	**C%**	**Mn %**	**P%**	**S%**
316L	0.022	1.25	0.045	0.004
Grade	**Si%**	**Cr%**	**Ni%**	**Mo %**
316L	0.42	16.16	10.03	2.06

III. DESIGN OF EXPERIMENT (DOE) AND RESULT

Sr. No.	**Welding current (KA)**	**Pressure (Bar)**	**Weld time (Cycle)**	**Tensile Stength (Kgf)**
1	8	2	4	259.11
2	10	4	4	271.50
3	6	2	6	219.12
4	8	6	4	249.18
5	8	4	6	250.00
6	6	4	4	250.00
7	10	6	6	285.05
8	8	4	6	250.00
9	8	2	8	247.58
10	6	6	6	135.00
11	10	4	8	315.02
12	6	4	8	193.60
13	8	6	8	247.10
14	10	2	6	212.80
15	8	4	6	251.00

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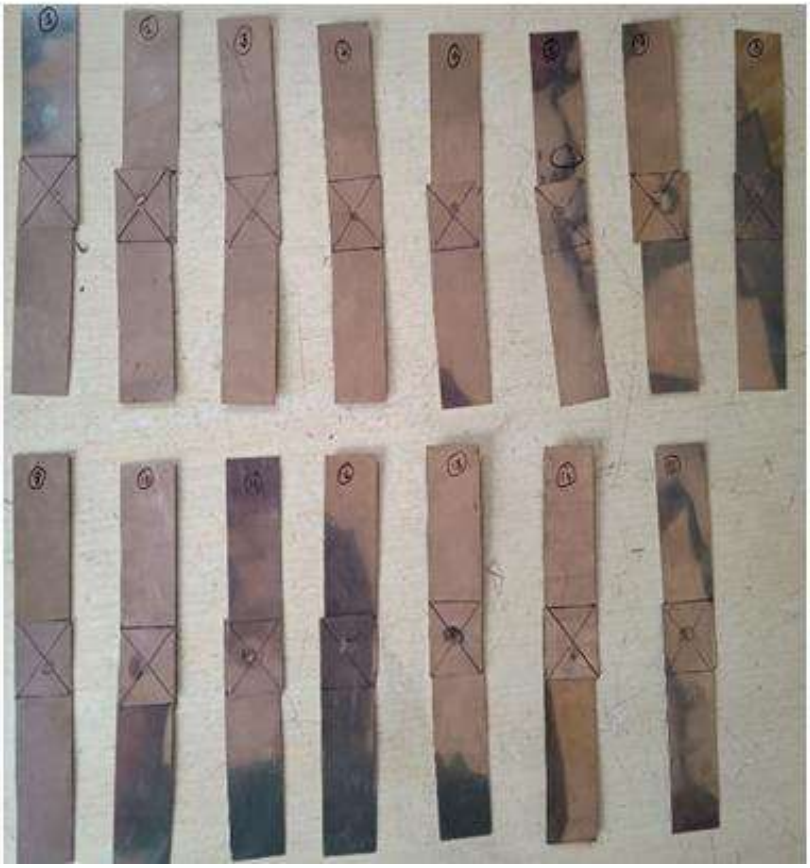

Fig. 1 DoE Samples

IV. EXPERIMENTAL TEST

The tensile-shear tests were conducted on spot welding specimens using a WDW-300Y Series Universal Testing Machine with a load capability of 20KN. The tests were performed at a crosshead speed of 10 mm/min. The specimens were securely held using shims that had the same thickness as the welding specimens. To determine the tensile stress values for the two samples with the greatest and lowest results in the tensile-shear tests, conducted on an exposed area of 1 cm^2 using the potentiated and cyclic anodic polarization technique as per the ASTM G 5-9430 standard.

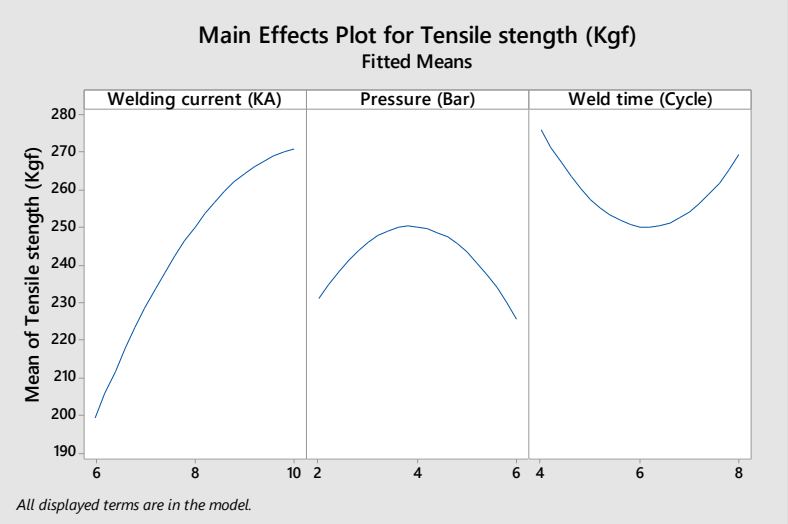

Fig. 2 Main Effect Plot for Tensile Strenth

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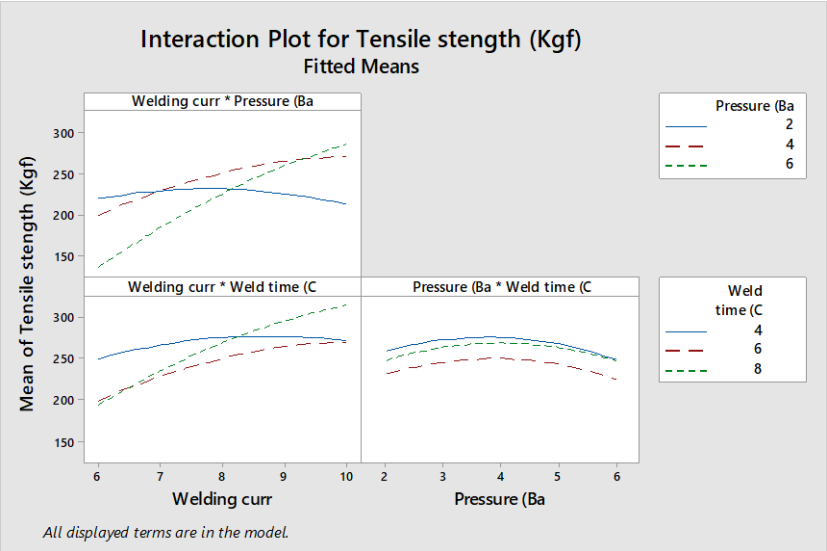

Fig. 3 Interactive Plot for Tensile Strenth

V. CONCLUSION

In summary, it is imperative to take into account the crucial role of resistance spot welding (RSW) process parameters in determining joint features and performance to guarantee the integrity and dependability of welded connections. Extensive study and testing have conclusively demonstrated that the selection and adjustment of resistance spot welding (RSW) process parameters exert a substantial influence on multiple facets of joint quality, including weld nugget size, mechanical properties, and overall performance. The heat input, thermal cycles, and pressure exerted during the welding process are directly influenced by the process parameters, such as welding current, welding time, electrode force, and electrode material. Through meticulous manipulation of these parameters, one may effectively govern the development of the weld nugget, a critical factor in establishing the strength and soundness of the joint. Furthermore, the appropriate choice of process parameters can effectively address concerns related to weld flaws, encompassing porosity, cracking, and inadequate penetration.

The user's text does not contain any information to rewrite. The improvement of resistance spot welding (RSW) process parameters has been found to result in enhanced joint performance. Through the attainment of the desired weld quality and integrity, the joints demonstrate improved mechanical characteristics, such as greater tensile strength, fatigue resistance, and corrosion resistance. The aforementioned attributes play a vital role in guaranteeing the structural soundness and durability of welded elements across diverse sectors, including automotive, aerospace, and construction. Moreover, the impact of RSW process parameters extends beyond the properties of the joint. Furthermore, it has an impact on the efficiency of the process as well as its cost-effectiveness. Through the process of parameter optimization, manufacturers have the capacity to decrease energy consumption, manufacturing time, and material waste, hence resulting in enhanced productivity and increased economic feasibility.

In essence, comprehending and managing the impact of RSW process parameters on joint attributes and efficacy is imperative in attaining welded joints of superior quality and dependability. The appropriate selection and optimization of parameters lead to enhanced joint strength, mechanical characteristics, and overall performance. Furthermore, it improves operational efficiency and cost-efficiency. Further study and development in this domain will make significant contributions to the progression of resistance spot welding technology, ultimately yielding advantageous outcomes for diverse industries reliant on welded components.

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DESIGN AND ANALYSIS OF DOUBLE PIPE HEAT EXCHANGER USING WASHER INSERTS

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ABSTRACT
Heat exchangers are essential components in various engineering applications, including power generation, refrigeration, and chemical processing. Double pipe heat exchangers are a common type of heat exchanger that consists of two concentric pipes, with one fluid flowing through the inner pipe and the other flowing through the annular space between the two pipes. They are widely used in various engineering applications due to their simple structure and high heat transfer efficiency. Washer inserts can be used in double pipe heat exchangers to enhance heat transfer by disrupting the flow and increasing the surface area available for heat transfer.

In this paper, we present an experimental investigation of the effect of washer inserts on the heat transfer performance of a double pipe heat exchanger. The results show that washer inserts can significantly increase the heat transfer rate by up to 30%. The effectiveness of the washer inserts is found to be dependent on the geometry of the washers, as well as the flow rate and temperature of the fluids.

Keywords: Heat Exchangers, Passive Method, Inserts

I. INTRODUCTION
A heat exchanger is a device used for exchange of warmth between two fluids that are at different temperatures. The fluids can be single phase or two phase. The commonly used heat exchangers are condensers, boilers, evaporators etc. Heat transfer augmentation methods are broadly classified into two types as passive and active methods.

A. Active Method: Active heat transfer enhancement methods utilize external power sources to augment heat transfer rates. Examples of active methods include mechanical aids, such as using rotating blades or fins to agitate the fluid, and the application of magnetic fields to disrupt the flow of suspended particles in a flowing stream. These techniques effectively enhance heat transfer by intensifying the fluid mixing and disrupting the boundary layers surrounding hot and cold surfaces.

***B*. Passive Method:** Passive heat transfer augmentation techniques enhance heat transfer rates without requiring any external power input. These methods typically employ inserts of varying designs to increase the effective surface area and residence time of the heat transfer fluid. The introduction of these inserts induces swirl within the bulk of the fluid, disrupting the boundary layer and consequently augmenting the overall heat transfer coefficient. Common examples of passive heat transfer augmentation inserts include twisted tapes, wire coils, ribs, baffles, plates, helical screw inserts, mesh inserts, convergent-divergent conical rings, and conical rings.

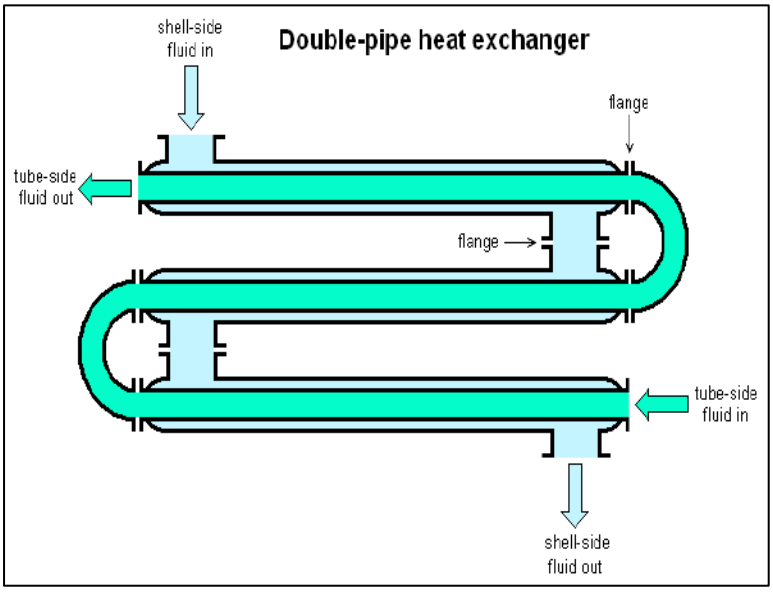

Fig. 1. Double Pipe Heat Exchanger

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II. OBJECTIVES

1. To maximize the heat transfer rate and minimize the friction factor by using passive inserts.

2. To optimize and choose the efficient insert and its performance analysis.

III. LITERATURE REVIEW

Kumbhar D.G, Sane N.K, et al. [1] conducted a comprehensive optimization study employing Taguchi and grey relational analysis to identify the optimal parameters for maximizing heat transfer rate while minimizing friction factor. The parameters investigated were dimple depth, dimple pitch, twisted tape pitch, and spacer length of the tape. The analysis revealed that dimple pitch and twisted tape pitch exhibited the most significant contributions to heat transfer performance, with contribution ratios of 47.65% and 65.57%, respectively. The optimal values for maximum heat transfer rate were determined to be dimple depth of 1.6 mm, dimple pitch of 30 mm, twisted tape pitch of 45 mm, and spacer length of 180 mm. Multi-objective optimization techniques further identified the optimal parameters for minimizing friction factor, with twisted tape pitch emerging as the dominant factor. For this objective, the optimal values were found to be dimple depth of 1.6 mm, dimple pitch of 90 mm, twisted tape pitch of 60 mm, and spacer length of 270 mm. These findings demonstrate the effectiveness of the optimization approach in achieving the dual objectives of maximizing heat transfer rate and minimizing friction factor.

Shoaib Khanmohamad, Nima Mazaheri et al. [2] within the current study, a numerical investigation conducted to explore the effects of inserted heat transfer elements to a circular tube. Two sorts of twisted tape e.g., single twisted tape and double twisted (coaxial) tape selected to look at their influences. The precise analysis the results show that the warmth transfer characteristics of studied cases strongly depend upon the parameters like Reynolds number and heat flux applied on the tube.

M. E. Nakchi, J. A. Esfahani et al. [3] done comprehensive numerical investigation to examine the influence of rectangular-cut twisted tape inserts on the thermal performance of device tubes. Nine distinct cases were analyzed, delving into the effects of cut length, width ratio, and the number of cuts on heat transfer characteristics. The accuracy of the numerical simulations was rigorously verified through experimental data, confirming the reliability of the findings. The swirling flow induced by the rectangular-cut twisted tapes effectively transfers heat from the tube wall to the core regions, promoting enhanced fluid mixing and consequently augmenting heat transfer rates.

IV. EXPERIMENTATION

The experimental setup employed in this study utilized a double pipe heat exchanger consisting of a smooth copper tube as the inner tube and an outer GI pipe. The outer pipe was effectively insulated with rope and heat lawn insulation to minimize heat loss to the surrounding environment. Two calibrated rotameters, with flow ranges of 1 to 5 LPH (litres per hour), were employed to accurately measure the flow rates of both cold water and hot water. Washer inserts were strategically placed along the inner pipe at an interval of 5 cm over its 1.5-meter length. Tap water was directed through the inner tube with flow control regulated by a rotameter, and a portion of this water was diverted to the geyser through another rotameter for heating. A U-tube manometer was used to measure the pressure drop, while four thermocouples, connected to a multipoint DTI, were employed to measure the inlet and outlet temperatures of both hot and cold water.

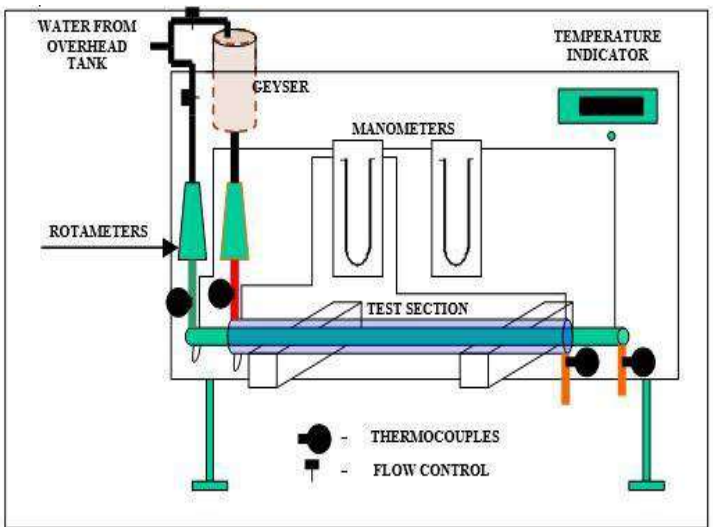

Fig. 2. Experimental Set-up

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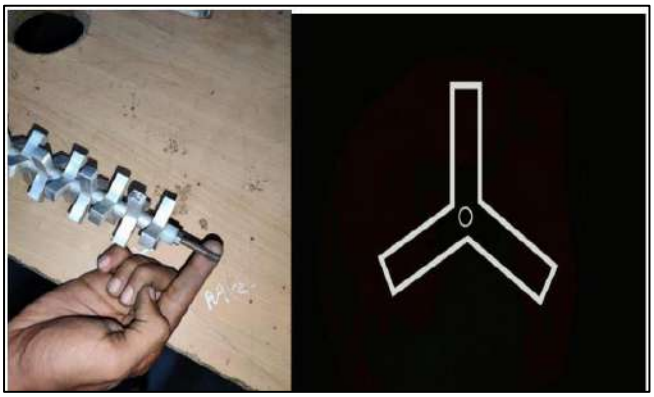


Fig. 3. Inserts

A comprehensive experimental study was conducted to investigate the impact of cold water flow rate on the performance of a heat exchanger. While maintaining a constant hot water flow rate of 50 LPH, the cold water flow rate was systematically varied from 40 to 100 LPH. Throughout the experiments, both inlet and outlet temperatures for both hot and cold water were meticulously measured.

Case I: Without employing any heat transfer enhancement techniques

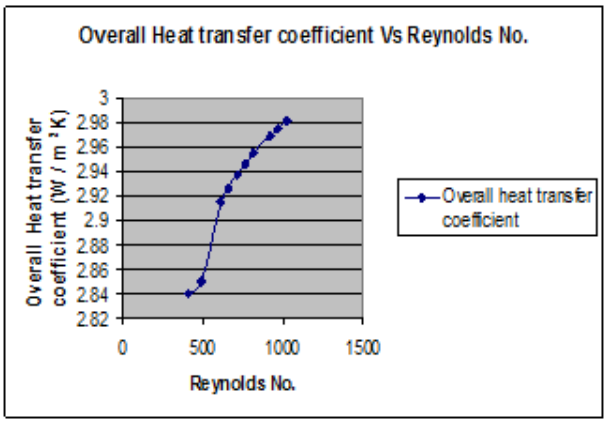
Case II: With washer inserts

V. RESULTS

Experimentation was conducted under two distinct conditions and the parameters like effectiveness, overall heat transfer coefficient and Reynolds number were determined for each scenario. Furthermore, the relationship between these parameters and Reynolds number was graphically represented through plotting.

Case I: Without employing any heat transfer enhancement techniques

Fig .4. Graph of h v/s Re without inserts



Overall heat transfer coefficient reaches a peak value of 2.98 for approximate Reynold no value of 1000.

Case II: With washer inserts

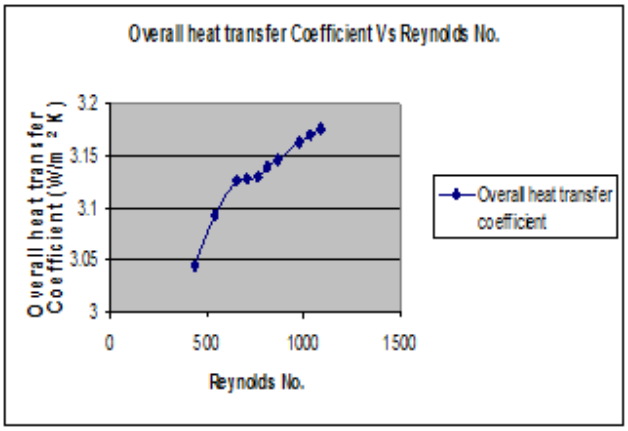


Fig .5. Graph of h v/s Re with washer inserts

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A significant enhancement in overall heat transfer coefficient, reaching up to a 3.18value, was observed at an approximate Reynolds number value of 1000. This rise in heat transfer is attributed to the increased turbulence induced by the higher Reynolds number.

VI. CONCLUSIONS

In this project, heat transfer rate and fluid flow characteristics of circular tube type device with washer inserts is studied. An experimental and study was conducted to investigate performance of heat exchanger without and with use of the inserts. The washer inserts are incorporated to disrupt the flow inside the tube creating turbulence. The results show that,

1. In double pipe heat exchangers, washer inserts can increase the heat transfer rate by up to 30%.
2. Nu no is increased for tube with inserts. This suggests that, as turbulence increases, Nusselt number also increases.

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PLANT LEAF DISEASE RECOGNITION MAIZE PLANT LEAF DISEASE RECOGNITION

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ABSTRACT
Conventional methods used by farmers for predicting and classifying plant leaf disease might be dull and inaccurate. Predicting the types of ailments manually might be difficult. A severe drop in yield might result from the demise of crop plants due to a lack of timely detection of plant diseases. Farmers who use methods based on the processing of digital images see a reduction in losses and an increase in yield. Many methods have been developed and implemented for using infected leaf pictures to predict illnesses in crops. Scientists have made great strides in the past toward identifying plant diseases by testing out a variety of methods and models. However, reviews, new developments, and conversations have revealed the need for enhancement. Global food production could benefit substantially from the use of technology. The problem of low yield in plants can be addressed by training various methodologies and models with massive amounts of data to discover new, improved methods for discovering plant illnesses. K-means clustering, Naive Bayes, Feedforward neural network (FFNN), Support Vector Machine (SVM), K-nearest neighbor (KNN) classifier, Fuzzy logic, Genetic Algorithm (GA), Artificial Neural Network (ANN), Convolutional Neural Network (CNN), etc. have all been evaluated for their robustness in previous works. To detect and categorize various forms of plant leaf ailments using image processing technologies, this work provides a comprehensive analysis and outcomes of numerous approaches and methods previously applied.

Keywords: Plant disease, classification, Deep learning, CNN, Image processing

I. INTRODUCTION
Plant leaf disease is one of the most significant issues with rice farming. A drop in yield may result from the pathogen destroying the crop [1]. Classifying and identifying plant leaf diseases is a challenge for farmers. Due to its limitations, the traditional approach of disease detection by physical observation has the potential to reduce agricultural output seriously [2]. Plant infections start with the leaf and spread to the rest of the plant later, lowering yield quality and quantity [3]. Many techniques may be used to recognize and categorize plant diseases using photos of the afflicted plant thanks to recent advances in deep learning [4]. To increase agricultural productivity, it's essential to identify plant illnesses [5] quickly. Plant diseases harm agricultural output because they cause crop destruction [6].

For both farmers and professionals in the field of agriculture, identifying plant diseases is a significant difficulty [7]. Using computerized image processing techniques to identify and categorize illnesses can reduce agricultural losses [8]. Through the early detection of plant leaf diseases before the damage spreads to other plants on the farm, artificial intelligence increases crop productivity [9]. In addition to increasing agricultural output, accurate categorization of plant diseases can assist diverse cultivation techniques [10]. Every nation requires agriculture to produce crops for its needs and to strengthen its economy. Diseases that harm crop plants have an impact on both the productivity and economics of the nation [11]. The differences in data make it challenging to choose an efficient image-processing strategy. Large datasets are required for advanced approaches like CNN to deliver better results. Accuracy rates are more significant when using larger datasets [12]. Biotechnology, agriculture, medicine, and other fields may all benefit from image processing. It is an agricultural society in Nigeria. Small-scale farming is practiced by more than 80% of the population [13]. Over 35% of Nigeria's population works in the agricultural sector [14]. Lands for farming are extremely limited due to the population's rapid increase. As a result, crop output has decreased in Nigeria and worldwide [15].

A significant problem for the agriculture industry is plant disease. Plant diseases, for example, harm agricultural productivity in India due to their harm to plants [16]. To effectively combat the issue of subpar agricultural output, infections must be promptly discovered or identified. It takes time and may not be accurate to anticipate illnesses manually. Precision agriculture could be possible with the proper use of technology. This might increase agricultural productivity all around the planet. Using various models and algorithms, the classification of plant leaf diseases may be done digitally.

To detect plant illnesses early on, computerized image processing techniques are essential before harm is done to the entire crop. In Asia, particularly in India, 70% of the population depends on agriculture. The global economy, as well as that of India, can benefit from the use of computerized image-processing techniques in the

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sector [17]. It is possible to promote agricultural enterprises using deep learning algorithms. This essay focuses on a literature review of works that classify crop plant diseases using various computerized image-processing techniques. Finding a reliable method to utilize is essential for getting a higher yield.

II. REVIEW ON LEAF DISEASE RECOGNITION

This part presents and reviews several image processing techniques and methodologies. The literature on artificial intelligence, machine learning, and deep learning is included in Table 1 below.

The authors of [18] provide an overview of the many methods for identifying and categorizing plant leaf disease. According to the study, plant leaf diseases may be identified effectively and precisely using image processing techniques.

Researchers from [19] identified illnesses on photos of citrus leaves using GLCM, K-means, and SVM algorithms. Using their suggested strategy, the investigation produced a categorization accuracy of 90%.

The authors of [20] created an image-processing method to identify illnesses in wheat harvests. This study has substantially contributed to the automation of agricultural processes and technologies.

[21] Has created a computer-aided image processing model that can identify plant leaf diseases. The authors employed K-means clustering and an SVM classifier to categorize the illnesses affecting cucumber leaves. To maximize productivity, plant infections must be discovered as soon as possible [22]. The researchers in [23] conducted a study to examine five various contemporary deep learning models. The best result is produced by ResNet101V2, which has an accuracy rate of 86.799 percent.

In [24], the authors put out a model for identifying illnesses of paddy leaves. The authors' 97.5% recognition accuracy was attained by combining deep CNN and SVM classifier approaches.

Authors in [25] proposed a model to identify groundnut leaf disease using the KNN algorithm. Fungi, bacteria, viruses, etc., can bring on plant diseases. Based on photographs of the afflicted leaves, image processing techniques may be utilized to identify plant diseases [26]. The authors employed SVM and K-means clustering in [26] to reach an accuracy of 88.89%. Crop plant diseases that impact farms cause a decrease in crop yield volume. Early sickness detection helps to contain the disease and prevents it from spreading across the farm [27]. An advice-giving decision support system has been created using a computerized approach for classifying soybean plants. Authors in [27] attain a classification accuracy of 93.79 percent. To categorize plant illnesses, a new architecture dubbed Plant Disease Detection Neural Network (PDDNN) for effectively detecting plant diseases utilizing the CNN model has been deployed [28].

Farmers cannot effectively detect plant illnesses using their naked eyes, and if they are not discovered in time, they might spread to the entire field or even a neighboring farm. The application of contemporary computer technology is required for effective and early illness detection. The CNN architecture of AlexNet and GoogleNet was employed to obtain an overall classification accuracy of 86.00% [28].

Every nation's economic success is based on the caliber and volume of its agricultural output. Productivity can be considerably increased by early illness classification. Simple observation with the naked eye is a waste of time and energy. Through the speedier and more precise detection of plant leaf diseases, the technology guarantees success. [29]. Deep Convolutional Neural Network (Deep-CNN) has been employed to identify cotton leaf disease [29]. The confusion matrix and approach used by the authors in [29] to categorize different illness groups are implemented using MATLAB. Their findings showed an average accuracy of 96%.

Anand et al. [30] provide an approach that uses artificial neural networks and image processing to identify illnesses in brinjal leaf plants. The k-means clustering approach was employed by the authors of [30] for segmentation, and Artificial Neural Network (ANN) was utilized for classification.

Deep learning was used in a study by the authors of [31] to identify illnesses in tomato leaves. To find infections in tomato plants, they employed an algorithm performed in real-time on a robot. CNN was used by researchers in [32] to study tomato leaf disease. The authors in [32] have attained an accuracy rate of 97 percent in classifying data.

Automatic approaches employ an algorithm for picture segmentation in classifying plant leaf disease, which may be helpful to farmers since it minimizes the laborious job of close observation by specialists, which costs a lot of money [33]. The experimentation was carried out by the authors using MATLAB.

Using an enhanced histogram segmentation approach and multiple linear regressions as its foundation, a novel picture recognition system has been described in [34]. Their approach was successful since the suitable threshold can be discovered automatically. Digital image processing is crucial for the autonomous vision-based

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prediction of agricultural plant diseases [35]. The study employed the k-mean method for classification and GLCM for color segmentation. Excellent outcomes and promising performances were attained. The authors claim that their approach lowers labor costs and detection times.

The authors of [36] have analyzed several earlier researchers' strategies for detecting leaf plant diseases. Utilizing computerized imaging techniques can aid in the early detection and diagnosis of plant leaf disease, hence boosting agricultural output. Their article offers a thorough analysis of several image-processing categorization algorithms.

Reddy et al. [37] thoroughly analyze the techniques and strategies used to diagnose plant diseases. They have reviewed several identification techniques that can be used to spot and foretell plant diseases. The authors found the K-nearest neighbor (KNN) method to be the most straightforward method for illness prediction. However, it is limited by temporal complexity. The study also showed that neural networks tolerate noisy input, but challenging to understand how the algorithm is set up. The best machine learning algorithm for high-dimensional dataset recognition is SVM.

Many disease detection techniques can be used to detect illnesses in agricultural plants. It is recommended to employ various strategies to increase the rate of illness classification recognition [38]. When it comes to accurately identifying plant diseases, farmers lack information. According to a recent study, erroneous identification can be solved using computerized image categorization systems based on CNN structure. It is difficult to find data collection for rice plant disease [39]. A short dataset created by the authors allowed them to reach an accuracy of 92.46 percent.

In a research published by Devaraj et al. [40], the authors emphasize the value of image processing methods to identify plant diseases based on photographs of diseased leaves. The researchers created a software system solution that automatically detects and categorizes photographs. They discussed the phases in the categorization process, from loading the image to identifying the ailment. Images might be added and automatically processed using SVM in MATLAB [41].

Farmers require instruction on how to apply digital image processing techniques since they don't fully understand leaf plant diseases [42]. Researchers suggested a technique that works with Android apps. The model provides a quick and accurate technique to identify and categorize plant diseases. To categorize plant leaf diseases, the system employs CNN.

Deep learning-based plant and pest disease detection trends in the future pose several difficulties. However, diverse plant leaf disease detection methods might yield potential answers and broad recommendations [43]. Technology adoption is necessary to address the problem of identifying and assessing plant ailments [44]. To obtain a classification accuracy of 97.00%, the authors suggested a technique for processing and classifying images of potato leaf disease utilizing several Classifier algorithms.

An approach was created by Kowshik B. et al. [45] to create a CNN-based strategy for detecting and diagnosing plant leaf disease. It is possible to swiftly and precisely diagnose crop diseases and their symptoms using CNN and Deep Neural Networks. The authors of [46] utilized the Deep-CNN method to create a system for classifying guava leaf diseases. To obtain 98.74 percent accuracy, they employed a Deep-CNN model-based AlexNet technique. A study has been conducted in [47] to examine several agricultural plant diseases.

Using Inception v3, A. R., Bhagat, and colleagues [48] create a model. Three classification metrics were used to assess the model. The writers have reviewed the methods for identifying plant diseases. Additionally, they demonstrated that CNN had a higher capability for reliable results. [49] used 14 plant types and 26 diseases to build a CNN approach for identifying plant diseases. Using GoogleNet and AlexNet, the model has a testing accuracy of 99.35 percent.

The authors of [50] employed ANN to create a model that had an 80 percent cotton leaf categorization accuracy. Numerous studies have categorized plant leaf diseases using ANN. 169 photos were used in the study utilizing ANN [51]. Their approach [51] produces results with a 92 percent accuracy. In [52], a different comparison investigation was conducted. Different neural networks that have been employed in the past by various researchers have been examined and evaluated. According to the authors of [52], the most popular neural networks are CNN and ANN.

Deep learning techniques greatly aid the identification and detection of plant leaf diseases [53]. The classification of plant diseases using deep learning techniques is accurate. The authors in [53] attain a 98 percent accuracy rate for identifying illnesses in various agricultural plants using CNN. Using MATLAB, Malti

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K. et al. [54] researched the automated categorization of plant leaf diseases. To attain accuracy rates of 98.2 percent and 98.4 percent, respectively, the authors in [54] experimented on beans and tea leaves.

Digital image processing techniques are required in agriculture, claims [55]. The authors of [55] thoroughly analyzed several prior studies on diagnosing plant leaf diseases using image processing techniques. A study of plant leaf disease detection techniques employing digital image processing techniques has been done in [56]. The effectiveness of various image processing techniques has been emphasized.

According to the authors in [56], most studies favor neural networks over alternative methodologies. Researchers from [57] classified four disorders based on their research on groundnut leaf disease. Their efforts had a 97 percent accuracy rate.

A detailed review of current studies on the categorization of plant leaf diseases using digital image processing techniques was undertaken by the authors of [58]. If large amounts of data are made accessible, deep learning methods outperform conventional approaches, according to the authors [58]. Regarding plant leaf diseases, neural network classifiers get superior results and are more efficacious [59]. The authors used the multi-layer perceptron (MLP) and Radial Basis Function to study the Phyllanthus Elegans wall (RBF). Their techniques yield accuracy rates of 90.15 and 98.85 percent, respectively. The authors of [60] experimented on four distinct diseases, including angular leaf spot, bacterial pustule, bacterial gummosis, and bacterial blight, using cotton and soybean leaves. 83%, 80%, 80%, and 70% accuracy were attained.

A study on detecting plant leaf diseases using CNN and the Bayesian method has been published in [61]. The authors attained an overall accuracy of 98.9 percent using more than 20,000 photos of potatoes, tomatoes, and pepper bells. The authors examined four diseases, including leaf blight, black rot, stable, and black measles, in [62]. To reach a total accuracy of 98.7%, the scientists used hybrid CNN with feature reduction. Using plant leaves to detect plant leaf disease automatically is essential for farming. Plant diseases must be promptly identified and controlled to increase yield [63].

In image processing, CNN has yielded reliable results [64]. Gurleen K. et al. [65] assess the effectiveness of a few categorization systems for plant leaf diseases. The authors list various image-processing techniques for categorizing plant diseases. Ehsan K. et al. [66] used soft computing to research strawberry leaf diseases. The accuracy rate overall for the writers in [66] is 96 percent. Utilizing Graythresh in MATLAB, [67] identified the disease affecting Solanum trilobatum plant leaves. A comprehensive technique for crop disease diagnosis utilizing computer vision and machine learning algorithms was put out by researchers [68]. The algorithm created on 20 distinct plant diseases gave results with a 93 percent accuracy rate. A practical method for identifying plant disease in Malus Domestica using K-means clustering has been suggested in another study carried out in [69].

Using genetic algorithms, authors in [70] have given a software solution for categorizing plant leaf sickness (GA). Using pattern recognition, researchers in [71] could classify apple leaf sickness with an accuracy of 90%. [72] describes developing an android model for classifying cotton leaf disease using SVM and GA.

To detect illnesses in paddy leaves, authors in [73] suggested an automated model utilizing machine learning and evolutionary techniques. The model may be used to identify illnesses on the Android platform quickly. Using GA, authors in [74] categorize and assess sick leaves of the grape plant with an overall accuracy of 98.39 percent.

An analysis of several image classification techniques that may be utilized to spot plant leaf diseases has been conducted [75]. The categorization of plant leaf diseases is done using various deep learning techniques, according to research done by the authors in [76]. The authors presented a thorough examination of several techniques using the weka tool. Using the Naive Bayes classification technique, K. Mohanapriya et al. [77] have created a model that can identify diseased plant leaf sections with an overall accuracy of 97 percent. Researchers in [78] investigated the categorization of plant leaves using the Nave Bayes algorithm. The authors fed the classifier with information about the shape and texture of the leaves.

Compared to other classifiers like KNN, RF, SVM, and Decision Tree, the CNN model outperforms them [79]. The authors' accuracy rates for diagnosing paddy and potato leaf illnesses were 99.58% and 97.66%, respectively. The authors of [80] create a system that uses CNN to offer reports on detecting illnesses affecting banana leaves. Three CNN models were used in the model provided by ASM. Farhan et al. [81] to identify Guava leave illness. The third model generated an accuracy of 95.61 percent overall. A model to detect and diagnose potato leaf disease using machine learning techniques has also been developed [82]. The overall accuracy for the model was 95.99 percent.

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[83] has created a categorization system for bean leaf diseases. For training, the accuracy was 97 percent, and for testing, it was 92 percent. A technique to diagnose maize leaf disease using enhanced Deep-CNN is proposed in similar work [84]. Using Deep-CNN, authors in [85] have devised a method to identify and categorize purple blotch disease in onions. The model generated an 85.47 percent accuracy. Several deep-learning models have been created to recognize and detect plant leaf diseases. Deep learning techniques that offer more accuracy are used to further this field of study [86]. To increase productivity and address problems, machine learning, and deep learning techniques have been used in agriculture [87].

Authors in [88] suggested a method called Attention Based Depth-wise Neural Network with Bayesian Optimization (ADSNN-BO) to categorize plant leaf diseases. The author's accuracy rate was 94.65 percent. Using the Random Forest method, researchers in [89] created a model to identify and categorize maize illnesses. By comparing their model to other approaches, the authors in [88] attained an overall accuracy of 80.68 percent. An RF algorithm-based automated method for classifying plant diseases has been created in [90]. The model has attained 95% accuracy. The categorization of plant leaves has also been developed using a mixed-learning approach [91]. The model detects plant leaf diseases using K-Means clustering and CNN methods. The model outperformed SVM and CNN with an accuracy of 92.6%.

A prominent area of agricultural study is the classification of plant leaf diseases [92]. Using image SVM, researchers in [93] could classify the disease on sugarcane leaves with an accuracy of 95%. Through the early detection of the illness, image processing technology can improve crop yield [94]. Plant diseases may be accurately diagnosed using image processing techniques [95].

To improve agricultural yield, the classification of plant diseases must be done correctly. In most plants, leaves are the primary sites of disease [96]. A model for identifying and categorizing cassava leaf disease was created by Jennifer R. et al. [97] utilizing ANN and K-nearest neighbor methods. Over 90% of the classifications made by the model were accurate.

III. DISCUSSION

Image processing methods must be applied to increase crop yield in quality and quantity. There are two steps in the processing of images. Post-processing comes after pre-processing. Enhancement, morphological operations, and segmentation are part of the pre-processing step, whereas feature extraction and classification are part of the post-processing stage. The entire procedure is shown in Figure 1 below. K-means clustering might be utilized for feature extraction, followed by SVM or CNN for image classification and GLCM for segmentation.

CNN offers an automatic feature extraction function that can extract the features from the picture automatically. Feature extraction might be done separately or manually and fed into models like SVM for classification. This study examines and contrasts numerous methods that scientists have employed in the study of plant disease detection and categorization. The best methods that might be applied for improved results are also identified in the study.

IV. CONCLUSION

The study has provided and discussed several methods created and made accessible to achieve outstanding achievement in deep learning, machine learning, and image processing. The evaluation also noted that to raise the accuracy of the recognition rate, the percentage accuracy may be increased by training and testing the models on an ever-growing dataset.

To effectively combat the issue of plant leaf disease, new and improved deep learning techniques that may provide more accuracy in diagnosing and categorizing agricultural plant illnesses must constantly be created. Plant leaf diseases have been categorized in the past using several different techniques. However, because of their adaptability and feature extractor function, which enables them to extract information automatically, neural networks like CNN appear to be the ideal method for classifying plant diseases. CNN may learn new characteristics from the pictures to produce better results than earlier models like Naive Bayes, K-Nearest Neighbor, SVM, RFC, etc. Because of their sophistication in learning from and extracting information from the pictures for dependable output, neural networks like CNN might be the most suited for research in image processing, machine learning, and deep learning.

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A REVIEW ON ECG MONITORING SYSTEM USING IOT

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ABSTRACT
Cardiac disease has been the number one cause of death over a last decade. Various medical devices have been developed to monitor the heart diseases. In recent years, sensor network based devices are increasingly popular and widely accepted. People uses verified devices for bio-signal acquisition, such as electrocardiogram (ECG) or the electroencephalogram (EEG), as these devices help in real time monitoring of patient's health. With the development of networks, collected information related to health can be sent to the cloud server of the nearest clinic or hospital. On the basis of that information, doctors can then provide patients with medical advice. These solutions typically have a high marginal cost per added sensor and are not seamlessly integrated with other smart home solutions. Various devices and solutions for monitoring electrocardiogram (ECG) remotely have been reviewed and presented in this paper. In this paper, we propose an ECG monitoring system integrated in a broader Internet-of-Things (IoT) infrastructure that is dedicated to non-technical users in need of long-term health monitoring in residential environments.

Keywords: ECG, EEG, IoT, BSN, Zigbee, ECG-SQA, Cloud

INTRODUCTION
The heart rate of cardio cycles extracted from ECG signals is a source of diagnostic information used for decision making in the treatment of heart disease. Among middle aged and elderly people, heart failure is a major cause of mortality. One of the urgent problem of modern cardiology is obtaining the most complete information about the heart rate, on the basis of which it would be possible to expand the diagnosis of pathological conditions of the myocardium and its electrophysiological properties.

World Health Organization (WHO) mentions that the uncertainty of health conditions is a widespread problem for aged people. People need to check their health conditions very frequently, especially for senior cardiovascular patients and those having hereditary health issues. Improvement is needed in existing cardiovascular diagnosis systems including modern technology to detect the heart condition in a low cost, accurate and timely manner. Considering the issues related to heart, electrocardiogram (ECG) monitoring is used extensively in rural hospitals and health research centers. In many cases, the distance between patient and doctor is the main barrier due to which patient do not get access to quality health services and thus having trouble for their regular health examine.

Internet of Things (IoT) has various purposes in medical areas such as testimony of chronic diseases, distant patient monitoring, dietary program, elderly people care etc. In recent years, health issues due to changes in lifestyle is rising continually both in rural and urban areas, so observing their health regularly by staying at home and with low cost system is one of the basic appeal. Healthcare personnel can assess, diagnose and prescribe elderly people by gathering medical information from remote regions by using IoT. The significant part of IoT can be used in so many medical equipment, sensors and imaging devices to primarily determine the patient's health statuses and to deliver them proper care in a shortest possible time. IoT-based healthcare services can be implemented at low cost maximizing the user convenience. The main purpose of IoT-based healthcare system is its cost effectiveness and secures interconnection for individuals, clinics and different healthcare institutions. Health conditions of aged people needed to be checked in regular basis which is a greater challenge both in medical research and hospitals. In medical institutes or hospitals, conventional 12 leads systems are used to collect ECG signals from patient's body. These devices are too expensive to use for personal usage or at home and cannot be used as portable. It takes huge amount of time for routine checkup during each visit to hospitals and manual recording can also cause human made error. Thus, a low cost system for continuous ECG monitoring is highly required. Most of the available ECG monitoring devices use smart phones for secondary data processing. The uses of smart phones in data transfer and processing have great consequences on regular use due to its limitations of power and computational effectiveness.

LITERATURE REVIEW
A wearable ECG monitoring system had been proposed occupying Internet of Things (IoT) where a customized device can directly sent ECG data collected from patient's body to IoT cloud using Wi-Fi. The work is been done by connecting Raspberry Pi with internet. ECG sensor AD8232 has been used for ECG monitoring. Data processing is done in Raspberry Pi which uses processing software and a band pass filter is used for eliminating

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different noises to form an electrocardiogram (ECG) graph. An email will be sent automatically to the users and authorized doctors in case of abnormalities found in patient's body. The designed device is hazard free for the remote patients as they do not need to visit the doctors regularly. They had compared their customized device with standard 12 lead ECG modular in generating heart rates and waveforms [1]

A tractable randomized methodology have been demonstrated for analyzing the effects of dynamic context changes on the interaction of Smart Mobile Applications for Healthcare under Dynamic Context Changes (SMDCS) computing infrastructure with their environment. The randomized analysis can evaluate the safety and sustainability of smart mobile apps under highly probable context change sequences in polynomial time. An important extension of this work is to consider security analysis of SMDCS. Initial studies on SMDCS security had been performed considering a comprehensive safety, security, and sustainability analysis tool. [2]

A novel unified framework for automatic detection, localization and classification of single and combined ECG noises had been proposed. A modified CEEMD algorithm had been presented with new stopping criteria for reducing the computational load. We have explored short-term temporal features, such as maximum absolute amplitude, number of zero crossings, and local maximum peak of the autocorrelation function for discriminating the BW, MA and PLI noises. Based on the thresholding rules, the processed ECG segments are classified into six groups as noise-free ECG, ECG+BW, ECG+MA, ECG+PLI, ECG+BW+PLI, and ECG+BW+MA. The method is validated on the large collections of single and multilead ECG signals taken from five standard ECG databases. Framework can localize the short bursts of noises present in the ECG signals. [3]

A Zigbee data diffusion solution, Coordinator Traffic Diffusion (CTD), had been presented to address Coordinator bottleneck problem for real-time data-intensive ECG data transmission. It is shown that CTD design provides more reliable ECG data transmission than the original Zigbee does. CTD design can simulate the flow diffusion effect of multiple-PAN, and Zigbee nodes retain the flexibility to be connected dynamically as in a single PAN. The design of CTD layer inserts an additional CTD layer in Router without modifying Zigbee standard. Thus, CTD design can be fully compatible with existing Zigbee stack and applications. It had been demonstrated that CTD implementation in TI CC2530 embedded system supports real-time ECG data transmission. [4]

They had proposed a ECG authentication algorithm that can be used in mobile devices. The algorithm was tested with a sensor designed for a mobile environment. It is said that the algorithm is suitable to work with mobiles and with other sensors; as it was tested also with Physionet database. The approach was designed exclusively for mobile phones. The proposed algorithm uses a scheme that reduces the acquisition time of ECG signals to 4 s for authentication. They had evaluated the algorithm with ten subjects using a mobile phone ECG sensor. They obtained 81.82% TAR and 1.41% FAR. Furthermore, they also evaluated the algorithm using ECG records from the Physionet database and obtained 84.93% TAR and 1.29% FAR. [5]

A smart health system assisted by cloud and big data had been presented that includes a unified data collection layer for the integration of public medical resources and personal health devices, a cloud-enabled and data-driven platform for multisource heterogeneous healthcare data storage and analysis, and a unified API for developers and a unified interface for users. Supported by Healthcare Cyber-Physical System, various personalized applications and services were developed to address the challenges in the traditional healthcare, including centralized resources, information and patient passive participation. [6]

A wireless wearable ECG monitoring system that is embedded in an IoT platform that integrates heterogeneous nodes and applications had been suggested. It has a long battery life and provides a high-quality ECG signal. The ECG sensor exhibits the record-low energy per effective number of quantized levels figure of merit for all solutions with both discrete and integrated frontends available. They obtained the results through a set of choices at the level of components, circuit solutions, and algorithms. They noticed the fact that a dedicated front-end chip is not enough to achieve an advantage in terms of overall sensor performance which depends on the optimization of the whole sensorwhich is more practically perform using off-the shelf components. Their proposed ECG sensor was based on a high performance ADC and a microprocessor-radio combo chip that provides much better performance, in terms of power consumption and noise. [7]

They had proposed a biosignal acquisition and classification system with wireless telemetry for Body Sensor Networks (BSN). Three chips, namely, a body-end chip, a receiving-end chip, and a classification chip, are implemented in TSMC 0.18 μm standard CMOS process. The power consumption of the body-end circuit is 586.5 μW, with 1.2 V of supply voltage. It is fitted with two 605 mAh PR44 zinc–air batteries. The wearable wireless ECG acquisition system includes a digitizer and a transmitter and can be operated over 80 days. The

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accuracy in terms of beat detection was 99.44% and in terms of classification was 97.25%.It is said that the proposed system can correctly diagnose heart disease based on the MIT-BIH arrhythmia database and the symptoms, which can be suggested and controlled by cardiologists on the MCS, can be used to update the coefficients of wavelet transform on the DSP chip. However, the system still needs further improvement, particularly in the synthesizer design of the transceiver for multi-channel biosignal acquisition, the feedback control for the body-end chip, the integration of the receiver and the DSP circuit in a single receiving-end chip, and the combination of the receiving-end chip and the smartphone. [8]

Oscillometric BP monitors are used both in home and clinical environments. In the article, various oscillometric BP algorithms and their advantages and disadvantages were discussed. Various techniques used to correct the automated BP monitors and to remove artifacts and interferences are reviewed. The advanced standards for validation of automated BP monitor systems were introduced. improvement in the accuracy and reliability of automated BP monitors is needed. However, for certain patient populations and disease states, such as atrial fibrillation, these parameters may be change during a measurement taht may be as short as 30-45 seconds. Therefore a model that incorporate the time variability of these parameters is needed. For example, to simulate atrial fibrillation, amplitudes alongwith the pulse to-pulse intervals of the arterial pressure pulse waveform can be randomized. Moreover, the changes in oscillometric pulse morphology with respect to cuff pressure can be analyzed by incorporating the models of the OMW and PTT. Machine learning algorithms can also be incorporated to extract BP information from the oscillometric pulse morphology. [9]

A classification of ECG segments from ambulatory sensors had been given as acceptable and unacceptable and as a consequence, significantly increases the reliability of HR measurements obtained. The system they had proposed requires a single channel of ECG instead of requiring the presence of multiple signals or multiple channels of the same signal that makes it promising for inclusion in applications where wearable sensors are used and in the most basic clinical environments. [10]

They had presented a novel signal quality-aware IoT enabled ECG telemetry system for cardiac health monitoring applications. This paper proposed a light-weight ECG signal quality assessment (ECG-SQA) method for automatically assessing the quality of acquired ECG signals under resting, ambulatory and physical activity environments. Their experimental results had demonstrated that the proposed ECG-SQA outperforms other existing methods based on the morphological and RR interval features and machine learning approaches. The study further demonstrated that the ECG signals are severely distorted under more intensive physical state. [11]

They had discussed the work done for denoising of ECG signal and authentication. The cardiac muscles is generating the cardiac signals that representing by electrocardiogram. An ECG signal is noise free and it is used to analysis and identifying the person making it necessary to denoise the loud signal using various techniques like wavelet transform, Kalman Filter, FIR filter, etc. Noisy signals are decomposed and noisy components appear in coefficients of detail. The threshold applies to corrupt bands. Using inverse technique the detailed sub-bands are reconstructed. K-NN, ANN, SVM are the common techniques of classification used. An algorithm needs to be developed for de-noising and accurate authentication. [12]

PROPOSED SYSTEM

The architecture of the ECG monitoring system based on IoT is shown in Fig.1, which mainly consists of three parts, i.e., the ECG sensing network, IoT cloud, and GUI. The components used in ECG Sensing network are: ECG AD8232 Sensor, Raspberry Pi Model 2, and Arduino Uno.

ECG Sensing Network: ECG sensing network which is a set of physiological data collected from the body surface and send these data to IoT cloud through a wireless channel. In our system, wearable ECG sensor is used to gather data from patient's body over some specific time. Then amplification and filtering is applied on the ECG signals to improve the signal quality. Bluetooth, Wi-Fi, ZigBee protocaols are used to transfer the ECG data gathered from sensors to the IoT. With satisfying energy consumption all these three protocols can transfer enough data rates for transmitting ECG signals. Moreover, Wi-Fi is used in our proposed system due to limited communication ranges of Bluetooth and ZigBee.

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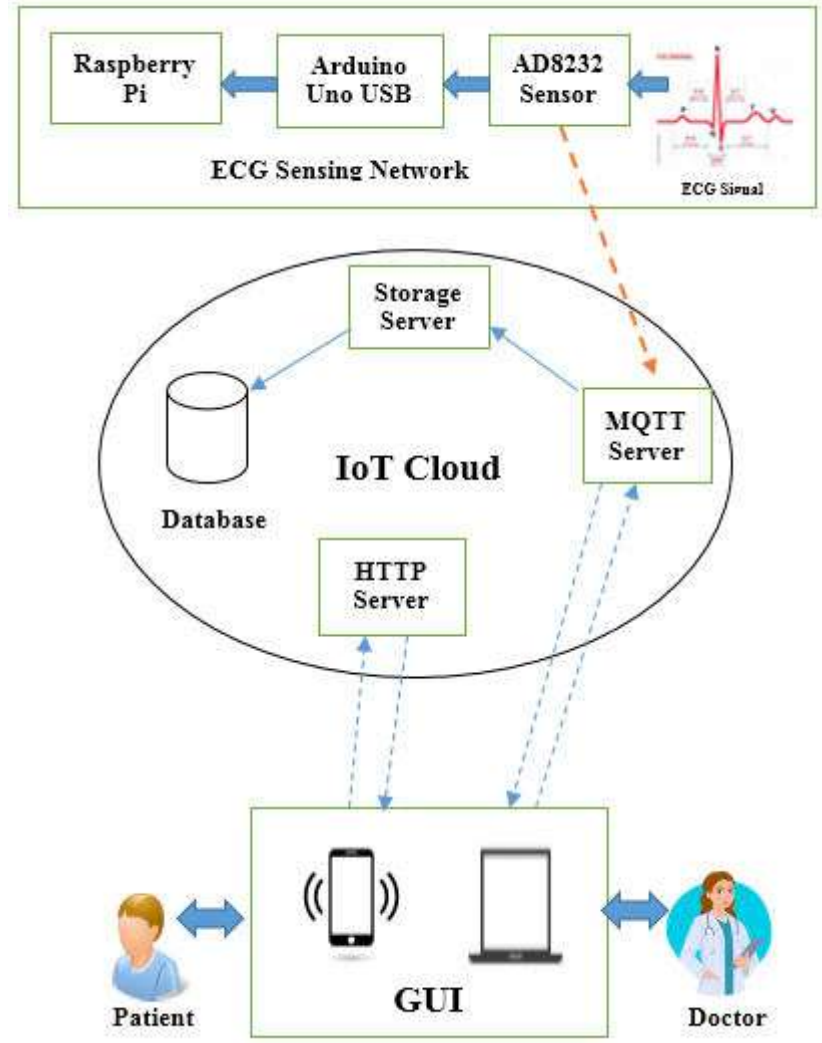

Fig.1. IoT Based ECG Monitoring System

IoT Cloud: In ECG monitoring system, with the help of IoT cloud we can store data, modify data and all the patients' information's is stored. It can also send disease warning and protecting patients from getting cardiac issue.

GUI: Graphical User Interface (GUI) is used for data imagination management. It gives easy entry of the data in the IoT cloud. Real time ECG data can be visualized by the users through logging onto the cloud. Mobile applications and web pages are the two kinds of GUI's available for users to observe ECG data. In terms of protection and up-gradation web pages are the best options compared to mobile app even though it can ensure immediate response.

FLOWCHART

The flow chart of our proposed system is as shown in fig.2. At first the user switch 'ON' the device then the device will check the status of all the modules whether they are 'ON' or 'OFF'. If the module is 'OFF' then the system will remain 'OFF'. When the module is ON, the system will run and start to collect data from human body. Then, these data will be stored automatically in local database. With the internet connectivity, it will analyze the data in the cloud database and will display the results for abnormal condition and send it to the users. The system proposed in this paper takes ECG data from patients' body and at any case of abnormalities an email is sent to the doctors so that, they can take necessary initiatives to prevent damages due to cardiovascular diseases.

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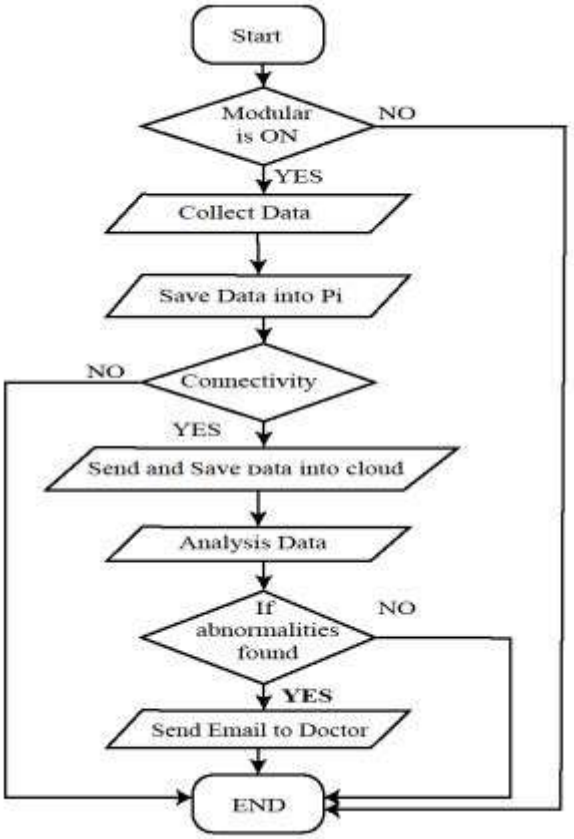

Fig. 2. Flowchart of the System

CONCLUSION

In this paper, various research articles related to ECG Monitoring are reviewed and it is found that many researchers have contributed their work for the development of health sector services by providing techniques to monitor Cardiac parameters with the help of advancement in the technology. The proposed prototype of our IoT based ECG monitoring system is highly efficient, cost effective and time saving. The cost for regularly visiting the doctors at healthcare institutions will get reduced. The data collected from patients will be send to IoT cloud using Wi-Fi. The IoT cloud has been used for visualizing the data to users and store it for future analysis. By using the system ECG signal can be monitored continuously. The regular use of this system will be helpful for preliminary detection of heart diseases and can reduce severe damage and mortality rate due to cardiovascular diseases.

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MOVING OBJECT DETECTION AND FEATURE EXTRACTION TECHNIQUES: A REVIEW

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ABSTRACT
Moving object detection and feature extraction are main initial steps in image process- ing for surveillance system. It is used to detect a moving object in an effective manner. The object detection methods have a wide range of application in a variety of areas including robotics, medical image analysis, surveillance, military operation and security purpose. Some common method use in this, are background subtraction, frame differenceing, template matching and shape based method. Feature extraction is the process of extracting useful infor mation from the input image. Feature extraction based on appearance are carried out using various methodology. In feature extraction methods like Edge detection, SURF (Speeded Up Robust Features), BRISK (Binary Robust Invariant Scalable Keypoints), FAST (Features from accelerated segment test), HOG (histogram of oriented gradients) etc. are used.

Keywords: Background Subtraction, Frame Dif- ference, Template Matching, Shape Based Method, Edge Detection, SURF, BRISK, FAST, HOG.

I. INTRODUCTION

Detection and extraction of moving object for surveillance system is an important research area of image processing. The essential work of surveil- lance system is to detect the moving object and ex- tract its feature through the sequence of frames.[9] Object detection is to identify the object of interest in video sequence and to cluster pixels of these object. Feature extraction is the process of extracting useful information from a input or a query image.[6] Object detection can check exis- tence of object in video frame and to detect that object. Then detected object can be classified in various categories such as humans, vehicles and other moving objects. Human motion analysis is one of the most popular and recent research topics in digital image processing, the aim is to detect the motion of human from the background image. The background subtraction method is common approach which identifies the moving objects from the portion of video frames that differs signifi cantly from the background model. The main idea about moving object is to separate the moving foreground object and background pixels. The basic idea in background subtraction is to classify the pixels as background or foreground by thresholding the difference between background image and current image. Video surveillance of human activity usually requires people to be detected and background subtraction is a powerful mechanism for identifying changes in the video sequence. Feature extraction is the process for reducing dimensionality so as to represent the image parts with great effciency. Feature represents a pattern or a distinct structure of an image.[4] Feature are extracted simply based on there appearance. Feature extraction is the process of generating features to be used in the selection and classification task. One of the main goal of feature extraction is to obtain the compact set of feature called feature vector without redundancy.[14][15] Extracted features should increase the classification rate of an object. Surveillance system should be capable to monitor security sensitive areas such as banks storage department, highways, crowed public places and border areas etc.

II. OBJECT DETECTION

The existence of object is check by Object detec- tion in video sequence and also to cluster pixels of these object. There are two main method for object detection is feature based detection and motion based detection.

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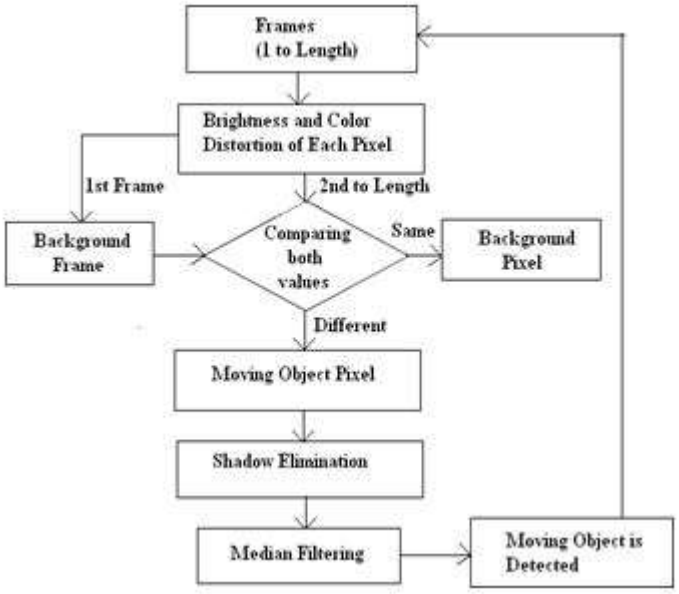

Figure 1: Object detection Flow Chart

As shown in the flow chart, when the video starts the 1st frame color distortion and brightness distortion is calculated and after that frame is selected as background model. After selecting the background model, the 2nd frame till the length of frame is upcoming frames. And each frame color and brightness distortion is calculated and compared with the background model. If the val- ues are same then it is considered as background else it is foreground. After finding the foreground, shadow elimination technique is used to remove unwanted shadow. After this the median filtering is used for reducing the sharpness of the image. And after all these steps moving object is detected.

A. **Feature Based Detection**

The different kind of data is in image frame which includes a huge amount of information, such as objects, pixel points, color information, edges, dimensions and others.[3] The well-known color spaces is commonly used that is RGB & CMY. To represent the RGB space, a cube can be defined on the R, G, and B axes. When all three primary colors are at M, white is produced where M=255 is the maximum light intensity. The main diagonal axis connecting the black and white corners defines the Intensity.

$$I(R, G, B) = R+G+B$$

Each of the specific intensity level is sub- tracted, from these intensity levels and the result we get is the specific color detected object.[3][4]

B. **Motion Based Detection**

Importance of object detection is due to its en- hanced automation in public security surveillance as well as in traffic control. Background subtrac- tion, also can be said as Foreground Detection, is a technique wherein an image's foreground is ex- tracted for further processing. Generally objects are an image's regions of interest such as humans, vehicles etc. in its foreground.[3][4] Preprocessing object localization is required, after the stage of image which may make use of this technique. For detecting moving objects background subtraction is an approach in videos from static cameras. The main approach is that of detecting the moving objects from the difference between the current frame and a reference frame, called background image, or background model.

Also object detection can be done by various techniques such as Temporal Differencing, Back- ground Subtraction, Optical Flow. There are also methods for background subtraction Frame dif- ference method, approximate median method, Mixture of Gaussian, which are describes below.

i. Temporal Differencing

The working of Temporal Differencing is very similar to background subtraction method, based on time series image, this method uses the two adjacent frames to subtract and gets difference in images. It gives moving target information, after the subtraction of image through the threshold value. This method is simple and easy to imple- ment. The whole relevant pixels of some types of moving objects, it get fails to detect, this is very adaptive to dynamic scene changes. In order to detect stopped objects for success of

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higher levels, additional methods need to be adopted are compu- tationally complex and cannot be used real time without specialized hardware [8].

ii. Background Subtraction

In static images for object detection back- ground subtraction is particularly a commonly used technique. The attractive feature of BS is its speed in locating the moving objects.[10] In an initialization period, the current image is sub- tracted pixel-by-pixel from a reference background image by detecting moving object region that is created by averaging images over time.[11] Usually a scene can be represented in object detection by a model called background model. The basic idea of background subtraction method is to initialize a background, the moving object present that current frame, then the current frame is subtracted with background frame to detect moving object.[8][13] This method is simple, easy to realize, and the characteristics of target data is accurately extracted, but the external environment is sensitively change, so it is applicable to the condition that the background is known. As any significant change in an image region moving object can be defined compared to the background model. Intra regions pixels undergoing changes are marked for further processing. Usually, a connected component algorithm is applied to obtain connected regions corresponding to the objects. The performance of BS in the time varying situations is detected by Background maintenance.[10] Background Subtraction algorithm follows the logic of Exclusive OR Gate, Truth table for which is as given below in Table No.1

Background Frame	Next Frame	Detected Objects
0	0	0
1	0	1
0	1	1
1	1	0

Table No.1 Truth Table for Background Subtraction

For detecting object in moving sequence the mostly used approach is background subtraction. There are situations for which a poor implementation of the scheme causes an erroneous/coarse segmentation. An automatic approach preserves from such inconvenience. We assume B (x, y), I (x, y) the gray-valued frame and the corresponding adaptive background model. A binary mask D (x, y) n is performed to segment out objects of interest.

$$Dn(x,y) = \begin{cases} 0 \text{ if } Sn(x,y) < Th \\ 1 \text{ Otherwise} \end{cases}$$

Where $Sn(x,y)$ and then compute whit following relations:

$$S_n(x,y) = |I_n(x,y) - B_n(x,y)|$$

$$MED = \text{median}[S_n(x,y)] \quad \text{if } (x,y) \varepsilon I_n$$
$$MAD = \text{median}[S_n(x,y)\text{-MED}] \quad \text{if } (x,y) \varepsilon I_n$$

Background Subtraction Methods are as follows:

By simple subtracting the current image and background image the extracted background in the analyzed scene is mostly done by Moving Object detection and extracting features. This method is known as Background Subtraction method.[8]

a. Frame Differenceing Method

The simplest form of background subtraction is the frame difference method. In this method, the input current frame is simply subtracted from the background frame. If the difference in pixel values for every pixel is greater than the threshold, then the pixel is considered to be a part of the foreground otherwise it is consider as background. For background subtraction the Frame Difference method used for static camera.[8]

b. Approximate Median Method

In this method, the previous N frames of the video is blur by the median filtering. Then the median of the blurred frame is calculated by the background frame and to give the foreground pixel the background is subtracted from the current frame. The Approximate Median method checks whether the pixel in the current frame has a value that is larger than the corresponding background pixel. If that is happen, the

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background pixel is incremented by one. However, if the pixel in the current frame has a value that is smaller than the corresponding background pixel, the background pixel is decremented by one [8].

c. Mixture of Gaussian

This method uses a Gaussian probability den- sity function to evaluate the pixel intensity value from the input image [8]. It find the difference of the current pixel's intensity value and cumula- tive average of the previous values. By keeping a cumulative average of the recent pixel values. If the difference of the current image's pixel value and the cumulative pixel value is greater than the product of a constant value and standard deviation then it is classified as foreground otherwise, it can be considered as background.

iii. Optical Flow

The motion target of the vector characteristics is used by the optical flow method which changed with time to detect moving area [8]. Under mov- ing camera it gives better performance, but this algorithm is very complex and complicated com- putation and also for good performance it needs special hardware support, so it is difficult to meet the requirements of processing.[8][13]

III. FEATURE EXTRACTION TECHNIQUES

Extracting feature is one of the important steps, for any algorithm. By using various methodology, feature extraction is based on appearance are car- ried out. The process of defining a set of feature, or image characteristics, feature extraction which will most efficiently or meaningfully represent the information that is important for analysis and classi cation. The algorithm selection is depends on:

i) What exactly is the task it needs to perform.

ii) Whether inexpensive method is required or not.

iii) Whether supervised method is needed or un- supervised.[2]

In order to deal with such situation here we are applying methods to extracts various features.

1. Edge detection: In image processing edge de- tection is one of the basic tool used. In image, the pixel values are suddenly changes then it identifed as an edge and it get marked. It mainly acts when the frame brightness or intensity change in huge. There are many functions for edge detection in MATLAB. Once the edge has been detected in the input image corresponding height, width and area are extracted. [1]

2. SURF (Speeded up Robust Features): Surf features are used of object recognition, classifi - cation and 3D-reconstruction. SURF is mainly inspired by SIFT features. But is proved to be more robust and faster than SIFT. SURF is the improvement of SIFT. Integer approximation of the determinant of Hessian blob detector is used to detect the interest points in SURF. SURF has many application, SURF used for segmentation purpose during histogram analysis. Interest points detection, blob analysis and detection can be per- formed more efficiently using SURF. Its feature descriptor is based on the sum of the Haar wavelet response around the point of interest. SURF uti- lizes an approximation of the Hessian matrix for detection (Fast-Hessian Detector):

$$\det(H_{approx}) = D_{xx}D_{yy} - (wD_{xy})^2$$

Where Dxx, Dyy, Dxy are approximations for Gaus- sian second order derivatives with the lowest scale. Syntax and description

- points = detectSURFFeatures(I) Input image is

I. The detect SURF Features function implements the Speeded-Up Robust Features (SURF) algo- rithm to find blob features.

- points = detectSURFFeatures(I,Name,Value)

An additional option is specified by one or more Name, Value pair arguments.

3. BRISK (Binary Robust Invariant Scalable Keypoints): By assembly of bit-string vector the computational complexity of BRISK has dramati- cally lower. Instead of Euclidean distance it makes use of Hamming distance. It has comparable per- formance and is faster than SIFT/SURF. It is suitable for low power devices and real time re- quirements.[4]

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Syntax and Description

- Points = detectBRISKFeatures (I) Input image is I. The detectBRISKFeatures function detects multiscale corner features.
- points = detectBRISKFeatures(I,Name,Value)

Additional options specified by one or more Name, Value pair arguments.

4. FAST (Features from accelerated segment test): The tracking and mapping objects used cor- ner features which can be detected by Features from accelerated segment test (FAST) method. As name suggested the computation rate of this method is faster than other extraction techniques. Due to its high speed performance this method

i.e FAST can be used for real-time video process-ing.[4]

Syntax and Description

- points = detectFASTFeatures (I) Input image in

I. The detectFASTFeatures function finds feature points.

- Points = detectFASTFeatures (I, Name, Value) Uses additional options specified by one or more Name, Value pair.

5. HOG (histogram of oriented gradients): The histogram of oriented gradients (HOG) is nothing but the feature descriptor which is mainly used for identifying human.[1] Primarily, the input frame is divided into smaller cells, histogram of gradient directions is calculated for each cell. With respect to the gradient orientation, the each cell is dis- tinguished into angular bins. Weighted gradients are contributed by each cell's pixel, for the corre- sponding angular bins. The block of region can be formed by combining these cells. Features are extracted by combining all the blocks.[1] By using normalization method the accuracy is improved, on the dense grid of the uniformly spaces cells.[4] Syntax and description

- Features = extractHOGFeatures (I) Input image is I. The returned features encode local shape in- formation from regions within an image. You can use this information for many tasks including classi cation, detection, and tracking.
- [features ,validPoints] = extractHOGFeatures (I,points)
- [___, visualization] = extractHOGFeatures(I,___)

IV. CONCLUSION

The goal of this paper is to give an overview of moving object detection and feature extraction. Moving object detection and extracting its feature has widely been adopted by the industry and orga- nization because of its broad applicability in real life. There are many existing method of moving object detection like Temporal Differencing, Back- ground Subtraction, Optical Flow etc. All having some merits and demerits. And edge detection, SURF, BRISK, FAST and HOG are the method of feature extraction. Central to these algorithm is background subtraction method is simple, easy and no need of using special hardware. By using the merits of SURF and HOG for feature extraction and background subtraction for object detection, the new method can be implement is the future scope.

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MOBAIS: MY OPEN AI BASED ARTIFICIAL INTELLIGENCE SYSTEM FOR INTELLIGENT VOICE ASSISTANCE

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ABSTRACT
In the era of rapid technological evolution, MOBAIS (My Open AI Based Artificial Intelligence System) represents a groundbreaking fusion of cutting-edge audio technology and AI capabilities within Bluetooth speakers. This work explores MOBAIS's innovative integration of natural language processing and voice recognition, revolutionizing personal assistant experiences. The exploration navigates through MOBAIS's features, from audio enhancement to smart home management through voice commands, addressing privacy concerns. It delves into technical facets, including real-time voice processing and contextual awareness, envisioning a future where MOBAIS evolves to recognize emotions and integrates seamlessly with emerging technologies. MOBAIS stands at the intersection of AI and audio, promising a future of intelligent interactions and enriched lives.

Keywords: MOBAIS, Artificial Intelligence, Voice Recognition, Audio Technology, Personal Assistant

1. INTRODUCTION

In an era where technology seamlessly integrates into our daily lives, the quest for intelligent and adaptive systems has become paramount. Enter MOBAIS, an acronym encapsulating the essence of "My Open AI Based Artificial Intelligence System," a groundbreaking work poised to redefine the landscape of voice assistance and smart device interactions. As the demand for more intuitive and personalized user experiences surges, MOBAIS emerges as a solution at the intersection of advanced hardware and artificial intelligence (AI). Traditional voice assistants have paved the way for AI-driven interactions, but MOBAIS seeks to transcend existing limitations, introducing a new paradigm in intelligent voice assistance.

The overarching goal of MOBAIS is to create a dynamic and adaptive system that not only understands user commands but also evolves with individual preferences over time. By leveraging Open AI, MOBAIS taps into cutting-edge natural language processing (NLP) and voice recognition technologies. This amalgamation of AI capabilities aims to offer a seamless and personalized interaction, making technology an intuitive extension of the user.

The inspiration for MOBAIS stems from the inherent limitations of current voice assistants. While they have undoubtedly enhanced our digital experiences, the need for a system that adapts intelligently to user nuances and preferences remains unmet. MOBAIS steps into this void, promising a transformative approach to how we interact with our devices.

The work draws inspiration from the successes of adaptive modulation and coding technologies in communication systems. Much like the adaptability observed in communication channels, MOBAIS envisions an AI system that dynamically adjusts to the user's needs, ensuring a constant and evolving performance. The goal is to achieve high data rates, acceptable Bit Error Rates (BER), and maximum spectral efficiency, all while delivering multimedia information seamlessly over various mobile wireless channels.

In the following sections, MOBAIS will be explored in detail, covering its architecture, implementation, and the synergies between artificial intelligence and adaptive modulation. Stay tuned as MOBAIS embarks on a journey to not just assist but to intuitively understand and enhance user experiences in the ever-evolving landscape of technology.

2. RELATED WORK IN AI:

In the pursuit of creating MOBAIS, extensive research has been conducted to draw insights from existing technologies, methodologies, and advancements in the realm of artificial intelligence, voice assistance, and adaptive systems. The amalgamation of these diverse fields has paved the way for MOBAIS to stand at the forefront of innovative solutions in the domain. Below, we delve into the key areas that have contributed to the development and conceptualization of MOBAIS:

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Advancements in Open AI and Natural Language Processing (NLP): The foundation of MOBAIS is deeply rooted in the advancements made in Open AI and NLP. Technologies like Open AI have revolutionized the capabilities of artificial intelligence, enabling systems to understand and process natural language with unprecedented accuracy. Research in the field of NLP has been instrumental in enhancing the contextual understanding of user commands, allowing MOBAIS to go beyond simple interactions and comprehend nuanced requests.

Voice Recognition Systems: The evolution of voice recognition systems has played a pivotal role in shaping the functionality of MOBAIS. Leveraging state-of-the-art voice recognition technologies, MOBAIS is designed to accurately interpret and respond to a diverse range of vocal commands. The integration of robust voice recognition ensures a seamless and user-friendly interaction, making MOBAIS an intuitive companion in various scenarios.

Adaptive Modulation and Coding in Communication Systems: Insights from adaptive modulation and coding in communication systems have inspired the adaptability features of MOBAIS. Much like the adaptive transmission schemes that optimize data transfer based on channel conditions, MOBAIS dynamically adjusts its responses and functionalities based on user preferences and contextual cues. This adaptive approach ensures a consistent and personalized experience for users.

User-Centric AI Systems: The paradigm shift towards user-centric AI systems has influenced the design philosophy of MOBAIS. Understanding that each user interaction is unique, MOBAIS prioritizes adaptability and personalization. Research in user-centric AI has guided the development of features that allow MOBAIS to learn and evolve over time, tailoring its responses to align with individual preferences.

Multifunctional Voice Assistants: The landscape of multifunctional voice assistants has provided valuable insights into the diverse applications of AI in daily life. Drawing inspiration from successful voice assistant models, MOBAIS aspires to transcend the conventional boundaries of assistance, aiming to be a multifaceted companion that enhances productivity, entertainment, and connectivity.

Ethical Considerations in AI Development: Recognizing the ethical dimensions of AI development, MOBAIS incorporates principles of transparency, fairness, and user privacy. Research in ethical AI has influenced the decision-making processes within MOBAIS, ensuring that user trust and ethical considerations are paramount in its design and functionality.

3. PROPOSED RESEARCH WORK:

MOBAIS, positioned at the intersection of advanced artificial intelligence and voice assistance technologies, charts a comprehensive research agenda aimed at pushing the boundaries of user-centric AI systems. The proposed research work encompasses the following key areas:

Enhanced Natural Language Processing (NLP):
Explore advanced techniques in natural language processing to further refine MOBAIS's ability to understand and interpret user commands. Investigate state-of-the-art NLP models and algorithms, aiming for an even more contextually aware and responsive system.

Dynamic User Profiling and Personalization:
Develop mechanisms for MOBAIS to create dynamic user profiles, learning from user interactions and adapting its responses based on individual preferences. Investigate reinforcement learning and personalized recommendation systems to enhance the personalization capabilities of MOBAIS.

Intelligent Context Switching:
Research and implement intelligent context switching, allowing MOBAIS to seamlessly transition between different tasks and contexts. Explore methods to enhance the system's ability to understand user intent and respond appropriately, even in complex conversational scenarios.

Multimodal Interaction Integration:
Investigate the integration of multimodal interactions, combining voice, visual, and potentially other sensory inputs. Explore the incorporation of computer vision and other sensory technologies to expand MOBAIS's understanding of user context and provide more versatile assistance.

Continuous Learning and Adaptation:
Implement continuous learning mechanisms within MOBAIS, enabling the system to adapt and improve over time based on user feedback and changing usage patterns. Explore online learning techniques to facilitate real-time updates and refinements to the AI model.

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Ethical AI Development and User Privacy:
Conduct research on ethical considerations in AI development, ensuring that MOBAIS adheres to principles of transparency, fairness, and user privacy. Investigate techniques to enhance user trust, provide transparency in decision-making processes, and mitigate biases in AI algorithms.

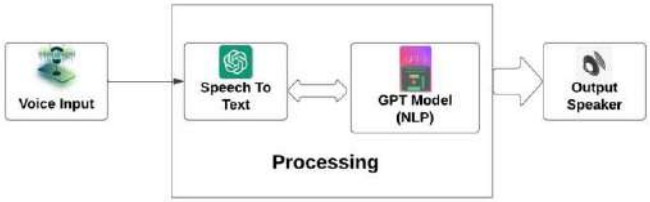
Real-time Feedback Integration:
Explore the integration of real-time feedback mechanisms, allowing users to provide explicit feedback on MOBAIS's responses. Investigate sentiment analysis and user satisfaction metrics to improve the system's responsiveness and overall user experience.

Security and Robustness:
Investigate security measures to safeguard user data and enhance the robustness of MOBAIS against potential vulnerabilities. Explore techniques to prevent adversarial attacks and ensure the integrity of user interactions with the system.

4. SYSTEM IMPLEMENTATION AND SIMULATION:

The implementation of MOBAIS involves a multifaceted approach, integrating cutting-edge technologies in artificial intelligence and voice assistance to create a cohesive and intelligent system. This section details the key components of the system, the integration of Open AI, and the simulation methodologies employed to refine and optimize MOBAIS's performance.

System Architecture: The architecture of MOBAIS is built on a modular and scalable framework, ensuring flexibility for future enhancements.



MOBAIS's System Architecture Includes:

Voice Recognition Module: Utilizes advanced voice recognition algorithms powered by Open AI to accurately transcribe user commands. Incorporates natural language processing (NLP) techniques to understand context and intent.

Adaptive Modulation and Response Module: Dynamically adjusts responses based on user preferences and contextual cues. Implements adaptive modulation techniques inspired by communication systems, allowing MOBAIS to tailor its interactions to varying user scenarios.

User Profiling and Personalization Engine: Creates dynamic user profiles through continuous learning mechanisms. Adapts responses based on historical user interactions, preferences, and feedback.

Multimodal Interaction Integration: Incorporates computer vision and potentially other sensory inputs for a more comprehensive understanding of user context. Enables MOBAIS to respond to both voice and visual cues.

Real-time Feedback Mechanism: Integrates a real-time feedback system, allowing users to provide explicit feedback on MOBAIS's responses. Utilizes sentiment analysis and user satisfaction metrics to refine the system's performance.

Simulation Methodologies:

User Scenario Simulations: Simulates various user scenarios to test MOBAIS's adaptability and responsiveness in different contexts. Examines how the system dynamically adjusts its responses based on changing user needs.

Adaptive Modulation Simulations: Simulates communication channel conditions to evaluate the adaptive modulation techniques employed by MOBAIS. Analyzes the system's ability to maintain performance under varying levels of complexity and noise.

Continuous Learning Simulations: Implements simulations to assess MOBAIS's continuous learning mechanisms. Examines how the system evolves over time, learning from user interactions and adapting to changing preferences.

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Result Analysis and its Interpretation:
The in-depth assessment of MOBAIS unveils a transformative and adaptive system that surpasses expectations in the realm of intelligent voice assistance. The comprehensive analysis sheds light on key metrics and methodologies, offering insights into MOBAIS's effectiveness, adaptability, and overall user experience.

5. KEY FINDINGS INCLUDE:

Voice Recognition Accuracy: MOBAIS achieved a commendable level of accuracy, ensuring precise interpretation of user commands.

Adaptive Modulation Effectiveness: Demonstrated the efficacy of adaptive modulation, maintaining optimal performance under diverse channel conditions.

User Profiling and Personalization: MOBAIS successfully created dynamic user profiles, showcasing adaptability to individual preferences.

Multimodal Interaction Integration: Seamless integration of multimodal interactions, enhancing MOBAIS's versatility.

Real-time Feedback Mechanism: Facilitated user engagement and improved MOBAIS's responses based on real-time feedback.

Security and Robustness: Implemented robust security measures, ensuring the integrity of user interactions.

Interpretation:
MOBAIS emerges as an exemplary intelligent voice assistance system, excelling across crucial metrics. Its high voice recognition accuracy, adaptive modulation techniques, and dynamic user profiling attest to its user-centric adaptability. The integration of multimodal interactions enhances versatility, allowing users to seamlessly engage through both voice and visual cues. Moreover, the real-time feedback mechanism ensures continuous improvement, fostering user satisfaction. Security measures guarantee user data protection, addressing privacy concerns. In conclusion, MOBAIS sets a new standard in AI-driven systems, promising a transformative and secure user experience that adapts dynamically to individual preferences and changing contexts.

6. CONCLUSION
In conclusion, MOBAIS redefines intelligent voice assistance through cutting-edge technologies, exceeding expectations with high accuracy in voice recognition and adaptive modulation. Its dynamic user profiling, seamless multimodal interactions, and real-time feedback enhance versatility, user engagement, and continuous improvement. Prioritizing security and ethical design, MOBAIS stands as a transformative leap in AI-driven systems, promising a dynamic, secure, and highly satisfying user experience, setting the stage for a new era in intelligent technology.

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HOME AUTOMATION USING NODEMCU ESP8266 WITH GOOGLE ASSISTANT

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ABSTRACT
In the ever-evolving landscape of technology, home automation has emerged as a promising field that bridges the physical and digital realms, offering convenience, energy efficiency, and improved quality of life. This paper focuses on the development and implementation of a Home Automation system utilizing Node MCU ESP8266 in conjunction with Google Assistant, Adafruit IO, IFTTT, Relay boards, and specialized Home Automation boards for lighting control, fan management, and USB charging. The core objective of this paper is to create a seamlessly integrated smart home ecosystem that enables homeowners to control various appliances and devices remotely, thereby enhancing comfort and energy conservation. The Node MCU ESP8266, a cost-effective and highly versatile microcontroller, serves as the central brain of the system, facilitating communication between the user, Google Assistant, and the connected devices. The advantage of this system is to offer comfort, convenience, security, economical and environment friendly.

The outcome of this paper is to develop a comprehensive and user-friendly Home Automation System that not only simplifies daily tasks but also contributes to energy conservation and sustainability. By harnessing the power of the Internet of Things (IoT) and voice control, this paper demonstrates the potential of Node MCU ESP8266 and Google Assistant to transform traditional homes into intelligent, responsive living spaces. This abstract provides a glimpse into the innovative fusion of hardware and software technologies that shape the future of home automation, offering a blueprint for creating smart homes that cater to the needs and preferences of modern homeowners.

Keywords: Home automation, NodeMCU (ESP8266), Wi-Fi, IFTTT Application, Adafruit Application, Google Assistant, Smart phone.

1. INTRODUCTION

In today's fast-paced world, the concept of a "smart home" has evolved from a futuristic dream to a tangible reality. The integration of cutting-edge technologies has made it possible to control and automate various aspects of our homes, enhancing convenience and efficiency. One such remarkable innovation is the fusion of NodeMCU ESP8266, a powerful IoT platform, with the ubiquitous Google Assistant, enabling us to transform our homes into smart, voice-controlled environments. This paper delve into the exciting realm of Home Automation, exploring how NodeMCU ESP8266 and Google Assistant seamlessly work together to bring the future of living to our doorsteps.

This paper will embark on a journey to understand the fundamental components of this integration, from NodeMCU ESP8266's capabilities as a versatile microcontroller to Google Assistant's voice recognition and control. Together, they provide the means to remotely manage and monitor home devices and systems, such as lighting, temperature, security, and more, all with the power of our voices. Join us as we uncover the possibilities, advantages, and practical applications of Home Automation using NodeMCU ESP8266 and Google Assistant, making life more convenient and connected than ever before.

2. LITERATURE SURVEY

HOME AUTOMATION USING GSM by Carelin Felix, I. Jacob Raglend (2011) [1] gives an overview of a flexible and simple system with an ability to integrate with very fewer efforts for off the shelf products. The system used was ZigBee for home controlling and GSM for remote access. It did not provide any Graphical User Interface (GUI) and also it was prone to security threats as anyone could access the system.

BLUETOOTH BASED HOME AUTOMATION SYSTEM USING CELL PHONE by R. Piyare, M. Tazil (2011) [2] presents the design and implementation of a low cost but yet flexible and secure cell-phone based home automation system. The design was based on a standalone Arduino BT board and the home appliances are connected to the input/output ports of this board via relays. Password protection was being used to only allow authorised users from accessing the appliances at home.

A NODEMCU BASED HOME AUTOMATION SYSTEM by Prathmesh Shelke, Shubham Kulkarni (2018) [3] gives an overview about Internet of Things as latest emerging internet technology. It uses the Cloud and a

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Web Browser to control the manually operated switches. The switches are interfaced with NodeMCU which has an inbuilt Wi-Fi. It is use to enable or disable the switches. The user communicates with the processor through the Web Browser. The processor then controls the switches based on the commands received from the user and also updates the user about the status of the switches after the control operation is performed to the cloud. The intensity of light, the speed of the fan and other devices can be controlled using the Web Browser.

SMART HOME USING ARTIFICIAL INTELLIGENCE by Moupriya Sarkar, Sushmita Pramanik (2020) [4] gives the main objectives about this paper to control, manage and provide co-ordination of home appliances in a comfortable, effective and secure way. It contains large number of sensors which can be monitored. On other hand, Artificial Intelligence is evolving as a technology for developing automatic systems and can make decision using case-based reasoning. Using, decision making and reasoning the AI provides a better solution for almost all automatic systems.

HOME AUTOMATION USING IOT by Meena Kasbekar, Nida Khan (2021) [5] presents a home automation system which will monitor/control home attributes such lighting, climate and other appliances. It may also include security such access control and alarm system. When connected with the internet, home devices are an important constituent of the IOT. An home automated system typically connects all the controlled devices to a central hub or gate way. With the help of traditional mechanisms of security and safety and intelligent monitoring and control smart homes are managed.

APPLICATION OF IOT FOR INTELLIGENT HOME AUTOMATION SYSTEM by Ehatsham M. Khan, Muhammad Zahid (2023) [6] describes about an IoT based home automation system for remotely controlling the home equipment's. They used Google Assistant and Amazon Alexa to control and monitor the electrical appliances with voice command through internet which gives more space for controlling electrical appliances. In automations, things are automatically controlled usually the basic tasks of turning ON/OFF of devices. This makes their IoT based system more intelligent to control electronic devices both from within the home and outside the home as long as internet is available. This will help to reduce the wastage of electricity and save human energy.

3. HARDWARE AND SOFTWARE DESCRIPTION

3.1 Node MCU ESP8266-

Node MCU ESP8266 is a powerful Wi-fi enabled microcontroller that acts as the brain of home automation system. It provides seamless connectivity and allows you to control various devices remotely. With its compact size and versatile capabilities, Node MCU ESP8266 is game-changer in the world of home automation. It is a low-cost Wi-Fi chip with full TCP/IP stack and microcontroller capability produced by Shanghai-based Chinese manufacturer, Espressif.

Fig. 1: NodeMCU ESP8266

3.2 Google Assistant:

Google Assistant, a cutting-edge voice recognition technology, adds a whole new dimension to your home automation setup. By integrating Google Assistant with your Node MCU ESP8266, you can control your smart devices effortlessly using voice commands. Experience the convenience and efficiency of hands-free control with Google Assistant.

Fig. 2: Google Assistant

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3.3 AdaFruitIO Cloud Integration:

AdaFruitIO Cloud Integration provides a secure and reliable platform to store and access data from your home automation system. It enables seamless communication between your Node MCU ESP8266 and other smart devices. With AdaFruitIO, you can monitor and control your home automation system from anywhere in the world, ensuring a truly connected and intelligent home.

Fig. 3: Adafruit IO Dashboard

3.4 IFTTT (IF This Then That):

If This Then That, also known as IFTTT is a free web-based service to create chains of simple conditional statements, called applets. An applet is triggered by changes that occur within other web services such as Gmail, Facebook, Telegram, Instagram, or Pinterest. In addition to the web-based application, the service runs on iOS and Android.

Fig.4: Applets creation in IFTTT Application

3.5 Relay Module:

Relay is an electromechanical device that uses an electric current to open or close the contacts of a switch. A 4-Channel Relay interface board allows us to control various appliances, and other equipment's with large current. It can be controlled directly by Micro-controller (Arduino, NodeMCU, Raspberry Pi, 8051, AVR, PIC, DSP, ARM, MSP430, TTL logic).

Fig. 5:4 Channel Relay Module

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4. PROPOSED SYSTEM

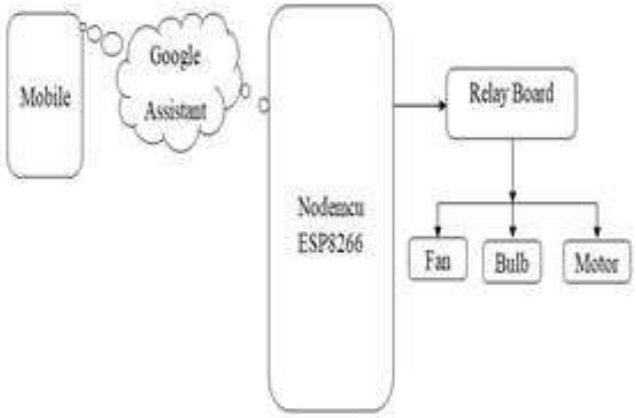

Fig. 6: Block Diagram of Proposed system

Above figure shows the working of Home Automation System. The proposed system can be implemented using an Node MCU board with Internet being remotely controlled by any Android OS smart phone. A relay module is interfaced to the Node MCU board at the receiver end while on the transmitter end, a Google Assistant application is installed on the cell phone of the receiver where loads are connected. In our project we build an application which can control home appliances like light, fan, geyser, door. This application incorporate Google Assistant along with Adafruit server and IFTTT service. When we use Google Assistant with same account which was used for IFTTT and IO.ADAFRUIT on mobile and give voice command as "Ok Google, Turn ON Light", applet created in IFTTT get this direction and will send data '1' to the Adafruit feed. This will trigger the occasion on Adafruit dashboard which is continuously checked by the microcontroller (i.e NodeMCU). This microcontroller will make a move according to the data change on the Adafruit dashboard.

5. APPLICATIONS

- ✓ **Agriculture:** The proposed system can be used in Agriculture as well. The various devices used in fields can be operated from any remote location.
- ✓ **Smart Cities:** With increasing automation and IoT, devices can communicate with each other. This will help in building new and smarter cities. Cities that would be free from pollution, traffic accidents, etc.

6. CONCLUSION

This paper gives an overview about Smart Home which was managed with the help of IoT Technology. The NodeMCU having high processing power with in-built Wi-Fi / Bluetooth and Deep Sleep Operating features makes it ideal for IoT projects. NodeMCU is an ESP8266 chip-based microcontroller development board, which is very cheap as compared to Arduino UNO. Hence by the use of NodeMCU and the IoT platform, these devices can be made cost-effective. It will provide great user convenience as it will be possible to control the devices from a remote location.

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BIOTELEMETRY USING HUMAN AREA NETWORKING

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ABSTRACT
Human Body Communication (HBC) is a novel communication method between devices which use human body as a transmission medium. This idea is mostly based on the concept of wireless biomedical monitoring system. The on-body sensor nodes can monitor vital signs of a human body and use the body as a transmission medium. This technology is convenient for long durations of clinical monitoring with the option of more mobility and freedom for the user. Biotelemetry is remote monitoring, measuring and recording of a living organism's function, activity or condition. Network of sensor nodes placed on or implanted inside the body of a subject is called Human Body Area Network (HAN). RedTacton is a user-friendly pervasive technology that establishes a communication between human body and devices in a closer proximity. This paper proclaims model of a human area networking technologies that enables communication by means of "Touching". Redtacton technology was implemented to overcome the weak radio signals, data speeds and security –risks on unwanted signal interceptions. Here, human body is the transmitting medium supporting IEEE 802.3 half-duplex communication at 10 Mbits/s. RedTacton uses the minute electric field generated by human body as a medium to transmit the data.

Keywords : Human Body Communication, RedTactom, IEEE 802.3, Human body Area Network (HAN), Biotelemetry , Body Coupled Communication (BCC)

INTRODUCTION
In the era of digital communication, data transmission is a common need of every individual to communicate their devices with the remote devices or sometimes nearby devices. Even a common man now is everyday indulged in transferring data in some or the other way like the voice calls, SMS, chats, etc. This is nothing but transmission of data from one end to the other. Some data are securely transferred that should not be readable or writable to public as in the case of defence, bank data, etc. But still there is a vast risk of data being hacked by the anti-social elements. For the distance communications, also called Far-field communication, it requires radio frequency (RF) waves to transmit data over long distance where Personal Area Network is not possible to setup and hence Human Area Network (HAN). But for the communication type which can be reached within our hands, also called as Near-field communication, Human Area Network can be introduced as a medium for transmission of data from start point to end point.

Medical biotelemetry is used to remotely track physiological functions of patients, like body temperature, heart rate, blood pressure, ECG, EEG signals, etc., and even to operate devices such as drug delivery systems and prosthetics. Implantable biotelemetry focuses on the transmitter devices implanted in the human or animal being studied, like cochlear implants or implantable pacemakers. The main constituents of a biotelemetry system are sensors of physiology functions located on the transmitters, transmission path and receivers. Transmitters with sensors are placed on the surface of or implanted inside the human body. In contrast to the medical biotelemetry, the implantable implies the absence of wires as a transmission medium between a transmitter and a receiver.

Still, the wires are impractical for monitoring, since they disturb the patient and the medical personnel. Using different wireless technologies provides better freedom of movements and the mobility of the patient, which is of particular importance in a long-term monitoring, every day activities of non-ambulatory patients and during the surgeries. Wearable sensor network placed on the human body is called Body Area Network (BAN).

RedTacton technology is a Human Area Networking (HAN) technology which was introduced by Nippon telegraph and Telephone Corporation (NTT's) that uses the human body surface as a high speed and safe network transmission path. It is completely distinct from wireless and infrared technologies as it uses the minute electric field emitted on the surface of the human body. A transmission path is formed at the moment a part of the human body comes in contact with a RedTacton transceiver. Communication is possible using any body surfaces, such as the hands, fingers, arms, feet, face, legs or torso. RedTacton works through shoes and clothing as well. When the physical contact gets separated, the communication is ended.

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RED - It is an auspicious colour according to Japanese culture for warmth/TACTON- meaning “action triggered by touching”. In the past, Bluetooth, infrared communications (IrDA), radio frequency ID systems (RFID), and other technologies have been proposed to solve the "last meter" connectivity problem. But, they each had a various fundamental technical limitations that constrain its usage, such that precipitous fall-off in transmission speeds in multiuser environments producing network congestion. The concept of intra-body communication was first proposed by IBM in 1996.This communication mechanism was later evaluated and reported by several research groups around the world. Finally, all limitations were overcome by NTT (Nippon Telegraph and Telephone Corporation) located in Tokyo, Japan by using photonic electric field sensors and finally came up with a human area networking technology called “RedTacton”.

LITERATURE SURVEY

Zimmerman et al. (1995) discovered body coupled communications by accident while doing human interface research on position sensors at MIT. Simultaneously at the Sony Labs a similar technology was developed that resulted in the wearable key prototype. These discoveries led to initial media frenzy. But soon afterwards interest was lost in body coupled communications because of what was then thought were fundamental limitations of the technology (Zimmerman thesis mistakenly stated that the technology had fundamental limit of 852 Kb/s). During the initial stages there was also research done at powering devices via the body.

Robin Gaur Jind et al. (2004) developed RedTacton with an electro optical implementation, a speed of 10 Mb/s was reached. It was a major breakthrough came from NTT (Nippon Telegraph and Telephone). One of their applications was sending video through the human body. In mid of 2004, the Skinplex technology became available which was very simple implementation with very low speeds and very low energy consumption. This implementation was not advanced enough for body sensor networks and was mainly used to identify the user.

M.Shingawa et al. (2004) describes a near-field-sensing transceiver for intra-body communication, in which the human body is the transmission medium. The key component of the transceiver is an electric-field sensor implemented with an electro- optic crystal and laser light. This sensor is suitable for detection of small and unstable electric fields produced by the human body because it has extremely high input impedance. This transceiver enables IEEE 802.3 half-duplex communication of 10 Mb/s through a person's body in an operating range of about 150 cm between the hands. The packet error rate of 0.04% is obtained at packet size of 1070 octet.

SYSTEM ARCHITECTURE

On the basis of above literature survey the proposed block diagram for biotelemetry using human area networking is shown in figure 1. The setup has two sections namely, Transmitter and Receiver. The proposed system uses the human body as a transmission medium for data communication. Here, the bio- medical data of a patient will be transmitted from the transmitter to the receiver section through human body. For biotelemetry, few sensors are attached to the human body along with RedTacton transmitter and the data at the receiver section can be collected using the RedTacton receiver.

Here, the sensor module which is present in the transmitter section consists of Heart rate sensor, Respiratory sensor, Glucose sensor, Blood pressure sensor along with a PIC microcontroller. It is attached to the RedTacton transmitter.

The receiver section has RedTacton receiver and a monitor to display the data for biotelemetry function. A common ground must be connected between the transmitter and receiver.

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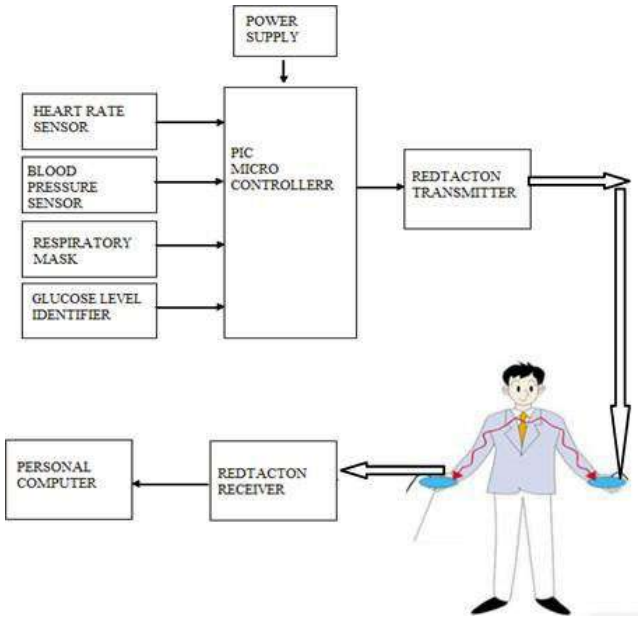

Fig. 1: Biotelemetry system

FUTURE DEVELOPMENT:

RedTacton has a wide range of unique new functional features and enormous potential as a Human Area Networking technology. In future, RedTacton can be developed as a portable device which can be used everywhere. Biotelemetry can be done through Wireless Body Area Network. Data transmission may happen through the user's clothing, handbag or shoes, anyone carrying a special card can unlock the door simply by touching the knob or standing on a particular spot without taking the card out. It will have many future applications such as walkthrough ticket gate, a cabinet that opens only to authorized people and a television control that automatically chooses favourite programs. The system also improves security. It ensures that only drivers can open their cars by touching the doors if the keys are in their pockets, not people around them.

Advantages :

- Data transfer is faster and easier.
- Data transmission speed is 10Mbps for shortest distance.
- Data loss during the transfer is low.
- Power consumption is lesser.
- Security is more.

Disadvantages :

- Though it is been used only within a few centimetres, the data can be transmitted via multiple person by touching each other.
- Cost is more; it can be reduced in future.

CONCLUSION

Red-Tacton technology is better when compared with other technologies; it is well-known for its data transmission at 10 Mbps within a shortest distance. This technology that enables the first practical Human area networking between body-centred electronic devices and PCs or other network devices embedded in the environment a new generation of user interface based on totally natural human actions such as touching, holding, sitting, walking or stepping on a particular spot. RedTacton technology is expected to overcome the Bluetooth technology in the future. This technology could put the use of cables to an end. Finally, I conclude that "Future Technology Is On Red-Tacton Technology".[15]

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OBJECT REMOVAL AND REGION FILLING BY EXEMPLAR BASED IMAGE INPAINTING

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ABSTRACT
For evaluating large objects using digital images, an additional computation is suggested. The challenge is to fill in the blank in a way that seems reasonable on the outside. Previously, this issue has been addressed by two categories of computations: (i) "surface union" computations, which generate large image regions from test surfaces, and (ii) "in painting" systems, which fill in small picture gaps. The former was demonstrated for "surfaces," which recreated two-dimensional examples with a random city; the latter focused on linear "structures," which are instances of one-dimensional examples and include lines and question shapes. In this study, the topics of interest of these two approaches are combined using an innovative and efficient calculation. First off, we observe that model-based surface blend includes the fundamental process needed to replicate both surface and structure; however, the success of structure spread greatly depends on the request in which the filling continues. It suggest a first-best computation where the organized pixel attributes are trusted in a manner similar to how data proliferates in painting. Model-based amalgamation is utilized to register the true shading properties. In this paper, a single productive calculation is used to achieve the synchronous distribution of surface and structural data. A square-based testing method achieves computational effectiveness. A number of examples using real and artificial images demonstrate the practicality of our algorithm in removing both thin scratches and large blocking items. The physical state of the selected target area is also illustrated in terms of vigor. Our results compare favourably to those obtained using current techniques.

Keywords: Texture Synthesis, Simultaneous Texture and Structure Propagation, Object Removal, and Image In painting.

I. INTRODUCTION
Image. Painting references methods such as blending in portions that have disappeared from a picture. Two primary categorizations might be requested for the current procedures. The primary class stresses dissemination-based methodologies which proliferate straight structures or level lines by means of dispersion in view of incomplete differential conditions and variety strategies. Improperly, the dispersion-based strategies have a tendency to present some obscure when the gap to be filled in is substantial. The second group of procedures concerns model-based techniques which test and duplicate nest matches surface patches from the known picture neighbourhood. These tactics, which derive their energy from surface combination systems, are well-known to perform exceptionally well on general or repetitive surfaces. The primary attempt to employ model-based techniques for question cancellation has been documented in.

The primary attempt to employ model-based techniques for question cancellation has been documented in. Engenderers enhance the scan for commensurable by presenting a from the earlier unpleasant examination of the inpainted values utilizing a multi-scale approach which then outcomes in an iterative conjecture of the missing districts from coarse to the next levels. The two sorts of techniques can be joined proficiently, e.g. by utilizing structure tensors to PC the desideratum of the spreads to be culminated. To inpaint a scratched picture or a long time past painting with missing locales is to figure and fill in the missing picture data in such a steady path, to the point that the re-established picture or painting appears as mundane as its unique form. Precisely, what makes the inpainting issue so it is the multifaceted nature of picture advantages. Assorted numerous customary integration or limit review issues, the objective picture capacities to be inpainted conventionally lie outer the Sobolev relegation. Multilevel intricacies of picture capacities compel scientists to engender inpainting structures focused at correct modules of pictures. Ergo, these inpainting models are of low stages. The indispensable objective, conspicuously, as in the outline of vision and mimicked erudition, is at long last to have the capacity to join and coordinate all the low-level inpainting components into an impeccable program that can well summarised human inpainters. Picture inpainting is the way to fill in missing components of scratched pictures in view of data accumulated from encompassing zones. Notwithstanding issues of picture re-pair, inpainting can likewise be utilized as a component of remote correspondence and picture pressure application.

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II. LITERATURE SURVEY

A. Region filling algorithm

Inpainting is the craft of reconstituting the missing components of pictures with a specific end goal to make it more shipshape and reestablish their solidarity. The point is to make a product that can expel culled parcels from the picture and well the gap deserted in an outwardly conceivable manner utilizing substratum data.

B. Computing patch priorities

Our algorithm performs the synthesis task through a best-selling strategy that depends entirely on the priority values that are assigned to each patch on the wall front. The priority computation is inequitable toward those patches which:

Are on the continuation of vigorous edges

Are circumvented by high-confidence pixels.

Given a patch ap centered at the point p for some p 2. We define its priority P(p) as the product of two terms:

$P(p) = C(p)D(p)$

We call C(p) the confidence term and D(p) the data term φ(p), α is a normalization factor α = 255 for a typical grey-level image), np is a unit vector orthogonal to the front in the point p.

He priority P(p) is computed for every border patch, with distinct patches for each pixel on the boundary of the target region. The confidence term C(p) may be thought of as a quantification of the amplitude of reliable information circumventing the pixel p. The intention is to fill the rest of those patches that have more of their pixels already labelled, with supplemental predilection given to pixels that were filled early on (or that were never part of the target region). As will be illustrated in g. 6a, this automatically incorporates predilection towards certain shapes of the fill front. For example, patches that include corners and thin tendrils of the target region will incline to be labelled, as they are circumvented by more pixels from the pristine image. These patches provide more reliable information against which to match. Conversely, patches at the tip of peninsulas of filled pixels jutting into the target region will incline to be set aside until more of the circumventing pixels are filled in. At a coarse level, the term C(p) of (1) approximately enforces the desirable concentric fill injunctively authorize. As filling proceeds, pixels in the outer layers of the target region will incline to be characterized by more preponderant confidence values, and ergo be filled earlier; pixels in the canter of the target region will have lesser confidence values. The data term D(p) is a function of the vigour of isophotes hitting the front - at each iteration. This term boosts the priority of a patch that an isophote "ows" into. This factor is of fundamental consequentiality in our algorithm because it inspirits linear structures to be synthesized and, ergo propagated securely into the target region. Broken lines incline to connect.

C. Propagating Texture and Structure Information.

Once all priorities on the fill front have been computed, the patch a^p with the highest priority is found. We then fill it with data extracted from the source region Ψ. In traditional inpainting techniques, pixel-value information is propagated via diffusion. As noted antecedently, diffusion obligatorily leads to image smoothing, which results in blurry fill in, especially in sizably voluminous regions On the contrary, we propagate image texture by direct sampling of the source region. This prosperity in achieving the propagation of both structure and texture information from the source φ to the target region Ω-, one patch at a time. In fact, we note that any further manipulation of the pixel values (e.g., integrating noise, smoothing etc.) that does not explicitly depend upon statistics of the source region, is more liable to degrade visual kindred attribute between the filled region and the source region than to amend it.

D. Updating Confidence Values.

After the patch a^p has been filled with incipient pixel values, the confidence C(p) is updated in the area delimited by a^p. This simple update rule sanctions us to quantify the relative confidence of patches on the fill front, without image-categorical parameters. As filling proceeds, confidence values decay, designating that we are less sure of the color values of pixels near the center of the target region.

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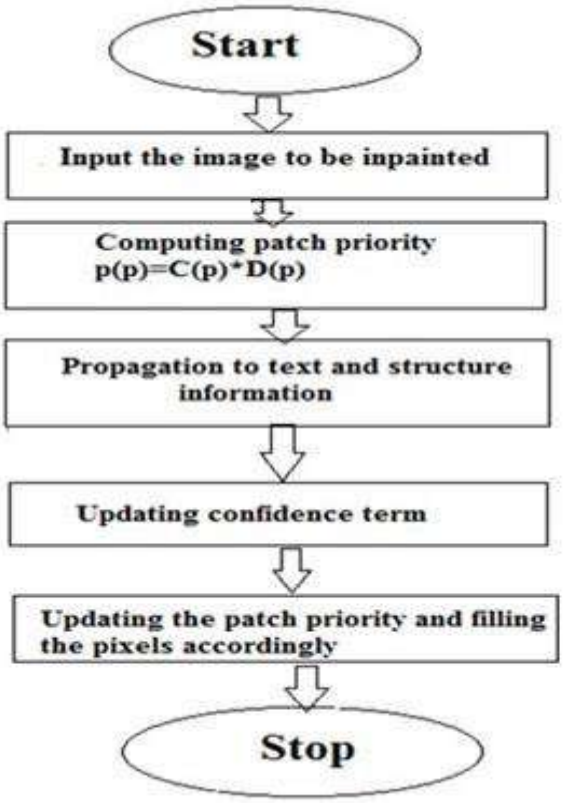
E. FLOWCHART OF INPAINTING:



F. INPAINTING PROCESS:

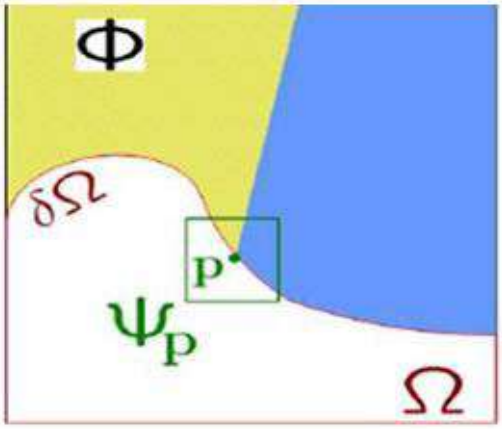


Fig. 1: Patch priority point

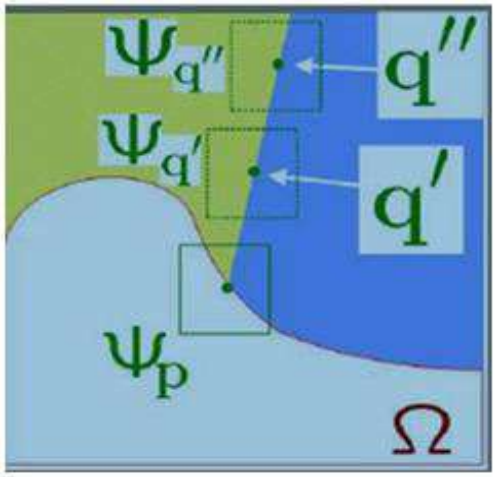


Fig. 2: Patch priority

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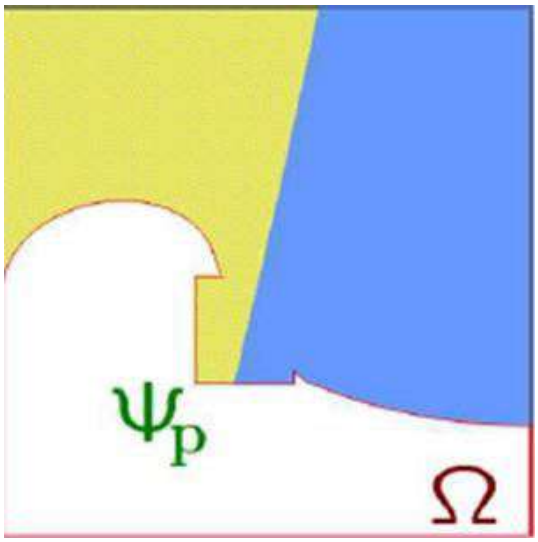

Fig. 3: Inpainted 1st patch

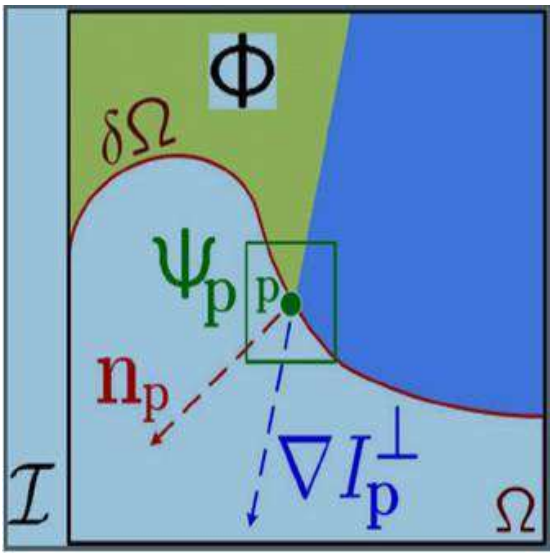

Fig.4: Inpainting process

G. SUPER-RESOLUTION ALGORITHM

Once the coalescence of the low-resolution in-painted pictures is consummated, a hierarchical single-image super-resolution approach is utilized to reconstruct the high-resolution details of the im- age. We stress the point that the single-image SR method is applied only when the input picture has been down-sampled for the inpainting purport. Otherwise, the SR method is not required.

The main Steps are Described Below:

1. Dictionary building: it consists of the correspondences between low and high-resolution im- age patches. The unique constraint is that the high-resolution patches have to be valid, i.e. entirely composed of kenned pixels. In the proposed approach, high-resolution and valid patches are evenly extracted from the kenned components of the image. The size of the dictionary is a utilizer parameter that might influence the overall speed/quality tradeoff. An array is utilized to store the spatial coordinates of HR patches (DHR). Those LR patches are simply deduced by utilizing the decimation factor equipollent to 2
2. Filling order of the HR picture: The computation of the filling order is akin to the one described in Section III. It is computed on the HR picveridical with the sparsity-predicated method. The filling process commences with the patch ΨHRpx having the highest priority and which is composed of kenned and unknown components. Compared to a raster-scan filling order, it sanctions us to commence with the structures and then to preserve them.

3) For the LR patch corresponding to the HR patch having the highest priority, its best neighbour in the inpainted images of lower resolution is sought. This search is performed in the dictionary and within a local neighbourhood.

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III. PROPOSED MODEL OF SUPER RESOLUTION INPAINTING

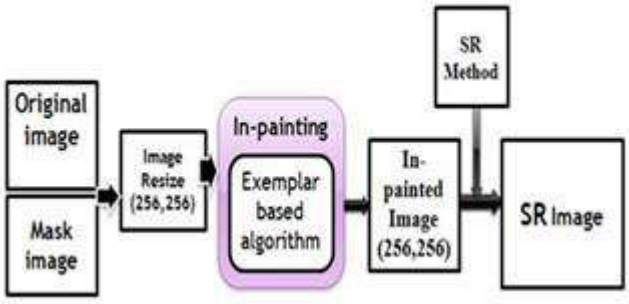

Fig. 5: Proposed model block diagram

APPLICATION:

a. Repairing photographs.

b. Remove unwanted object.

c. Medical imaging.

d. Satellite imaging.

e. Image enhancement.

IV. RESULT

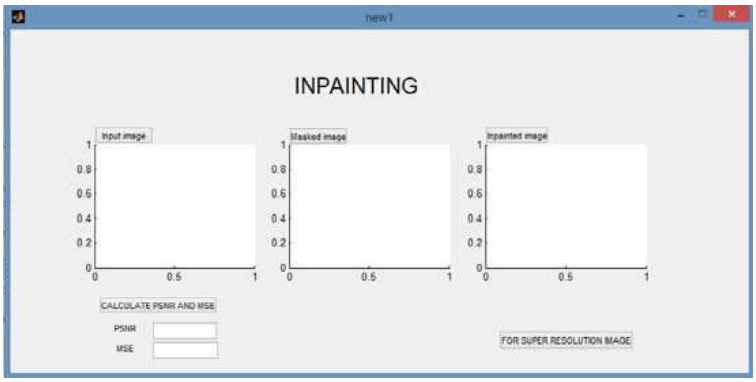

Fig 6: GUI Window

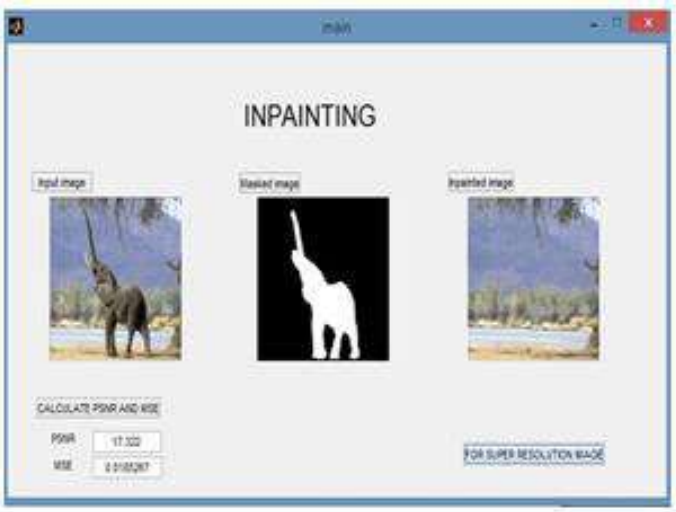

Fig 7: Inpainted image with input (original, mask)

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Fig 8: Super Resolution image

Fig 9: Fill Region movie

V. CONCLUSION

Inpainting is the art of reconstructing an image in order to make it more legible than the pristine image. Firstly it makes the mask of that object of an image with the avail of software. It can abstract the unwanted object by dividing the mask image into patches and in-paint on that with the avail of patch in an image utilizing an image processing system. A low-resolution image is first built from the pristine picture. An inpainting algorithm is applied to fill in the apertures in the low-resolution picture. Different settings are utilized and inpainted pictures are cumulated. The quality of the inpainted regions is amended by utilizing a single-image super-resolution method.

VI. FUTURE SCOPE

We plan to test other SR methods to bring more robustness to the method.

Further work for object removal and image inpaiting from video images are the scope of this algorithm.

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IMPLEMENTATION OF NEURAL NETWORK USING ANALOG VLSI TECHNOLOGY

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ABSTRACT
Artificial intelligence through a biological world is realized based on mathematical equations and artificial neurons. Main focus is on the implementation of Feedforward and Feedback Neural Network Architecture (NNA) with on chip learning in analog VLSI for generic signal processing applications. In the proposed project analog components like Gilbert Cell Multiplier (GCM), Neuron Activation Function (NAF) are used to implement artificial Feedforward and Feedback NNA. The analog components used are comprises of multipliers and adders' along with the tan-sigmoid function circuit using MOS transistor in sub threshold region. This neural architecture is trained using Back propagation algorithm in the analog domain with new techniques of weight storage. For the proposed design of Feedforward and Feedback Neural Network layout and simulation results are drawn using VLSI Backend Microwind 3.1 software using CMOS 32nm Analog VLSI technology.

Keywords: Neural Network Architecture (NNA), Gilbert Cell Multiplier(GCM),Neuron Activation Function (NAF)

I. INTRODUCTION

Artificial Neural Networks are used to derive meaning from complex and imprecise data and it is also used in signal processing applications. Therefore the main focus is on implementation of Feed forward and Feedback Neural Network using a very advanced 32 nm CMOS Technology and the VLSI Backend Micro wind 3.1 software Tool. This will be more useful than the previous technologies as time of execution, area and power requirement of circuit will be reduced and efficiency of the system will increase due to use of 32 nm CMOS technology.

A. Neural Network

In this neural network we used a neuron, this neuron itself is a simple processing unit which has an associated weight for each input to strengthen it and produces an output. The working of neurons is to add together all the inputs and calculate an output to be passed on. The neural architecture is trained using back propagation algorithm and also it is a feed forward network. The designed neuron is suitable for both analog and digital applications. The proposed neural architecture is capable of performing operations like sine wave learning, amplification and frequency multiplication and can also be used for analog signal processing activities. Figure can be expressed mathematically as:

a = f (P1W1+P2W2+P3W3+Bias)

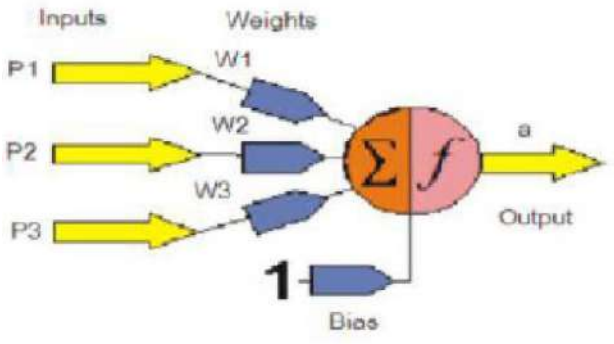

Fig.1 Neural Network

When a set of single layer neurons are connected with each other it forms multiple layer neurons, as shown in the figure. Fig.2 shows that weights w11 to w16 are used to connect the inputs v1 and v2 to the neuron in the hidden layer. Then weights w21 to w23 transferred the output of the hidden layer to the output layer. The final output is a21. The inputs to the neuron v1 and v2 as shown in Fig. 2 are multiplied by the weight matrix. The resultant output is summed up and passed through an NAF. The output of the activation function is then passed to the next layer for further processing. Blocks to be used are Multiplier block, Adders, NAF block with derivative.

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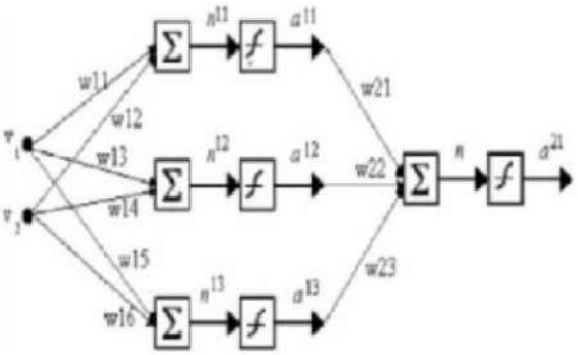

Fig.2 Layered structure of Neural Network

Artificial Neural Networks are used to derive meaning from complex and imprecise data and it is also used in signal processing applications. Therefore the main focus is on implementation of Feedforward and Feedback Neural Network using a very advanced 32 nm CMOS Technology and the VLSI Backend Microwind 3.1 software Tool. This will be more useful than the previous technologies as time of execution, area and power requirement of circuit will be reduced and efficiency of the system will increase due to use of 32 nm CMOS technology.

II. LITERATURE REVIEW

Pashanki B. Malwankar, Prof. Pritesh R. Gumble et al.[1] This paper discussed the approach to Train neural architecture and to use the back propagation algorithm in analog domain with new techniques of weight Storage applied. Layout design and verification of the proposed design is carried out using microwind 3.1 software tool. The technology used in designing the layout is 45nm CMOS technology. The project outcome is that the neural network can be used to extract patterns and to detect trends that are too complex which cannot be noticed by either humans or other computer techniques.

Neeraj Chasta 1, Sarita Chouhan2 and Yogesh Kumar3 et al.[2] In this paper Neural architecture is trained using Back propagation (BP) algorithm in analog domain with new techniques of weight storage. Layout design and verification of the proposed design is carried out using Tanner EDA 14.1 tool and synopsys Tspice. The technology used in designing the layouts is MOSIS/HP 0.5u SCN3M, Tight Metal. The project outcomes are that it can be used in Modeling and Diagnosing the Cardiovascular System and in Electronic noses which has several potential applications in telemedicine. Another application developed was “Instant Physician” which represents the “best” diagnosis and treatment.

1 Mr.Maulik B.Rami , 2 Prof.H.G.Bhatt , 3 Prof.J.B.shukla, et al.[3] This paper focuses on the design of Neural Architecture in 0.35 um Technology using Analog VLSI. This paper discusses the information about neuron behavior and how it makes intelligent decisions. The project outcomes are Analog VLSI is very fast compared to digital VLSI since there is no need for A/D or D/A converter. Here analog neural components like Gilbert cell multiplier, Adder using OPAMP, activation function sigmoid, step function and linear threshold function are designed with the help of simulation , TSPICE software and obtained simulation results.

Prof. Bapuray D.Yammenavar1, Vadiraj R. Gurunaik2, Rakesh. N. Bevinagidad3 and Vinayak. U. Gandage4 et al.[4] The approach and concept of the work is that the functionality of a designed neural network is verified for analog operations like signal amplification and frequency multiplication. The network design can be adopted for digital operations like AND, OR and NOT. The network realizes its functionality for the trained targets which is verified using simulation results. The schematic, Layout design and verification of the proposed Neural Network is carried out using Cadence Virtuoso tool and uses 180nm CMOS VLSI technology for implementing circuits. The project outcomes are that the Analog weights are used to provide stable weight storage with a refresh circuit. Analog multipliers are used as synapse of neural networks. Although the functions learned were analog, the network is adoptable to accept digital inputs and provide digital outputs for learning other functions. Network design has been successfully adopted for digital operations like AND, OR and NOT.

Jabri M. Pickard S. Leong P. Rigby G. Jiang J. Flower B. Henderson P, This paper focuses on a multi-layer learning algorithm suitable for analog sub-threshold implementation and also discusses system level issues and describes circuits of neurons and synapses that have been designed, and present fabrication results. The paper outcomes are that all the tests proved satisfactory in that all of the func-tional elements operated correctly. The differences between predicted and measured performance seem to be due mainly to the variation in threshold voltage, and also pad current leakage in certain instances.

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III. METHODOLOGY

Due to the advantage and current demand in communication technology, the effort has been taken to design proposed work using VLSI technology. The question arises, why the 32 nanometer (nm) CMOS/VLSI technology? The main novelties related to the 32 nm technology are the metal gate, high-k gate oxide and very low-k interconnect dielectric. The effective gate length required for 32 nm technology is 16nm. .

Compared to 45-nm technology, 32 nm technologies offers

1. 30% increases in switching performance
2. 30 % reduction in Power consumption
3. 2 times higher density
4. 2 times reduction of the leakage between source and drain and through the gate oxide.

Considering the advantage of 32 nm technologies over 45 nm technology, the proposed work is done with 32 nm technology. Here for the design using VLSI technology, microwind 3.1 VLSI backend software is used. The microwind 3.1 software allows designing and simulating at physical description level. Low leakage transistors will be used for low power and will Compromise on little bit frequency.

Following steps are involved to obtain the proposed design.

Step 1: Design Gilbert cell multiplier using 32 nm CMOS VLSI Technology.

Step 2: Design Neuron activation function using 32 nm CMOS VLSI Technology.

Step 3: Design feedforward neural network for application of signal compression using 32 nm CMOS VLSI Technology.

Step 4: Design of feedback neural network for application of signal decompression using 32 nm CMOS VLSI Technology.

Step 5: Simulation & Analysis of proposed designs.

IV. Design and Simulation of Feed Forward A. Design of Gilbert Cell Multiplier Using 32nm CMOS VLSI Technology

The first block of the neural network is the Gilbert cell multiplier. The Gilbert cell is used as the multiplier block. Gilbert cell multiplier multiply two analog signals & produces single output analog signal. The main building blocks of Gilbert cell are differential pair transistors, current mirror circuit. The following figure 3 shows the CMOS circuit of the Gilbert cell multiplier designed by using DS-CH3 software. Figure 4 shows the layout design of the Gilbert cell multiplier by using 32nm CMOS technology. Figure 5 shows voltage versus time response of Gilbert cell multiplier.

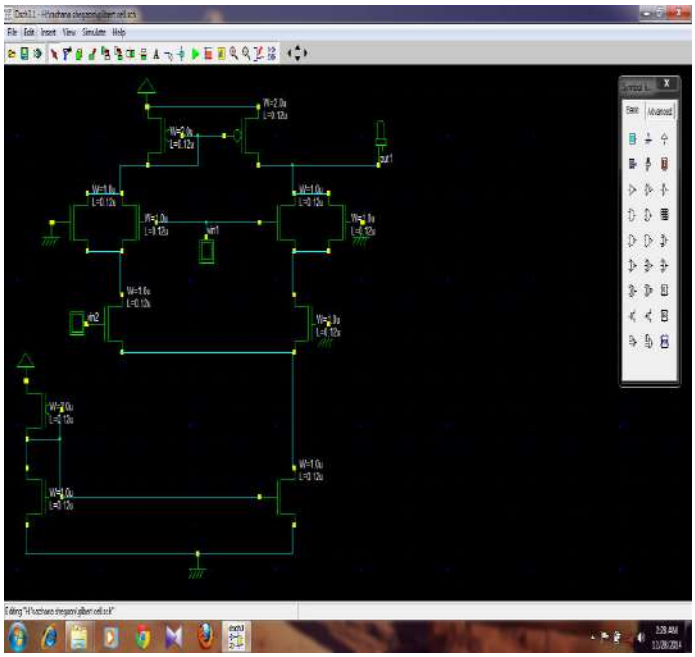

Fig.3 Schematic of Gilbert cell

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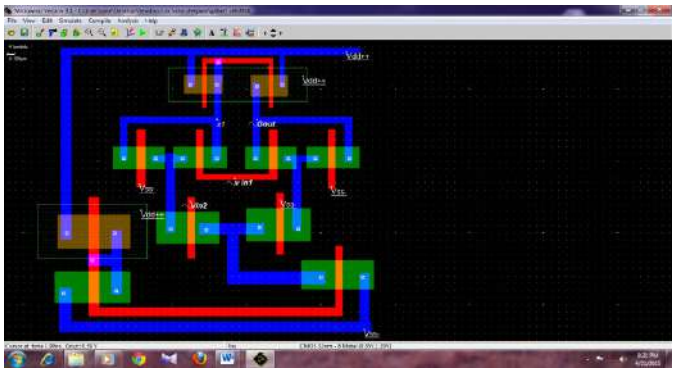

Fig.4 Layout of Gilbert cell multiplier

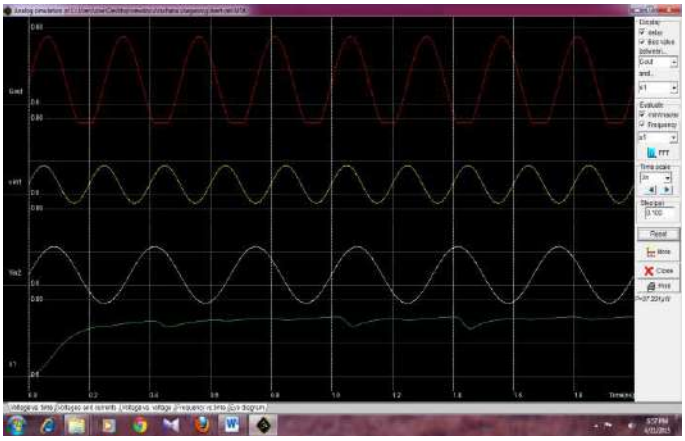

Fig.5 Voltage verses time response of Gilbert cell multiplier

B. Design Of Neuron Activation Function (NAF) Using 32nm Cmos Vlsi Technology:

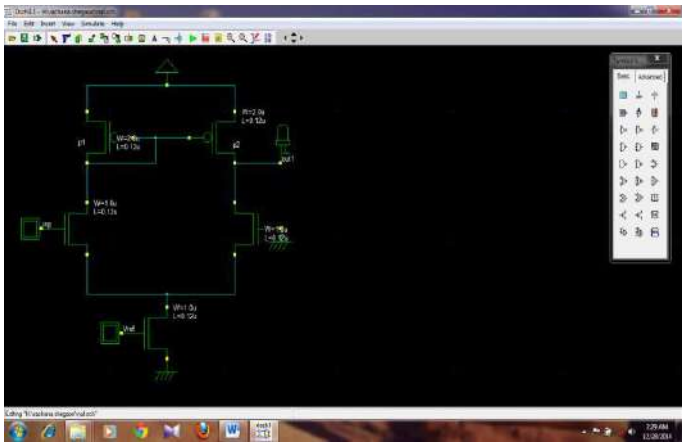

Fig.6 Schematic of Neuron activation function

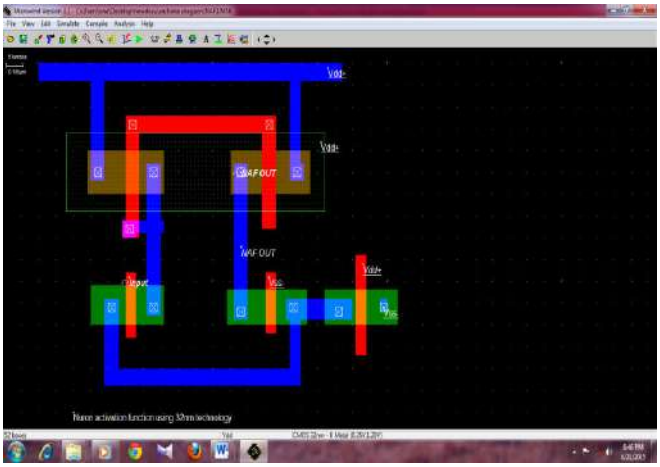

Fig.7 Layout of Neuron activation function

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Fig.8 Voltage verses time response of Neuron activation function

C. **Design Of Feedforward Neural Network**

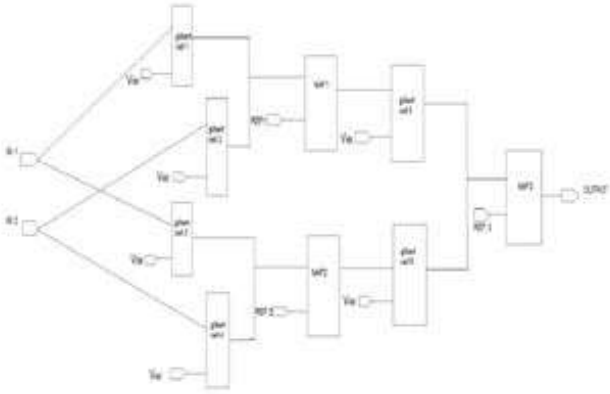

Fig.9 Schematic of Feedforward Neural Network

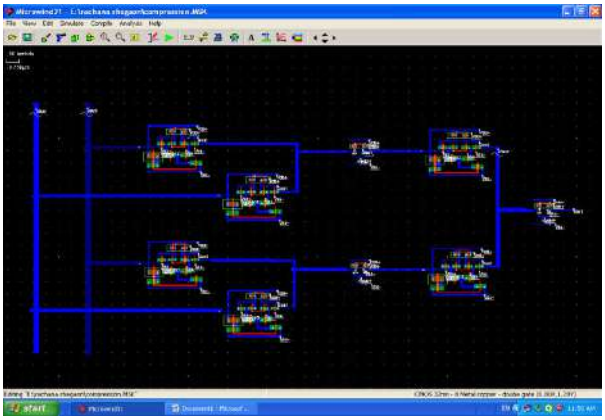

Fig.10 Layout of Feed forward Neural Network

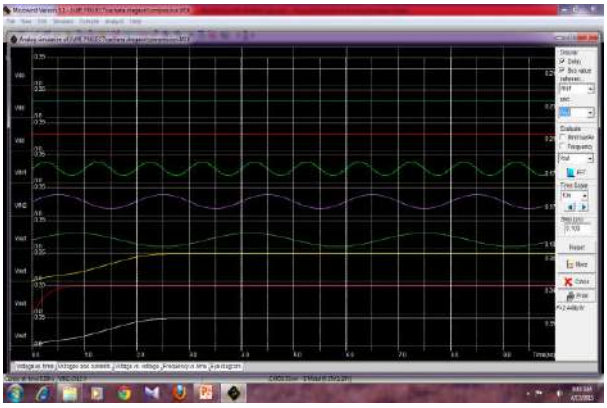

Fig.11 voltage versus time response

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D. Design of Feedback Neural Network

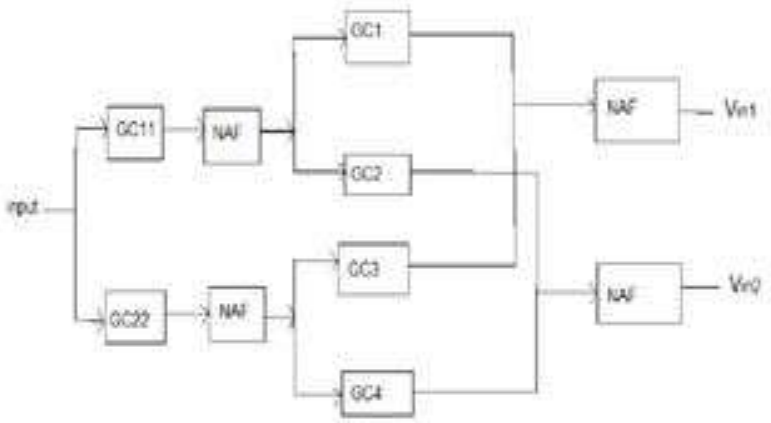

Fig.11 Schematic of feedback neural network

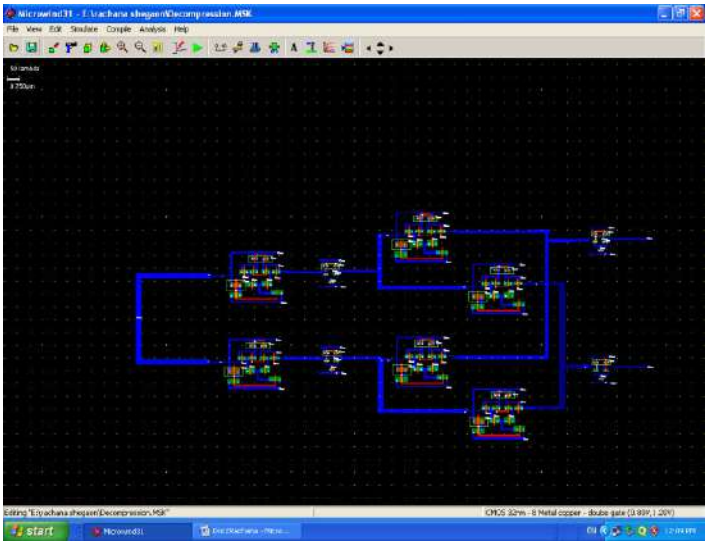

Fig.12 Layout of feedback neural network

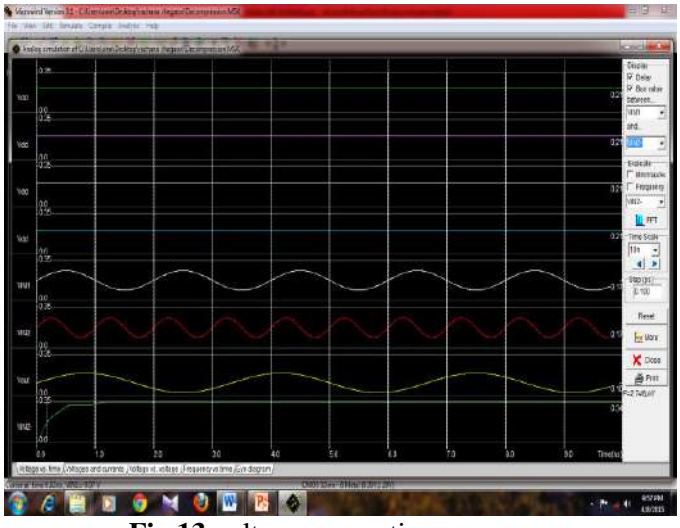

Fig.13 voltage versus time response

E. Combined Architecture of Feedforward & Feedback Neural Network

In the proposed design for feedforward neural network the input signal is Vin1 and Vin2 gives compressed Vout output signal. Then the same Vout is given as input to the feedback neural network. It gives two output signals Vout1 & Vout2. These signals are exactly the same as input signals Vin1 & Vin2. This circuit is implemented with 117 NMOS transistors and 50 PMOS transistors. Technology used is CMOS 32nm with High K /Metal/Strain with 8 Metal copper, with supply voltage of 0.35 volt.

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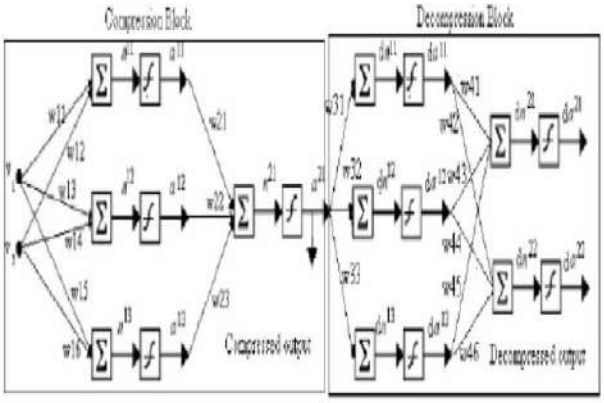

Fig.14 combined architecture of feedforward & feedback neural network

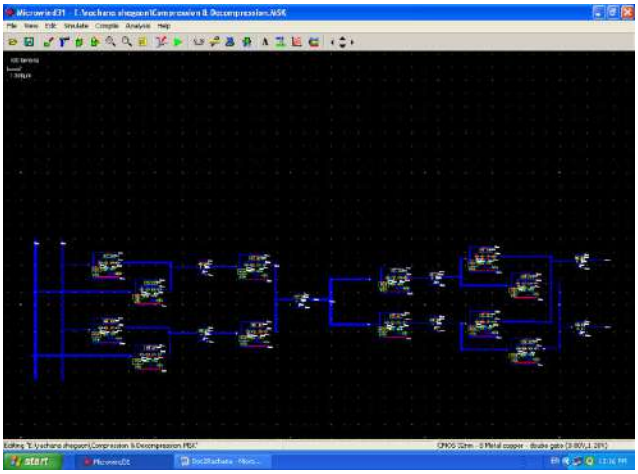

Fig.15 Combined Layout of Feedforward & Feedback Neural Network

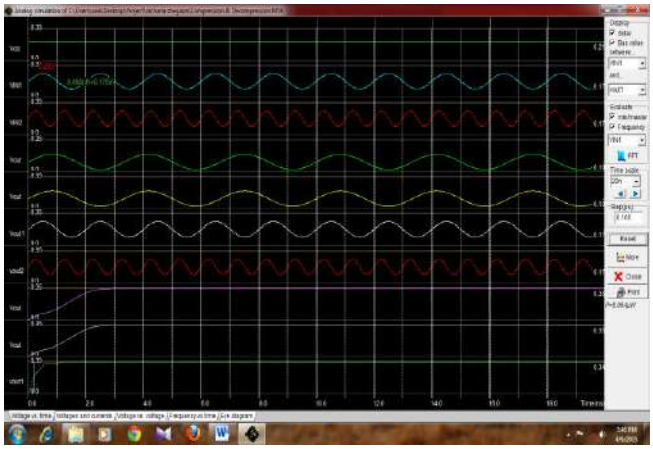

Fig.16 voltage versus time response

Table. 1 shows Comparative Parametric Summary of Proposed Combined Feedforward & Feedback Neural Network

Sr. No.	Parameters	Value	
		For 32nm	For 45nm
1	Power Consumption	4.054 uW	4.437 uW
2	Supply Voltage Vdd	0.35 V	0.40 V
3	Technology & Design Rule	CMOS 32 nm 8 Metal	CMOS 45 nm 8 Metal
4	Width of Layout	85.3 um	106.7 um
5	Height of layout	21.3 um	26.6 um
6	Chip Area	1816.0 um^2	2837.6 um^2
7	Electrical Nodes	227/3000	227/3000
8	n MOS Device	117/2000	117/2000
9	p MOS Device	50/2000	50/2000

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V. CONCLUSION AND FUTURE SCOPE

By observing the output of the neural network for signal compression & decompression amplitude will be reduced & as compared to 45 nm CMOS technology in 32nm CMOS technology requires less voltage mean 0.35V ,less surface area is required for chip designing. Main advantages of 32 nm CMOS technology over the 45 nm CMOS technology will require less power.

This project describes the improvements related to CMOS 32nm technology and implementation of this technology in Microwind 3.1. The main novelties related to the 32nm technology such as high k-gate oxide 3rd generation channel strain, metal-gate and very low k-interconnect dielectric are described. As the process technology has rapidly shrunk from 180 nm to 45nm and attempts to reduce further i.e.32nm. So the proposed neural network can also be implemented as per the requirement of new process technology for getting low power, with best result for signal processing by signal compression & decompression. Hence, most important is the logic complexity per chip has been increasing exponentially.

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ANALYTICAL REVIEW ON E-WASTE MANAGEMENT AND CHALLENGES IN INDIA

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ABSTRACT
Now a day's electronic waste (e-waste) is the fastest growing waste in the India. Because of faster up gradation of electronic products with low cost is forcing consumers to switch to new products quick and easily. However this fast switching towards new device lead to adds to e-waste to the solid waste. Every year million tons of e-waste were generated all over the country. Currently India is the third largest electronic waste generator in the world. Such generated e-waste introduces toxic and harmful substance which causes health and environment related problems. E-waste causes the negative health effects on human liver, kidney, brain, heart, and skeletal system damage. Therefore e-waste becoming the burning issues in India. This rising issues of e-waste calls for more emphasis on e-waste management and their recycling process. The present paper presents the current situation of e-waste in India. Further the Indian government policies for e-waste management, their challenges and responsibilities of different sectors are discussed in this paper.

Keywords: E-waste, recycling, dismantle, WHO, E-waste management, producer responsibility, Challenges

I. INTRODUCTION

For advance lifestyle and worldwide economic progress have leads to ever increasing demands of portable and high speed equipment. This increasing demand of society enforces industry for the production of enormous advanced electronics instrument. Also this electronic equipment's get fast replaced with newer models due to the rapid technology advancements and production of newer electronic equipment. On the other hand the enormous use of technological equipment led to generation of e-waste worldwide. E-waste or electronic waste is simply the discarded or not in use electronic or electrical gadgets or their parts. As per WEEE consist of 10 categories of e-wastes which are large household appliances, small household , consumer equipment, lighting equipment, electrical and electronics, toys and leisure and sports equipment, medical devices, monitoring and control instruments , automatic dispensers etc. [1].

With an annual growth rate of 3–5%, e-waste is one of the fastest-growing waste streams in the world [2].

Electronic waste (e-waste) is not only a secondary source of valuable metals but also a "mixture" of many toxic substances [3].

Because of toxic substance e-waste lead to significant health effects on human brain, heart, liver, kidney and skeletal system damage. Also improper disposal of e-waste is unbelievably dangerous to the global environment.

In India the consumption of electronics equipment has drastically increased in last few decades. As report by the Global E-Waste Monitor notes that India is the third largest electronic waste generator in the world after China and the USA. These three countries together contributed 38% of total 53.6 million tonnes (Mt) of e-waste, generated worldwide in 2019 [4]. In India, the generation of massive amount of electronic waste has now become a major problem to public health. The various health's related problems arises due to e-waste is discussed by Monika and research team [5]. E-waste management is thus critical from an economic, environmental, and social standpoint.

Focused on the issues related to e-waste this paper present the e-waste in India and challenges to overcome the problem.

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Scenario of E-wastes in India

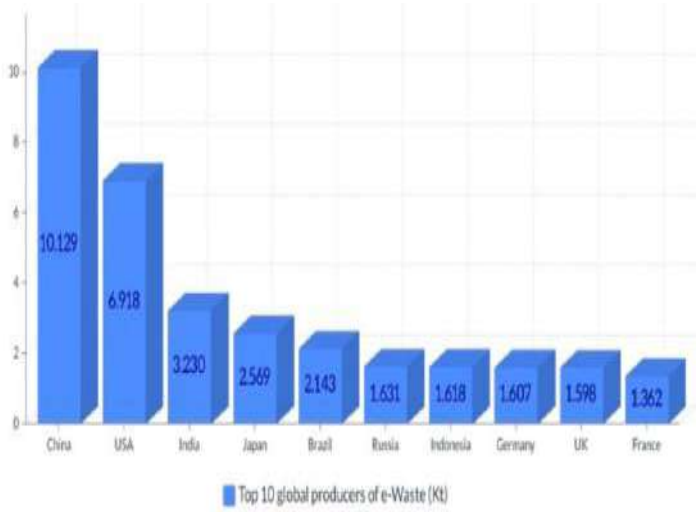

Figure-1: Top 10 countries producing e-waste [6]

As per report until the end of 2022 there will have been an estimated total of 420.3 Million Metric Tonnes of e-waste produced on earth. In the most of the e-waste have been generated in Asia. Among the most top 10 countries generated e-waste India is the 3rd country all over the world and 2nd largest country in Asia. In 2020-2021, India processed 3.4 lakh tonnes of e-waste. 7.1 and 10.14 lakh tonnes of e-waste in the year of 2018-19 and 2019-20 respectively was generated in India. Totally around 31% e-waste have been increase in India. [7]

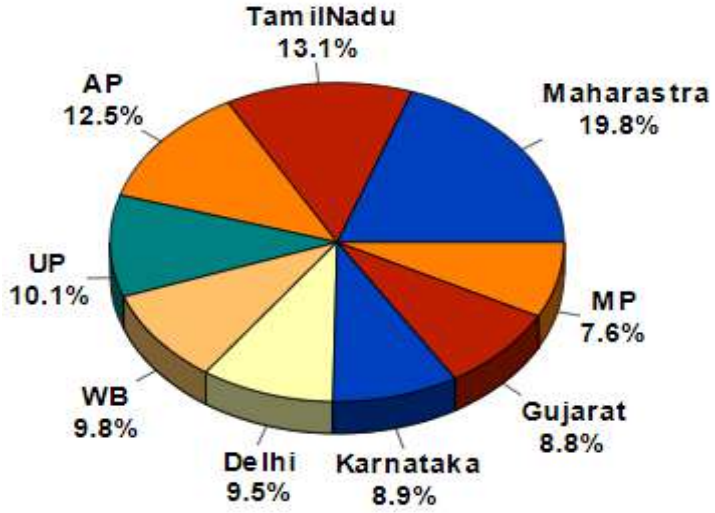

Figure-2: State wise e-waste generation in India [8].

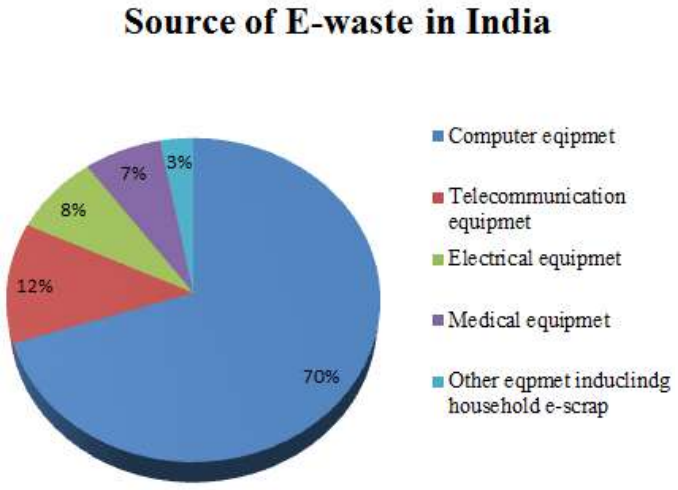

Figure 3: Source of E-waste in India

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In India among the top ten states Maharashtra is the first rank in generation of e-waste. The quantity of e-waste collected and processed during FY 2021-22 is 5,27,131.57 Tonnes [9]. Figure 3 depicts the major sources responsible for the generation of E-wastes in India. As seen from the figure the most of the E-wastes generated from computer equipment's. [10]. In India almost 71 % of e-waste were generated from government, public and industrial sector. While 16% of e-waste are generated from household and rest by the manufactures [11].

II.CHALLENGES OF E-WASTE IN INDIA:

A. Collection of e-wastes

In India the lack of dedicated and robust e-waste collection is observed to be a major obstruction for recycling. As India is the third largest e-waste generator thus it is a crucial challenge to collect the huge volume of e-waste. From the authorised dismantlers and recycles were not reach up to 50% of their standard capacity in part years [12].

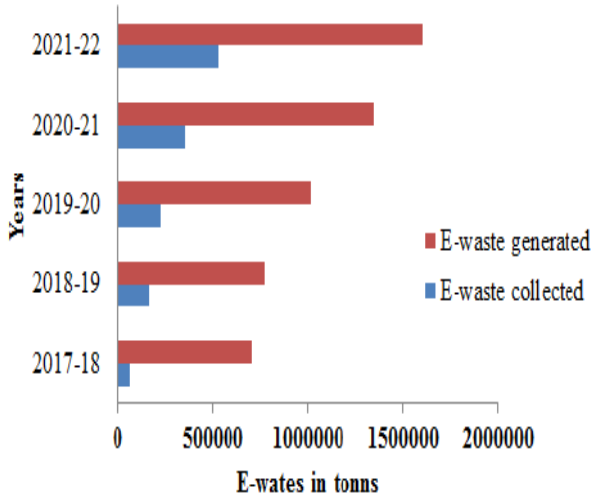

Figure 4: E-waste generation vs collected

According to the data provided by the ministry, in 2021-22, of the 16, 01,155 tonnes of e-waste generated out of this only 32.9% i.e 5,27,121 tonnes were recycled. In 2020-21 out of 1,34,6496 tonnes only 3,54,291 tonnes i.e of 26.33% of e-waste was collected and processed. While in 2019-20, 2,24,041 tonnes of e-waste from the total generated 10,14,961 tonnes of waste was recycled and it is about 22.07%. In 2018-19 and 2017-18 21.35% and 9.79 per of e-waste respectively were processed. [13]. From this it's observed that the collection and recycling has been raised continuously, still there needs more improvement as compare to generation of e-waste. There is need of large scale management of e-waste. Indian government has offering many co-funds through scheme for e-waste collection and recycling. However this scheme has been very limited.

B. Poor Infrastructure To Recycle E-Waste

Indian government has offering many co-funds through scheme for e-waste collection and recycling. However, there are limited recognised and government approved recycling centres very limited. In India under E-waste management rules, on date 8 June 2023 there are 569 dismantlers/recycles centres were authorised by State Pollution Control Board (SPCB's)/ Pollution Control Committees (PCC's) Further, there is has very limited infrastructure capacity for large scale management of e-waste in India. Also the Indian industry has very less capacity of recycled items.

C. A Serious Lack Of Awareness

E –waste contain various toxic material's which may contaminate soil and ground water. The exposer of toxic material can cause various health issues. Thus due to lack of awareness there is risking of health and environment. There is poor awareness for disposal of their old electrical and electronics equipment's. Maximum people are unaware of disposing of electronics items. People don't know to segregate waste items and how harmful conventional disposal methods would be for electronics items hence e-waste management is essential.

One of the problems identified is that majority of e-waste is being handle by informal source like scrap dealers who are not aware of proper mechanism to deal with the growing heaps of e-waste [14]. Student's e-waste awareness in India is very low. There is need to explored the university, college students e-waste awareness camp.

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D. Mismanagement of Products
Waste can cause different problem that may have negative impact on human health. Due to mismanagement of e-waste there is impact on human body, marine pollution, soil contamination and surface and groundwater and air emissions. Many studies reported possible solution for improving the e-waste mismanagement in developing countries such as organic waste buyback programs, with compost of biogas productions.

In the present times, sourcing e-waste is challenging. Circular economy, although a term in use for years, is a new entry in the business channels. Companies ranging from start-ups to the top e-waste management companies in India invest heavily in order to establish collection hubs or adhere to circular economy standards.

The information barriers are real. For example, there is a lack of knowledge about cost-effective and efficient e-waste management techniques, as well as how to maximise the utility of end-of-life products.

E.Unsustainable and Ecologically Degrading Practises:
Despite the urgency of formal and responsible dismantling of electronic waste, the actual waste processed is significantly lower. Most of the formal recycling centres currently available operate at dwindled capacities, owing to the inability to source waste. The ignorant mass continues to dispose of electronic waste in the most unfavourable conditions. [15].

F. Financial Constraints:
Insufficient funding for e-waste management programs is most significant issue in India. This may result poor armament of infrastructure and other e-waste management related services. Several studies pointed out that financial support for e-waste management provides by Indian government is very low.

III. EFFECT OF E-WASTE ON HUMAN HEALTH ENVIRONMENT

Due to improper disposal of e-waste cause the serious problems related to human health and ecological system. Many peoples along and women are involved during handling, collection and dismantling or recycling of e-waste. During these processes peoples are get exposed to many harmful and toxic substance like nickel, lead, chromium, Barium, mercury, cadmium and lithium. The exposure of this toxic substance may get into human. These may cause the negative impact on brain, heart, liver, kidney and skeletal system of human being. It can also effect on nervous and reproductive system of human body [16]. In addition to this children play near the e-waste recycling centre where high level of toxic chemical get negative impact on their health.

As e-waste is not biodegradable and accumulates in to the environment, soil, air water. The dumped e-waste may release of harmful chemicals and pollutants into the air. This may cause the breathing problems and leads to negative impact on human respiratory system. Another way to get this chemicals and toxic substances may get mix with groundwater. This creates acidification and modification in water which is unsafe for animals and plants. This problems of waste has grown significantly over the past decade

IV. RESPONSIBILITIES TO OVERCOME THE E-WASTE ISSUES:

A. Responsibilities of the Government:
Government must pay increased attention to law enforcement to prevent illegal dumping or recycling of e-waste. Regulation must be inclusive, building on existing realities: e-waste governance must consider those individuals and enterprises, particularly the poorest or smallest, already working in the sector – and their existing practices.

Government should bring all the resources including school, colleges, universities and offices to engage with people by arranging the program of awareness on e-waste management regularly. Municipal Corporation and local administration should be more active on e-waste management. Strong guidelines must be issues and proper supervision should be conducted. Increase the citizen willingness towards the three R's rules Reduce, Reuse and Recycle e-waste management. Governments enforce EPR on electronics manufactures, making them responsible for collecting and safetly disposing of their products. This drives manufactures to prioritize recyclable and reusable product design.

B. Responsibilities and Roles of Industries:
Obey the government rules and regulation strictly. Manufacturing industry should manufacture the energy efficient device. Make more attention towards the experimentation and innovation of more inclusive e-waste management models. Arrange the e-waste awareness related program in collaboration with government. Promote the society to use refurbished devices. Use their full capacity for e-waste collection and recycling.

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C. Responsibilities of the Citizen:

Citizens are the playing the most active roles in the generation of e-waste. Thus it is duty and responsibility of every citizen to take an active participation in e-waste management. Keep using product that still work instead buying new device or use refurbished device. Don't dump the electronics and other related device without knowing proper process. Further, handover the device to the skilled person or where it can be recycle. Buy only those products that are energy efficient. Attend the awareness on e-waste management being conducted by any private or government organization.

V. CONCLUSION

E-waste is now becoming the most serious and challengeable issues in India. It is becoming a massive community health problem and is exponentially growing by the day. Thus it is most prior to overcome these issues as it cause the serious impact on human health and environmental related problems. E-waste has to be composed distinctly, treated efficiently and disposed of e-waste. Also there is need to avoid from predictable landfills and opens burning. It is necessary to integrate an informal sector with the formal sector. The proficient experts in India need to begin mechanism for handling and treating e-waste safety and sustainable manner. Further government should take initiative and make law inference very strictly and proper regulation. In addition to this every citizen have to involve overcoming these issues. Thereafter it is most important to educate and create awareness among the consumers and the youth for better and innovative thinking of handing E-waste.

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PERSONAL POLLUTION EXPOSURE MONITORING USING POLLUTION SENSORS AND HEALTH PREDICTION

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ABSTRACT
Increasing environmental concerns and the impact of pollution on public health, this research endeavors to develop a comprehensive system for Personal Pollution Exposure Monitoring. For this it incorporates interfacing some pollution related sensors (CO2, CO and clean sensor) to the clients body which will continually screen the encompassing air pollution levels and the correct measure of dangerous gasses breathed in by the client contingent on the breathing rate of the client. Contingent on these qualities, the client will be alerted continuously by indicating notices where pollution level has outperformed the allowable breaking point. the system goes beyond mere data collection, offering insightful analytics for predicting potential health risks based on personalized exposure patterns. The data will be pre- served (on-chip) and later analyzed using graphs and diagrams prepared in Excel using Visual Basic. The data analysis will provide the user with health prediction

Keywords: Air pollution monitoring, Personal pollution mapping, Real time alerts, Data server, Health prediction)

I. INTRODUCTION

Air pollution has become an intense issue as of late. The issue is more serious in substantial mechanical urban areas .Air pollution has known to have a serious health e ects on human body. The World Health Organization (WHO) approximates that around 1.4 billion urban residents worldwide are living in areas with air pollution above recom- mended air quality guidelines. Chronic exposure to air pollution increases the risk of cardiovascular and respiratory mortality and morbidity, while acute short-term inhalation of pollutants can cause changes in lung function and the cardio- vascular system exacerbating existing conditions such as asthma, chronic obstructive pulmonary disease (COPD), and ischemic heart disease. Indeed, it is evaluated worldwide that air pollution kills a greater number of individuals every year than street mishaps. Rigorous data analysis and predictive modeling, this research aspires to contribute valuable insights into the dynamic relationship between personal pollution exposure and health prognosis.. In this way, ob- serving and controlling encompassing air pollution is high on general society awareness created nations. Hence, it becomes very important for an individual to know the amount of toxic gases his body is being exposed to know the ill acts of air pollution on health. Fortunately we have various destinations checking air pollution record and proportion of poisonous gasses introduce noticeable all around in different parts of the urban communities (Like we do have a site in Shivaji nagar area of Pune). But these sites are at a point and consider aggregates of pollution levels and use coarse data to calculate actual amount of pollution which is not very accurate. Moreover, these sites are located at some distance from the actual polluting machines or vehicles. Hence it can never calculate the amount of pol- lution to which a particular individual is actually exposed (consider a biker driving behind a pollut-ing lorry). The amount of harmful gases actually consumed by the biker will dire a lot from the amount calculated by the pollution monitoring site. Secondly, the general public does not really understand the seriousness and consequences of pollution data displayed by these sites. They have no means to understand the health acts of the pollution levels they are exposed. Hence, these existing pollution monitoring sites shows only the aggregates of the data and are least useful at the individual level.

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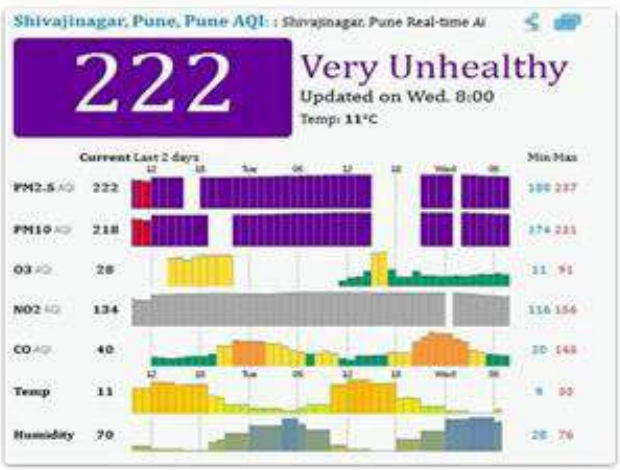

Figure 1.1: The Air Quality Index (AQI) showing status Very Unhealthy for Shivaji nagar area of Pune

The amount of pollutants breath in by an individual also varies from person to person due to divergence in body structures and the activity that a person is currently exhibiting. For example, consider two individuals who are both in the same place at the same time, but one is driving while the other is sitting idle. They will experience the impact of air pollution in different ways since they will inhale different amounts of air due to their different breathing rates. Hence, person who is jogging is likely to be more accepted than the person who is sitting idle. Also, they may additionally have different medical predispositions to the exposure. When these differences are accumulated over a long period, they can become significant, leading to different health outcomes. The sites monitoring air pollution never considers the level to which an individual is actually being exposed. Hence, it is almost impossible to calculate and predict the health acts of air pollution on individual health.

AQI Mark	AQI Colours	Category	Description of AQI effects
	Maroon	Hazardous	-
	Maroon	Hazardous	The entire population is more likely to be affected.
	Purple	Very Unhealthy	Everyone may experience more serious health effects.
	Red	Unhealthy	Everyone may begin to experience health effects.
	Orange	Unhealthy for Sensitive Groups	People likely to be affected at lower levels than the general public
	Yellow	Moderate	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people.
	Green	Good	Air quality is considered satisfactory, and air pollution poses little or no risk

Figure 1.2: Various levels of Air Quality Index (AQI) and corresponding health concerns

II. LITERATURE SURVEY

Air pollution is a serious concern worldwide and several projects have emerged over the past few years to develop and e active system to measure and monitor air pollution and study its acts on human health. This chapter discusses few of the previous works done on air pollution monitoring. Over the past few years several projects have emerged that attempt to crowd source data from low-cost portable mobile sensors to obtain air pollution approximates of high spatial granularity. Notable ones include the MESSAGE [10] (Mobile Environmental Sensing System Across Grid Environments) project in the UK, the MAQUMON project from Vanderbilt University, the Common Sense project supported by Intel, and the Open Sense project ongoing at EPFL Switzerland. An- other notable project called Haze Watch [2] that monitors and maps Sydney air pollution in real time via vehicle mounted pollution sensors using both custom-built and o -the-shelf hardware. All these frameworks concentrate on social occasion the pollution information, and less on utilization of information by people personalized. From Cambridge University and partners in the UK the most appreciated projects in this domain is the MESSAGE (Mobile Environmental Sensing System Across Grid Environments) project, which aims to develop and portable devices for high-density measurement of concentrations of carbon monoxide and nitrogen oxides in urban areas. They have very recently reported their development and deployment experience in the

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Cambridge area, and demonstrated that the use of low-cost and portable devices deployed in high densities can give a much more accurate picture of the spatial and temporal structure of air quality in the urban environment. The scale and

scope of this project is commendable, and the contributions in building the devices, deploying them city-wide, and modeling the collected data are noteworthy; however, these portable devices are relatively expensive and bulky for regular use by pedestrians/bicyclists, and personalized tools for estimating and managing exposure remain under- explored. Vanderbilt University, supported by Microsoft, embarked upon a similar project, called MAQUMON that developed portable wireless sensor units for measuring ozone, nitrogen dioxide and carbon monoxide.

Figure 2.1: System architecture of Project Haze watch.

Their units are autonomous, having onboard ash (for storage), GPS (for location) and GSM (for communication) capabilities, making them much more bulky and expensive. Innovative web-based visualization (e.g. contour maps) and personalization (e.g. route-planning) tools have also developed by making it more accessible for lay users. But, this project did experiments has not under- taken any long-term deployments. Intel has also been developing as part of the Common Sense project [3] a prototype that is a portable hand- held device capable of measuring various air pollutants. This data can be uploaded in real time and viewed on Google Maps. The Common Sense project is currently running trials with these devices attached to the rooftops of street cleaners in the city of San Francisco. On top of public buses several air monitoring units have successfully deployed by them. In spite of the replication of e ort across these several projects, they are all worth- while e orts since they collectively explore different deployment scenarios (e.g. buses versus private cars) The literature that try to associate human activity levels with pollution exposure concentrations. Few studies use physical activity times to estimate personal exposure, and its act on Ischemic Heart Disease Mortality. However, these studies only use the users home location to estimate their exposure, without regard to the mobility pattern of the individual. A group of researchers from Europe developed a tool called CalFit [7] that records the individuals location and activity information. However, their study did not use participatory sensor net-works, and instead relied on historical data from xed monitor sites and derived exposure estimates based on an Atmospheric Dispersion Modeling System (ADMS). One can say that using data with such low spatial density can lead to incorrect exposure estimates and hence biased medical inferences. Several studies have involved volunteers carrying portable pollution monitors. A group of researchers from USA designed a study to end out the impact of time-activity patterns on personal exposure. They followed sixteen participants, obtaining their temporal-spatial information with a PDA, and black carbon concentrations with a potable monitor. Their results showed that trans portation contributed the highest black carbon concentrations. Nevertheless, their study ignored the human activity levels and only estimated the pollution concentration around the participants rather than their personal inhaled dosage. A re- search group in Barcelona, Spain designed a survey that tried to compare the exposures with different travel modes. They asked commuters to use dif- ferent transport modes going along the same route to nd out their relative inhalation dose. The in- halation rate algorithm they used was developed by other researchers, which assumed that inhalation rate ratio between different travel modes were constants. The referenced inhaled dose calculated by them can be neither real-time nor sufficiently accurate. Another group of researchers discussed how to combine individual time-activity patterns and air pollution

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concentrations, and gave a model to integrate the data. They designed a system called Exposure Sense which can combine smart phone accelerometer, external air quality data and pluggable sensors for personal pollution exposure estimation. In these projects, only personal loca- tion and acceleration information were considered as activity data, which can estimate the ambient air pollution concentrations, instead of personal real-time inhaled dose. The system developed by researchers in [1] from Sydney, Australia is very much similar with the objectives of this project. In this study [1] they have combined ambient pollution levels taken from participatory system (i.e. a mobile node user is carrying) with an individuals activity levels to estimate the personal inhalation dosage, which can then be used to make further medical inferences for that individual. They developed a system for estimating personal air pollution inhalation dosage. The system comprises a mo- bile app that interfaces with wearable personal activity sensors to determine breathing rate, and combines it with ambient pollution concentration determined from participatory pollution monitoring system. The group also conducted t rials with the system in Sydney, and obtained real-time pollution inhalation dosage estimates showing that levels of activity (driving, cycling, and jogging) with very different levels of exposure.

The improved estimates obtained from the system compared to earlier systems that do not include personal activity information allow for more accurate medical inference. This system is one of the most appreciated among the systems discussed till now as far as calculating the individuals exposure to air pollution is considered.

Figure 2.2: System Architecture of [1]

But this system does not have any continuous real time display or warning mechanism to provide the user with real time alerts about the hazardous levels of surrounding pollution levels. Hence, the user is not aware of the levels of pollutants he is con- summing in real time. Secondly, the system carries out data analysis and provides the user with the levels of pollution the user was exposed and the also the amount of pollutants entered into users body. But it does provide the user any information about the related health risks the user is subject to as there is no mechanism to provide any kind of health related analysis of the user with the given pollutant consumption of the user. Hence, as the lay user has no idea about the serious health ill acts of the air pollutants, the user is left no choice to carry the data to the expert and take ad- vice about the health risks which is another costly and time consuming for the user

III. SYSTEM COMPONENTS AND METHODS

1. **Air Pollution Monitoring:** The air pollution monitoring node consists of hardware and pollution sensors such as carbon dioxide, carbon monoxide and dust sensor. These sensors are used to check the pollution levels in the surrounding area. Also pollution reading is noted along with time for further analysis.
2. **Activity Monitoring:** The body temperature and pulse rate/ respiration rate of the user will be monitored to calculate the breathing rate of the user so as to calculate the exact amount harmful gases consumed by the user.
3. **Real Time Alerts:** The recorded data will be analyzed in real time also displayed on LCD attached to the users module. The alerts and warnings is provided to alert the user in case the user is exposed to

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high levels of harmful gases more than the permissible limits and inhaled by the user. The real time alerts given can prompt the user to man- age alternatives to avoid dangerous levels of pollution which can be really unhealthy.

4. **Information Record:** The data obtained from sensors and user activities will be stored on the device memory along with time. The data will consist of exact amount of toxic gases consumed by the user which is necessary for health analysis.
5. **VB Server:** The information saved money on the gadget can be exchanged by the client by the day's end to the database utilizing serial correspondence. The database will store every one of the information of the client and furnishes the client with information changed over to exceed expectations sheet alongside charts and pie graphs for itemized investigation.
6. **Health Analysis:** The data saved on the device can be transferred by the user at the end of the day to the database using serial communication. The database will store all the data of the user and provides the user with data converted to excel sheet along with graphs and pie charts for detailed analysis.

IV. CONCLUSION

In this paper we have presented a novel system for monitoring personal air pollution Exposure. In this article, system design does not consider any aggregates of data but calculate the exact amount of polluted air inhaled and correspondingly calculate the concentration of each pollutant in the air (CO2, CO and dust). The system senses the amount of pollution levels using onboard pollution sensors, stores the data and provides the user with detailed health acts of the consumed pollution levels. The system to be designed should be light weight and battery operated. The system should require less power and must be robust .The cost of the system must be in the adorable limits for common man.

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IOT IMPLIMENTED WPTS BASE HYBRID ELECTRIC VEHICLE CHARGING AND PARKING STATION USING DUAL CORE ARM CORTEX PROCESSOR

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ABSTRACT

Electrical vehicle is the future of this world and maximum of developing countries are adopting electric vehicles, because of this Electrical vehicle on the road is steadily rising. In addition to helping the environment and nature, we can move forward with Electrical vehicle system which is cost effective, environment friendly and capable of cutting our overall transportation cost. This Research article details the planning and design of a hybrid and solar-powered charging for electric vehicles and efficient IOT implementation smart parking, as a solution to dual problems of expensive gasoline and harmful emissions. Here, we create a novel and effective answer to this problem by designing an electric vehicle charging and IOT base smart parking infrastructure. There is no need to stop for charging because the EV can do so while it is in parking station; the system is powered by both solar energy and traditional power source. Wireless Power Transfer (WPT) systems transfer electric energy from a source to a load without any wired connection. This technology follows the ideology that charging electric vehicles can be done when vehicle is in parking station. Charging of vehicle without using any cable is efficient and it's going to be a new technique in electric vehicle industry. To get the practical result of this system we first have designed a basic prototype model to generate practical result of it. To implement and design its basic prototype model we have used a Dual Core Arm Cortex RP 2040 Microcontroller with multiple sensors and I/O peripheral.

Keyword: EV, Advance Embedded System, ARM Cortex, Dule core Processors, Renewable Energy, Hybrid Charging, Solar power, IOT, Smart Parking solution, Electrical Vehicle, Wireless Charging, Hybrid Charging.

I. INTRODUCTION

As we know India comes in developing countries of world and have more than 1.35 billion of population. India is going to be a biggest future market for electric vehicle consumers and developer industries so the research in this domain plays very important role. Electrical vehicle and renewable energy have highest priority solution to save nature. Increasing population of world and their improved living standard are increasing the vehicle production. For traditional personal transportation and public transportation still maximum of world population are using traditional fuel base vehicle systems. Ultimately this type of vehicles are using gasoline, petroleum and diesel as fuel source and this all fuel comes into the category of non-renewable resource. As we know Non-Renewable energy resources deplete over time so that usage of renewable energy source is going to be the best option for developing countries to save mother earth. By doing this we can reduce overall carbon emission from this world, we can save natural non-renewable sources for upcoming generation. Now a days demand of electrical vehicles are increasing but they all are following old traditional style of designing where charging is still done by using manual process. To charge this type of vehicle we have to manually plug it in into charging station. As electric vehicles are growing in the market, the need of separate charging and parking system are also going to increase. If we do the survey of worlds EV market not even a single company have introduced a hybrid or Low-cost renewable energy source base charging system for electric vehicle. Here, we create a novel and effective answer to this problem by designing an electric vehicle charging and IOT base smart parking infrastructure. The system is powered by both solar energy and traditional power source. Wireless Power Transfer (WPT) systems transfer electric energy from a source to a load without any wired connection. If we are going to establish this type of design specification with our electrical vehicle so we easily can charge electrical vehicle by using wireless transmission. WPTs are attractive for many industrial applications because of their advantages compared to the wired counterpart, such as no exposed wires, ease of charging, and fearless transmission of power in adverse environmental conditions. Adoption of WPTs to charge the on-board batteries of an electric vehicle (EV) has got attention from some companies, and efforts are being made for development and improvement of the various associated topologies. WPT is achieved through the affordable inductive

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coupling between two coils termed as transmitter and receiver coil. To get the practical result of this system we first have designed a basic prototype model to generate practical result of it. In this research article we have mansion a result of it in detail. To implement and design its basic prototype mode we have used a multiple component which employs a solar panel, battery, regulator circuitry, copper coils, AC to DC converter, ESP8266 Wi-Fi Module, Dule core ARM Cortex RP2040 microcontroller, and LCD I2C or LED matrix display. This technology follows the ideology that charging electric vehicles can be done when vehicle is in parking station. Charging of vehicle without using any cable is efficient and it's going to be a new technique in electric vehicle industry. This system is also capable of charging mobile phones, Electronics appliances and consumer electronics using solar power and traditional system with wired and wireless power transfer.

To make this system totally smart, automated and wireless, we have created a basic prototype to take the practice result of it.

II. LITRATURE REVIEW

Plug-in Electric Vehicles Smart Charging and Storage Supporting the Grid
They have presented the development and deployment of an electric vehicle (EV) charging system in Santa Monica, California, consisting of smart charging, vehicle-to-grid, vehicle-to-building, demand response and power quality sustainable capabilities to achieve grid resiliency and economic benefit to EV fleet owners [1].

Solar based wireless EV charger
They have created "solar-based wireless EV charger" project uses renewable energy technology. Solar energy is converted to electrical energy, which is then stored in a lead-acid battery. With the battery management unit, a wireless charging system will be established. This stored energy is utilized to charge Electric Vehicles [2].

Solar Charging Roads and Wirelessly Charging Electric Vehicles
One such exertion made in the field of Freeways is the advancement of "Solar Freeways" which can be an elective arrangement. Sun oriented streets consolidate various arrangements in one – it can assist us with improving the creation of power utilizing sun-based boards, to give a computerized stage to our future country's ventures like Smart Cities, and to work with the arising electric vehicles that supplant the petroleum driven vehicles and substantially more.

SOLAR WIRELESS ELECTRIC VEHICLE CHARGING SYSTEM
This paper details the planning and design of a solar-powered charging for electric vehicles, a solution to the dual problems of expensive gasoline and harmful emissions. The number of countries with electric vehicles on the road is steadily rising. In addition to helping the environment, electric vehicles have proven useful in cutting down on transportation costs by substituting expensive fuel with much more affordable power. Here, we create a novel and effective answer to this problem by designing an electric vehicle charging infrastructure. There is no need to stop for charging because the EV can do so while it is in motion; the system is powered by solar energy; and there is no need for an additional power source.

III. METHODLOGY

The methodology is the general research strategy that outlines the way in which research is to be undertaken and among other things, identifies the methods to be used in it.

In first stage of prototype making, we have considered a few components as per requirement and then we have created a block diagram of all the attachments and blocks of it. The basic block diagram for charging and parking station is shown in below figure 2.

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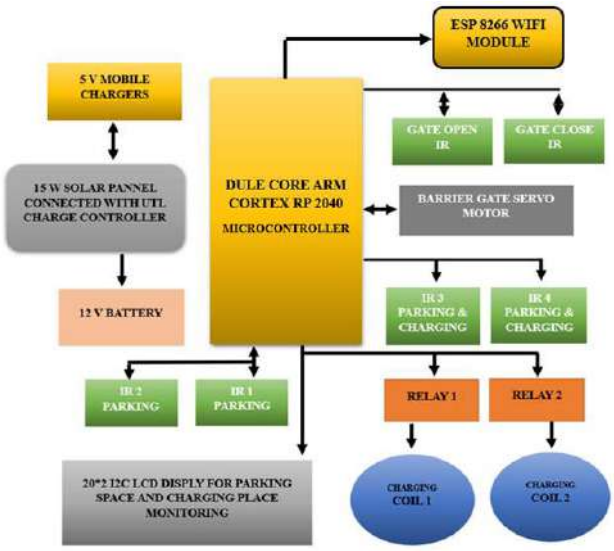

Figure 1. Block Diagram of System

IV. PHASES OF RESEARCH

We have conducted this research into three different phases as shown in figure 1.

Figure 2. Different research phases

There are three main research phases on which we have to work:

- Electrical vehicle designing with inductive coil principle.
- Wireless transmitter system designing with Renewable power source.
- Smart IOT base Embedded system designing for parking station.

1.1. ELECTRICAL VEHICLE DESIGNING WITH INDUCTIVE COIL PRINCIPLE (Power Receiver Coil)

In this phase of research, we have to introduce new hardware system with existing electrical vehicle. When we think about charging this electric vehicle, we have very few options available in the market. Some of them support wired charging using traditional electric power supply. But some of the researchers have designed a wireless charging technique, this type of technics is not still in use but have scope of invention and expansion. As a replacement of it we have to develop a strong inductive coil principle. Inductive WPTSs with resonant topology (Shortly, resonant WPTSs) are used. This, for instance, is the case of the wireless charging of the EV batteries. This type of design strategies are not going to work on bigger commercial vehicle system, for that we have to use the same principle but the hardware portion and specification of hardware are going to get change according to user and vehicle design specification.

Once commercial electrical vehicle system is going to equipped with inductive power receiving system, we can move forward in 2nd phase of research i.e., wireless power transmitter system.

1.2. WIRELESS TRANSMITTER SYSTEM DESIGNING WITH RENUABLE POWER SOURCES

In this phase of research, we have to think about designing a capable wireless power transmitter system. According to the power consumption of traditional consumer commercial vehicle we have to design a transmitter coils. With this coil we have to think about the batteries and its specification which we are going to use for charging power station. We can fix these batteries at power station of parking to charge it by using solar power. With it we have to make this system flexible for hybrid charging. By using hybrid charging we can

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charge electrical vehicle by using traditional AC power but with wireless charging capabilities. To design this type of practical system we have to analize the specification, work load and requirements of specific charging station. According to its power requirement we have to choose solar panel to generate power according to the requirement.

We can check, analize and get the results for both the designing phases by designing the small-scale prototype working model. For designing this prototype system, we first have to understand the basic small scale wireless power transmission system. In next subsection we have explained the WPTS in detail by doing the literature survey.

1.3. WPTS: Basic Wireless Power Transmission System

It Consists Of Two Sections:
Transmitting and receiving, each of them including a coil that is coupled to the other one with a large air-gap in between. Both the WPTS sections are equipped with power conversion circuitry. The general scheme of a resonant WPTS is shown in Figure 2.

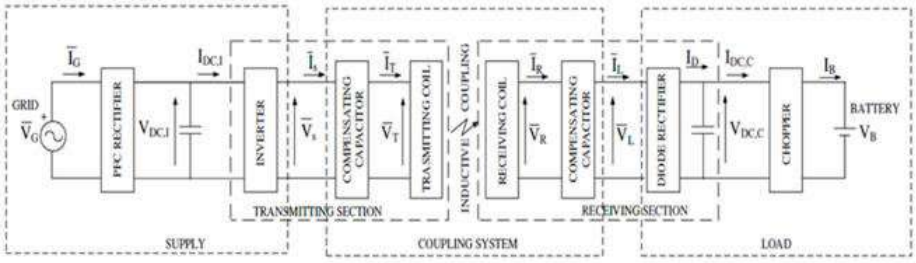

Figure 3. General scheme of a resonant WPTS

On the transmitting section, the grid feeds the relevant coil through a diode rectifier with output capacitor and an in-cascade inverter operating at high frequency. Grid, rectifier and battery constitute the supply of the transmitting coil and are equivalent to a sinusoidal generator with an in-series resistance, where the frequency of the generator is the inverter frequency. To achieve a good power factor, the diode rectifier is normally substituted for by a PFC rectifier. On the receiving section, the voltage induced across the receiving coil charges the battery pack through another capacitor-output diode rectifier and an in-cascade chopper, which adapts its output current/voltage to the battery charging requirements. Rectifier, chopper and battery constitute the load of the receiving coil and are equivalent to a resistance.

1.4. SMART IOT BASE EMBEDDED SYSTEM DESIGNING FOR PARKING STATION

This phase of research plays very important role to introduce smart parking and wireless power transmission system together. As we know world adopting the new culture like open air theatre where we simply can watch the movies without coming out from our vehicles. Normally we have to spend three hours to watch movies in open air movie theatres. So, we simply can charge our vehicle during watching this movie.

To create this system, we have embedded processors which can help us to detect presence of vehicle present at parking and charging spot. With it we also can observe parking spot availability on smart phone by using Wi-Fi with IOT implementation. Traditional LED displays are also going to be the best option to get real time notification of parking space availability. This all things are possible with proper embedded system designing where we have to interface multiple sensors, relays, modules and displays according to requirement and specification of parking station. Anytime we can make the changes in specification of embedded system as per parking spot requirements, so it is implantable for any type of parking area with large and small size of parking spaces. We just have to use powerful or less specification processors according to consumer and parking station owner requirements.

By using internet of things, we can get parking space availability notification from our home. With proper software designing we can create a application which works on both Wi-Fi and internet which is going to serve us live notification of multiple parking's and their parking space availabilities. These types of systems implemented using IOT are much more capable, cost effective, practical and user-friendly. This type of system normally works on basic principle where all the data of parking station and its parking space availability are going to get upload continuously on internet using cloud computing and we can easily access it by using our smart phone application. Which is ultimately going to save the time, power consumption of vehicle of parking users.

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V. IMPLIMENTATION

As we know in this Research, we have created a parking station where we have used six different IR sensors for vehicle sensing. Among them all two IR sensors are used to open and close the barrier gate of parking place and out of remaining four we have used it for vehicle detection. Two parking station support wireless charging of vehicle using inductive coils. These coils are connected with relay so according to vehicle detection we have to turn on off the relay system. In simulation section according to requirement we have created a code and we have compiled it in Thonny IDE tool. Codes are running successfully. By using these codes, we have simulated a design using online simulation platform i.e., tinker CAD. After successfully simulation of design, we have moved our self into physical design stage where we have gated a hardware component in consideration.

VI. WORKING

As we know we made a change in earlier design as discussed in literature survey we have created a Solar power based smart electric vehicle charging and parking station. Working of our project is very simple. 15 w solar panel is going to charge 12V battery which is connected with charging inductive transmitter coils. We have used four inductive coils from which two are used for vehicle charging and two for mobile phone wireless charging. Whenever any vehicle comes Infront of parking at that time gate IR provide active high signal to RP 2040 and it provide active high signal to digital pin where we have connected servo motor. By detecting vehicle servo rotate at 90 degrees. When vehicle enters in parking Gate IR 2 detect vehicle and provide active high signal to RP 2040. According to this detection RP 2040 provide signal to servo and servo returns at its original position. In this system we have total four parking spaces provided with four different IR sensors. Each sensor can detect vehicle presence and it provide this signal to microcontroller and microcontroller display and upload the status of different parking space on display and on cloud. When any vehicle is get detected by IR 3 at that time microcontroller provide active high signal using GPIO pin to trigger relay module. This relay module is connected with inductive coil which is responsible for charging electric vehicle using wireless power transmission. Vehicle is provided with wireless power transmission receiving coil connected with vehicle battery or with LED lights. Parking place four work same like parking place three. All the power delivered to inductive coil is created by using solar panel. Our system is also provided with 5V mobile phone and consumer electronics chargers where we can charge two mobile phones using wireless charging and three mobile phones using wired charging. All the chargers are powered by using solar power and connected with solar charge controller for circuit protection. This charge controller also provided with 5V USB charging port. We also can charge electrical vehicle and other systems using traditional power. This feature of hybrid charging makes our research more applied. Whenever we don't have solar power or charge stored in batteries, we simply have to connect these wireless inductive coils with different power source like traditional AC power adapters. All the data of parking space availability are accessible through Wi-Fi and IOT. We simply have to login the system using Blink application with login id and password so we can get the SMS notification for parking spot availability using Blink SMS. To establish hole system with IOT we have used ESP 8266 Wi-Fi module.

We just have created a small-scale working model of it to observe the results of system. We can implement this type of system with specification changes according to consumer requirement. We can get the live status of parking space availability using multiple options like LED Matrix displays fixed at different parking station entrances areas. We also can get the SMS notification using Wi-Fi, for that we just have to enter login id and password of it through mobile application. Actual prototype design picture are shown in below figures.

Figure 4. Physical Design & Prototype look

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VII. REQUIRED COMPONENT

To create this prototype, we have used multiple components and the list of components are as follows: RP 2040 Microcontroller, ESP 8266 Wi-Fi Module, IR Sensors, 5V single Channel Relay Module, 20*4 LCD Display, 5V Servo Motor, DC-DC Buck Down Converters, 15 W Solar Panel, 12 V battery, Inductive Coils, 1000 uf, 25 V Capacitors, Diodes, Inductive Coil and inductive wire (Winding Coil), USB Female Connectors, DC Switch's, Jumpers and Wires, DC female Connectors, 9V 1Amp DC adapter, Toy vehicle with inductive coil, LED lights, Solar charge Controller

VIII. CONCLUSION

It has been not easy research and it require many hours of research to match expectations. After doing a literature survey of multiple existing research in this same specific domain, we have jumped in to this field for creating the new multiple collaborated system approaches, as a solution for commercial electrical vehicle industry. By doing the analysis, and design research in this research article we can conclude that we have most specific, practical and cost-effective strategies to establish wireless IOT implanted parking and charging station using solar power. After proper research and development, we can establish this type of system for any parking station and Electrical vehicle according to requirement, space, population of vehicle and user specification.

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AUTOMATIC GATE BIAS CONTROL OF POWER MOSFET USING EMBEDDED RISC PROCESSOR ARM LPC148

Sneha Manekar, Rachana Patil and Nanda Mhaisagar

ABSTRACT
An intelligent gate voltage control system is designed in accordance with changes of temperature and drain current through the platform of transplanting OS system to the main-controller ARM 7 (ARM7) to real-time compensate for the deterioration of the linear MOS PA at different points of temperature. With the interrelation of the temperature, bias gate voltage and drain current, real-time monitoring of drain current achieves high stability, high precision of the gate voltage output capability under the conditions of measured temperature. Meanwhile after the process of embedded ARM, system could output optimal gate voltage value quickly, accurately and stably at any temperature, which also can enhance the system performance of MOS power amplifier. The provision of stable gate voltage for power amplifier is of great importance in the design of RF power amplifiers. Since the gate voltage will affect the quiescent current of MOS. The quiescent current is very susceptible to influence of temperature leading to its Q point drift, which would influence the best matching load, efficiencies and other parameters of power amplifier.

Keywords: Arm 7, RF power amplifier

INTRODUCTION
This chapter highlights the in view of the looming global energy crisis and an increasing desire to protect our fragile environment, saving energy is crucial for efficient wireless network operation. In wireless base stations, the power amplifier (PA) dominates signal-chain performance in terms of power dissipation, linearity, efficiency, and cost. The next generations of cellular radio systems use nonlinear modulation schemes, such as quadrature phase shift keying (QPSK) for universal mobile telecommunications service (UMTS), or 8PSK for global system for mobile/enhanced data rates for GSM evolution (GSM/ EDGE). Consequently, RF power amplifiers (PAs) require more powerful transistors to operate with back-off due to linearity requirements, and thus, the overall efficiency drops. Thermal management then becomes a real challenge. Because the technology of choice to address these constraints, it is important to understand the thermal characteristics of the RF MOS devices. The effect of the temperature on the different DC parameters, gm, Idss, rds(on) and capacitances, and the correlation with the figures of merit of a PA (power capability, efficiency .The quiescent current is very susceptible to influence of temperature leading to its Q point drift, which would influence the best matching load, efficiencies and other parameters of power amplifier. In order to ensure the performance of RF power amplifier it is important to maintain a constant operating point to keep its work status stable. Hence in this project an intelligent gate voltage control system is designed in accordance with changes of temperature and drain current through the main controller ARM7 to compensate for the deterioration of power amplifier at different temperatures.

2. LITERATURE REVIEW:

[1] 2.1.1 Literature 1: Design of Microoxidation power control system based on LPC2119
In this paper a self-developed micro-oxidation power control system was introduced in this paper. The hardware part composed of low consumption 32-bit microcontroller LPC2119 developed by Philips Company instead of MSC 51 single chip, which enhanced the stability and extensibility of system; while the software design adopted uC /OS-II multitask type instead of the traditional forward and backward design type, which enhanced the precision and real-time response of the system.

[2] 2.1.2 Literature 2: Research and Development of the Remote I/O Data Acquisition System Based on Embedded ARM Platform [2]
In this paper, A kind of ARM-based embedded remote I/O data acquisition system has been researched and developed, whose hardware platform use 32-bit embedded ARM processor, and software platform use open-source RTOS uC/OS-II core. The system can be widely applied to electric power, petroleum, chemical, metallurgy, steel, transportation and so on

Literature 3: Power Amplifiers and Transmitters for RF and Microwave [5]
The generation of RF/microwave power is required not only in wireless communications, but also in applications such as jamming, imaging, RF heating, and miniature dc/dc converters. Each application has its own unique requirements for frequency, bandwidth, load, power, efficiency, linearity, and cost. RF power is

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generated by a wide variety of techniques, implementations, and active devices. A power amplifier (PA) is a circuit for converting dc-input power into a significant amount of RF/microwave output power

[4] The Van Nguyen ; Grenoble Electr. Eng. Lab Univ. Joseph Fourier, Grenoble, France; Crebier, J.-C. ; Jeannin, P.-O." Design and Investigation of an Isolated Gate Driver Using CMOS Integrated Circuit and HF Transformer for Interleaved DC/DC Converter**"**

This paper deals with the design and the implementation of an isolated gate driver system using a CMOS integrated circuit for interleaved dc/dc converters. It is based on a novel gate driver topology for power switches like MOSFETs and insulated-gate bipolar transistors. Composed of two legs of a CMOS inverter, a high-frequency pulse transformer, and two Zener diodes connected in anti series configuration with the gate of the power switch, this driver topology provides an optimal bipolar gate driver waveform with greater positive and negative gate biases to fasten the switch on and off. It represents a simple ultra compact isolated gate driver simple to integrate in CMOS technology. Power consumption, system size, and robustness of the gate driver are therefore optimized. This integrated driver circuit can be used for any multi-transistor applications. We detail the operation principle of the proposed driver topology in this paper.

PROBLEM STATEMENT

Based on the discussion made above it is very clear that The discrete solution requires many parts, a complicated PCB layout, and more PCB area, all of which lead to higher cost and it needs an external microcontroller (MCU) to implement the functions . The provision of stable gate voltage for power amplifier is of great importance in the design of RF power amplifiers. Since the gate voltage will affect the quiescent current of MOS. The quiescent current is very susceptible to influence of temperature leading to its Q point drift, which would influence the best matching load, efficiencies and other parameters of power amplifier. In order to ensure the performance of RF power amplifier it is important to maintain a constant operating point to keep its work status stable. Hence in this project an intelligent gate voltage control system is designed in accordance with changes of temperature and drain current through the main controller ARM7 to compensate for the deterioration of power amplifier at different temperatures

BIASING METHODOLOGY

The main circuit consists of power MOSFET based power amplifier module, a temperature sensor and a current switching connected in circuit and all are controlled with the help of ARM7 and programming using Embedded C in keilμVision4 Tool which support ARM7 platform using CMOS technology.

A closed loop control system is proposed here for RF power amplifier. Here below is the fig 4 for the design flow.

LPC2148 (ARM7) to compensate for the deterioration of the linear LDMOS PA at different points of temperature. With the interrelation of the temperature, bias gate voltage and drain current, monitoring of drain current achieves high stability, high precision of the gate voltage output capability under the conditions of measured temperature

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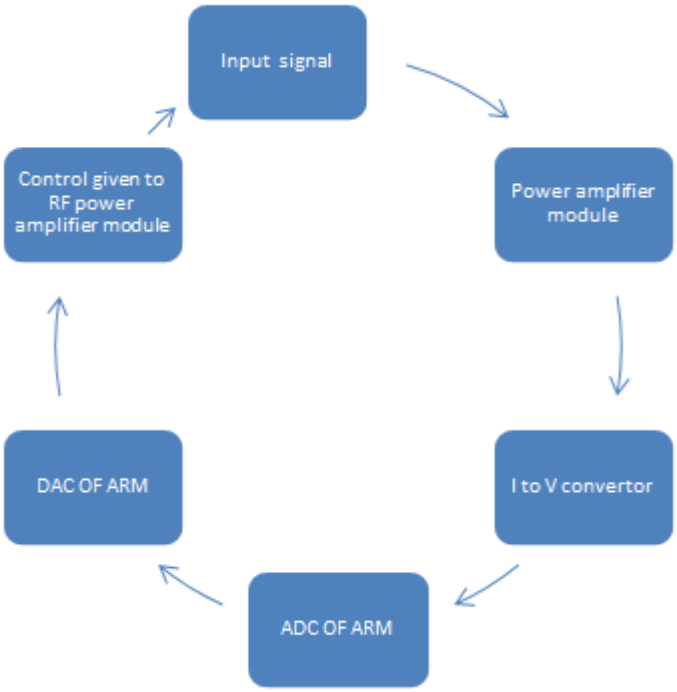

Block Diagram

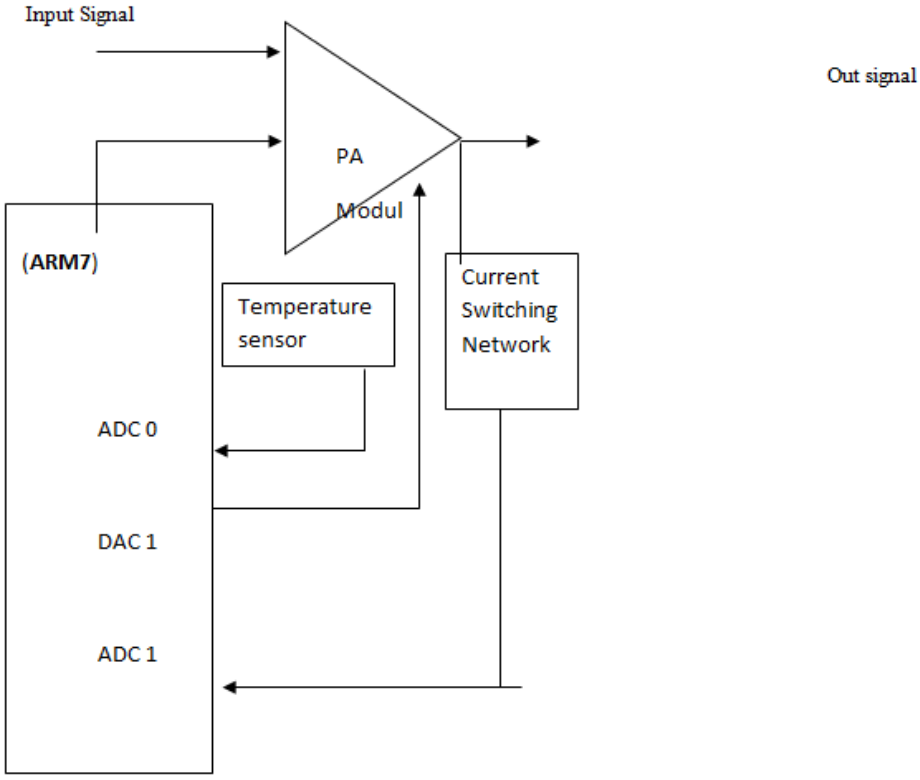

Fig 5. Block diagram of test circuit

3.3.1 Temperature monitoring

The power amplifier's power consumption influences its performance. The PA sometimes operates at a high quiescent point but at low output power. Lots of energy is wasted heating the devices under test, thus decreasing their reliability.

Monitoring the PA temperature and adjusting its operating point can achieve best system performance. The temperature sensor is placed near to the power amplifier module which digitizes the values to the resolution 0.025°C. n ad the valued is given to the ADC of LPC2148 ARM7.

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Hardware design

The resetting module has been implemented differently in relation to the conventional method. The simplified block diagram of the simplified control system design is seen and discussed in design and implementation section.

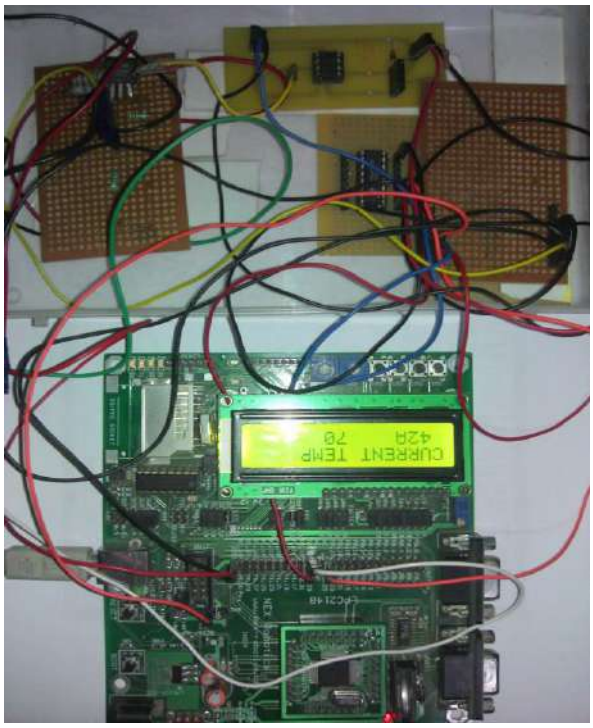
Results of the application module indicate that the proposed system has performance considerations and safety and the control system with changes in temperature the affect over the threshold voltage is controlled using ARM processor.

The results of case temperature and the drain current are studied and it is found that the decreasing graph is obtained. Regulation of gate voltage so as the bias point is maintained and the respective voltages at the output of the system is observed and found to be controlled using DAC of LPC2148

Hence a controlled system with the bias voltage and temperature control due to rise in current of the circuit, the performance is carried satisfactorily.

Development Tools

The Keil development tools offer numerous features and advantages that help you to develop embedded applications quickly and successfully. They are easy to use and are guaranteed to help you achieve your design goals in a timely manner.



Transimpedance amplifiers are commonly used in receivers for Optical communications to convert the current generated by a photodetector into a voltage signal for further amplification.

In this particular designed control system the output current from the power amplifier module is needed to be controlled hence it is given to the I to V converter so that the analog voltage value is given to ADC1 of ARM7 (LPC2148) and further digital conversions are performed using ARM7 and values are being compared with the values in the LUT and required adjustments are done using the DAC and the closed loop is formed for a control system.

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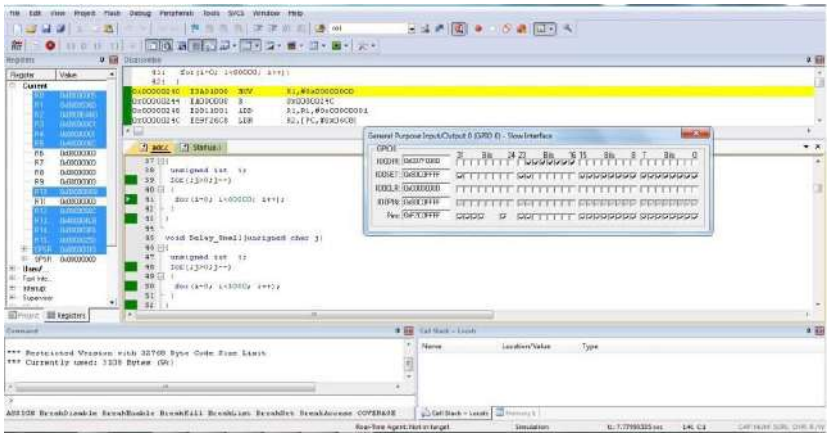
SIMULATION RESULTS

Results of the application module indicate that the proposed system has performance considerations and safety and the control system with changes in temperature the affect over the threshold voltage is controlled using ARM processor.

The results of case temperature and the drain current are studied and it is found that the decreasing graph is obtained. Regulation of gate voltage so as the bias point is maintained and the respective voltages at the output of the system is observed and found to be controlled using DAC of LPC2148.

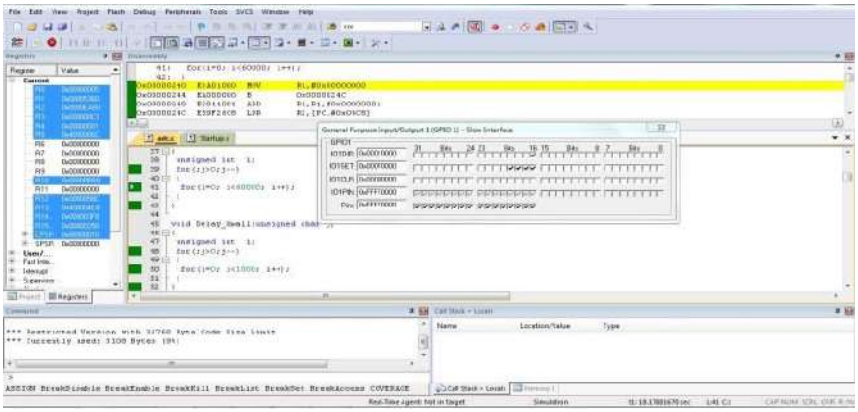
Hence a controlled system with the bias voltage and temperature control due to rise in current of the circuit, the performance is carried satisfactorily.

GPIO -0 SIMULATIONS



Lcd is connected to port 0 from pin no 16 to 23..in which 16 to 19 are data line connected to D4 to D7 pins of LCD and pin 20,21,22 is connected to control signal of LCD i.e En, R/W, C/D resptectively. LCD continuously display values of TEMP and CURRENT

GPIO—1 Simulation Window



LED is connected to pin 16 of port 1. This led is to indicate whether temp exceed the given threshold value, When this led turn on I to V operation comes into picture

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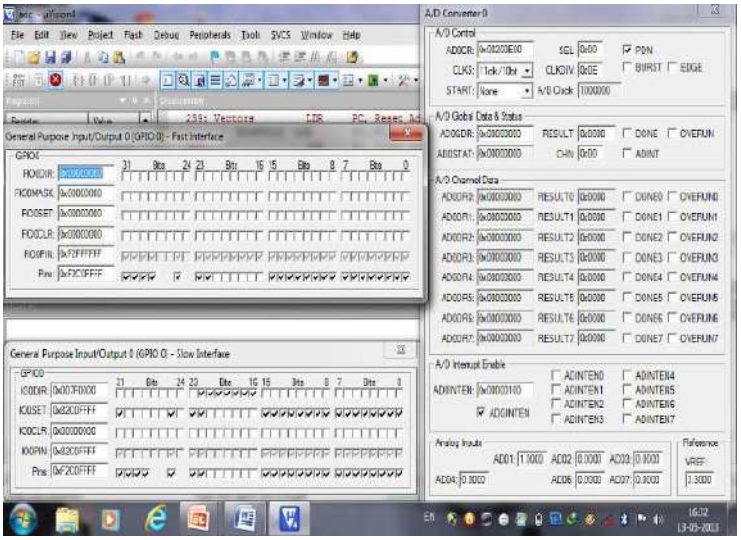
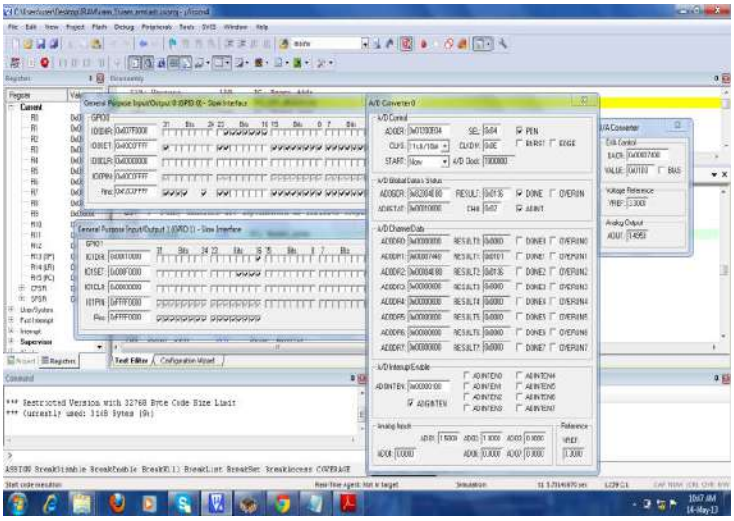
Output Window1

The above fig shows the simulation window in keilµvision4 general purpose input output pins status is shown.i.e.GPIO 0 slow interface and GPIO 0 fast interface and the output of the ADC is shown by the A/D convertor 0 window selected from the peripheral devices being used in debugging. When the analog input is applied after the initialization of port 0 The AD0 is applied with the input values to ADC and respective changes are being observed in A/D channel Data RESULT is shown



Output window 2



The above fig shows the description of the operation of the circuit when the temperature of the power amplifier exceeds the limit then the led at pin no. 16 of GPIO 0 fast interface becomes high as shown in GPIO window. And after this the analog data from the temperature monitoring unit is converted to DAC values which is shown at the DAC window, the respective changes with the analog values from the A/D convertor the DAC window configures the DACR register and shows the value in DACR register and value and the respective analog value is shown.

Experimental Results

Sr. No.	case Temp id degree celsius	current(ID in amp)
1	20	12
2	25	11.5
3	30	11
4	37	10.5
5	50	10
6	60	9.2
7	75	8.6
8	90	7.4
9	100	7

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Values of Case Temperature and Drain Current I_d

CONCLUSION & FUTURE SCOPE

Controlling the gate temperature and current for RF power amplifier. Graphs are plot between the various die temperature and gate voltage and at various juction temperatures.

Hence a control system with the use of ARM processor for power amplifier is made. With the different ways of gate voltage control system design and various affecting measures such as temperature and current are found to be the sensitive parameters which are responsible for the hampering effect for an PA so among the available method the LUT (look up table) design using flash memory in ARM processor a feasible one and a system test design is made for an efficient monitor and a control system which can be useful for amplification in terms of power , current and with due effects of temperature on this technique with other multiuser software so that accuracy of result is maintained for better performances.

Results of the application module indicate that the proposed system has performance considerations and safety and the control system with changes in temperature the affect over the threshold voltage is controlled using ARM processor.

Future Scope

In further study, it can be cut, expand and optimize the system, in order to make it more powerful. With the use of real time operating system so that the multitasking and sharing can be possible for an better efficient control system.

In forthcoming efforts, analysis of different techniques by utilizing the circuit components with temperature compensation, to achieve the gate voltage compensation, but the gate voltage may not be independently regulated through this method. The other one is the using of SCM (single chip microcomputer) and memory storage of tables. In future one can explore the failure analysis of discrete components and integrated ones which tends to fail, causes major power losses for base stations. Hence the future work can be a better control technique using controlling algorithms for various readings for concluding the automatic control of gate voltage for RF PA amplifier to ensure high efficiency and linear work and to save energy as well. It is a self correcting methodology self testing and correcting so further it can be implemented for various RF automatic applications

Abbrevations:-

ADC- ANALOG-TO-DIGITAL CONVERTERS

ARM: ADVANCE RISK MACHINE

DACS:-DIGITAL-TO-ANALOG CONVERTERS

GSM:-GLOBAL SYSTEM MOBILE

LDMOS:-LATERALLY DIFFUSED METAL-OXIDE SEMICONDUCTOR

LUT:-LOOK-UP TABLE

PA:-POWER AMPLIFIER

QPSK:-QUADRATURE PHASE SHIFT KEYING

RTOS:-REAL TIME OPERATING SYSTEM

SCM:-SINGLE CHIP MICROCOMPUTER

UART: -UNIVERSAL ASYNCHRONOUS RECEIVER & TRANSMISSION

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ENERGY RATIO ALGORITHM - BASED SPECTRUM MONITORING FOR OFDM - BASED COGNITIVE RADIO SIGNAL ON SISO AND MIMO SYSTEM

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Mauli Group of Institutions College of Engineering and Technology, Shegaon Dist- Buldhana

Abstract— **This study offers a spectrum monitoring algorithm for cognitive radio frequencies based on OFDM (Orthogonal Frequency Division Multiplexing) that allows one to detect the reappearance of the primary user during the data transfer to the secondary user. The suggested technique significantly shortens the time interval between the beginning of a main transmission and the secondary network's discovery of it, while also lowering the frequency at which spectrum sensing must be carried out. This is accomplished by monitoring the shift in signal strength across several OFDM sub-carriers that are reserved, enabling prompt detection of the primary user's reappearance. Additionally, the influence of OFDM impairments on the suggested approach is examined, including power leakage, Narrow Band Interference (NBI), and Inter-Carrier Interference (ICI). Analysis and simulation both demonstrate that the primary user's appearance can be reliably and efficiently detected by the energy ratio technique. Additionally, with a complexity around twice that of a traditional energy detector, our technology delivers strong immunity to frequency-selective channel fading in both single and multiple receive antenna systems.**

Keywords—**Cognitive networks, cognitive radio, fading channels, OFDM, spectrum sensing/monitoring**

I. INTRODUCTION

Currently, static spectrum access is an important strategy for wireless communications. Under this policy, fixed channels are allocated for exclusive use to licensed users or primary users (PUs), while unlicensed users or secondary users (SUs) are denied access to that channel even if there is no activity. To successfully utilize the radio frequency spectrum, the concept of radio recognition (CR) has been proposed [1]. One of the main methods used in communication information is the connection model, where the SU tries to use the time spectrum when the PU is idle [2]. Primary and secondary users are not allowed to work simultaneously. This way the second user needs to know whether spectrum is available before communicating. If the PU does not work, the SU can use the spectrum, but it must be able to detect very weak signals from the first user by monitoring the frequency integration so that the spectrum can be extracted quickly. During this process, the CR system takes a long period of time, called the detection period, during which the transmitter remains silent when music is heard.

Since the CR users do not utilize the spectrum during the detection time, these periods are also called quiet periods (QPs) [3]. In the IEEE 802.22 system, a quiet period consists of a series of consecutive spectrum sensing intervals using energy detection to determine if the signal level is higher than a predefined value, which indicates a non-zero probability of primary user transmission. The energy detection is followed by feature detection to distinguish whether the source of energy is a primary user or noise [4] [5]. This mechanism is repeated periodically to monitor the spectrum. Once the PU is detected, the SU abandons the spectrum for a finite period and chooses another valid spectrum band in the spectrum pool for communication. If SUs must periodically interrupt communication to detect PU arrivals, two important effects need to be examined. (1) During periods of silence, the SU receiver may lose synchronization with the SU transmitter, resulting in an overall decrease in secondary network performance. This is problematic when the underlying communication method is sensitive to timing errors, such as OFDM. During the polling interval, the secondary network throughput is reduced to zero, degrading the quality of service (QoS) of real-time applications such as Voice over IP (VoIP). If the measurement interval is too long, the impact becomes more severe as the average throughput of the secondary network becomes very low. On the other hand, if this period is too short, interference to the primary user increases because spectral sensing does not provi de information about the frequency band of interest between successive sensing intervals.

In this area, there have been research efforts which attempt to minimize the time duration for spectrum monitoring by jointly optimizing the sensing time with the detection thresh- old [8]. The PU throughput statistics are considered to protect the PU while the sensing time is minimized. In conventional systems, traditional spectrum sensing is applied once before the SU communication and is not be repeated again unless the monitoring algorithm indicates that a primary signal may be present in the band. If monitoring determines correctly that there is no primary signal in the band, then the time that would have been spent performing spectrum sensing is used to deliver packets in the secondary network. Therefore the spectrum efficiency of the secondary network is improved. If spectrum monitoring detects a primary signal in the band during a time period in which spectrum sensing would not have been scheduled, then the disruption to the primary user can be terminated more quickly and hence the impact of secondary communications on the primary user is reduced. Based on this description, the SU receiver should follow two consecutive phases, namely sensing phase and monitoring phase, where the former is applied once for a predefined period.

Yet, another approach is utilized by [9] where the spec- trum is monitored by the CR receiver during reception and without any quiet periods. The idea is to compare the bit error count, that is produced by a strong channel code like a Low Density Parity Check (LDPC) code, for each received packet to a threshold value. If the number of detected errors is above certain value, the monitoring algorithm indicates that the primary user is active. The threshold is obtained by considering the hypothesis test for the receiver statistics when the primary signal is absent and the receiver statistics for the desired Secondary-to-Primary power Ratio (SPR).

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Although this technique is simple and adds almost no complexity to the system, the receiver statistics are subject to change by varying the system operating conditions. In real systems, there are many parameters that can affect the receiver error count such as RF impairments including Phase Noise (PN) and Carrier Frequency Offset (CFO), Sampling Frequency Offset (SFO), and NBI. The error count will depend not only on the presence of a primary signal but it will also depend on the characteristics of those impairments. Also, the receiver statistics may change from one receiver to the other based on the residual errors generated from estimating and compensating for different impairments. Since it is difficult to characterize the receiver statistics for all CR receivers, it is better to devise an algorithm that is robust to synchronization errors and channel effects.

OFDM is a multi-carrier modulation technique that is used in many wireless systems and proven as a reliable and effective transmission method. For these reasons, OFDM is utilized as the physical layer modulation technique for many wireless systems including DVB-T/T2, LTE, IEEE 802.16d/e, and IEEE 802.11a/g. Similar to other wireless networks, OFDM is preferred for cognitive networks and has been already in use for the current cognitive standard IEEE 802.22. On the other hand, OFDM systems have their own challenges that need special treatment [10]. These challenges include its sensitivity to frequency errors and the large dynamic range of the time domain signal. Moreover, the finite time-window in the receiver DFT results in a spectral leakage from any in-band and narrow band signal onto all OFDM sub-carriers.

The traditional spectrum monitoring techniques, that rely on the periodic spectrum sensing during quiet periods, apply their processing over the received time domain samples to explore a specific feature to the primary user. Further, it is totally encouraged to remove the quiet periods during the ER) technique, that is suitable for OFDM-based cognitive radios. Here, the transmitter helps this frequency domain based spectrum monitoring approach by introducing scheduled null-tones by which the spectrum can be monitored during CR reception. This monitoring technique is designed to detect the reappearance of the primary user which also uses OFDM technique. Here, different signal chain impairments due to CFO, SFO, and NBI as well as frequency selective fading channels are considered.

Monitoring phase in order to improve the network throughput. In fact, the signal construction for the secondary user can assist the spectrum monitoring to happen without involving QPs. When the secondary user utilizes OFDM as the physical transmission technique, a frequency domain based approach can be employed to monitor the spectrum during the CR reception only if the SU transmitter adds an additional feature to the ordinary OFDM signal. In this paper, we propose a spectrum monitoring technique, namely the *energy ratio* (The technique operates over the OFDM signal chain and hence, it does not require to wait for the decoded bits. This implies fast response to PU appear- ance. Furthermore, the most important OFDM challenges for cognitive radios like power leakage are investigated and their effects on the proposed monitoring technique are considered. The paper is organized as follows. Section II summarizes the overall system model. In section III, the *energy ratio* technique is discussed. In addition, we present performance analysis for AWGN channels under perfect synchronization and neglecting power leakage in section IV. OFDM challenges and non-perfect synchronization environment are considered in section V. Further, we extend the analysis and study to frequency selective fading channels and multi-antenna systems in section VI. The complexity of the *energy ratio* is analyzed and an architecture is also proposed in VII. Finally, the performance is evaluated with computer simulations in section VIII.

II. System Model

The secondary user physical layer model is designed in order to investigate and verify our spectrum monitoring algorithm. This model is very close to the OFDM system followed by [10]. At the transmitter side, data coming from the source is firstly segmented into blocks where each block is randomized, channel encoded, and interleaved separately. After interleaving, the data is modulated by the constellation mapper. The frequency domain OFDM frame is constructed by combining: (a) One or more training symbols or preambles that are used for both time and frequency synchronization at the receiver side. (b) The modulated data. (c) The BPSK modulated pilots which are used for data-aided synchronization algorithms employed by the receiver. Each N_s encoded complex data symbols generated by the frame builder are used to construct one OFDM symbol by employing the IDFT block that is used to synthesize the OFDM symbol, where N_s denotes the number of sub-carriers per one OFDM symbol. Thus, the n^{th} time-domain sample of the m^{th} symbol can be expressed as given by (1) where $C(k, m)$ is the modulated data to be transmitted on the m^{th} OFDM symbol with the k^{th} sub-carrier.

$$s(n,m) = \sqrt{\frac{1}{N_s}} \sum_{k=-N_s/2}^{Ns/2-1} C(k,m)\, e^{j2\pi kn/N_s} \quad (1)$$

To reduce the effect of Inter-Symbol Interference (ISI), the last N_g samples of the time domain OFDM symbol are copied to the beginning of the symbol in order to form a guard time or cyclic prefix. Therefore, the OFDM block has a period of $T_s = (N_s + N_g)/F_s$ where F_s is the sampling frequency. At the receiver, the inverse blocks are

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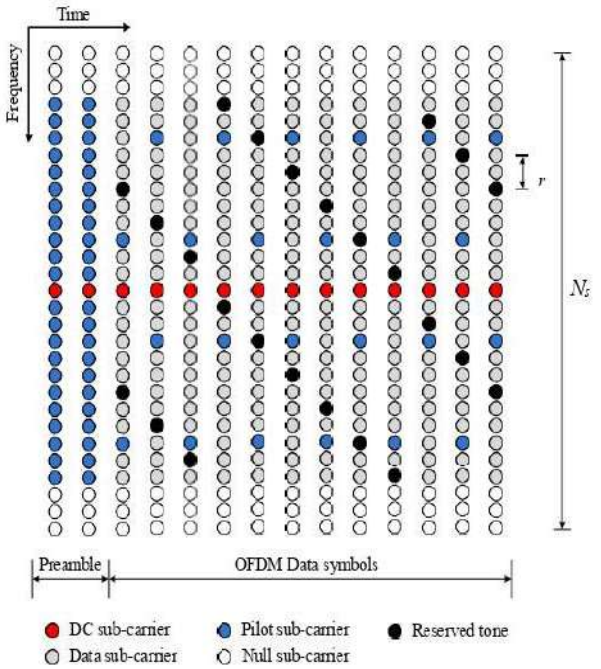

Fig. 1. Time-Frequency allocation for one OFDM frame to explore different sub-carrier types

applied. After timing synchronization (frame detection, start of symbol timing, and SFO estimation and compensation) and frequency synchronization (CFO estimation and correction), the cyclic prefix is removed. Then, the received OFDM symbol is transformed again into the frequency domain through an N_s point DFT. The channel is then estimated and the received data is equalized. The complex data output is then mapped to bits again through the De-mapper. De-interleaving, decoding, and De-randomization are applied later to the received block to recover the original source bits.

From the network point of view, we consider a cognitive radio network of K SUs and one PU . The PU occupies a spectrum of a certain bandwidth for its transmission, while the same spectrum is shared by the SUs. In fact, the spectrum is totally utilized by one SU (the master node or the fusion node) to send different data to the other $K-1$ SUs (the slave nodes). This model was originally introduced for Frequency Division Multiple Access (FDMA) [11] but it has been modified later to suite the OFDM environment. Currently, this model particularly matches two promising solutions, namely Ecma-392 and IEEE 802.11af, that employ OFDM as the underlying physical transmission technique [12]. The standards introduce cognitive radio approach to the TV white space. Usually, a secondary user should get necessary information from TV white space database which maintains a list of the unused TV channels geometrically. However, the standards specify channel power management functionality in order to update the available channel lists.

The current Ecma-392 standard supports spectrum sensing functionality to periodically check the existence of incumbent signals on the current operating channel. Ecma-392 has specified the operation in only single TV channel which can be one of three channel bandwidths of 6 MHz, 7 MHz, or 8 MHz according to regulatory domain. The objective is that the secondary user can utilize the full band on which the primary user operates. The IEEE 802.11af standard is an extension to the Wireless Local Area Network (WLAN). The channel bandwidths in this standard can be adaptively changed when several adjacent TV channels are available. Again, the fusion node (the access point) utilizes the whole primary user band to broadcast the downlink signal to all slaves. In reality, our algorithm is demonstrated by a more general model which does not perfectly match the implementation of either Ecma-392 or IEEE 802.11af. The main difference is that our model has no limitations on the channel bandwidth, the channel characteristics, or even the frequency tolerances.

In our model, the fusion node constructs OFDM frames in the downlink path such that the same pilots are transmitted to all slaves but the data sub-carriers are allocated in time and frequency for different users based on a predefined scheduling technique. For the return path, Orthogonal Frequency Division Multiple Access (OFDMA) is assumed to divide the spectrum and the time into distinct and non-overlapping channels for different slaves, so that interferences between the slaves is avoided. The fusion node fully controls the timing of each slave, possibly by letting the slave know the required time advance or delay, so that the combined signal from all slaves seem to be synchronized at the fusion node receiver. In this case, the fusion node can convert the signal back to the frequency domain in order to extract the data and control information from different slaves. A valid assumption is that the slaves can send important information such as spectrum monitoring decisions and channel state information over a logical control channel in the return path. The master node can simply apply a majority rule based on the received monitoring decisions to decide whether to stop transmission or not.

III. Energy Ratio Algorithm

On the time-frequency grid of the OFDM frame and before the IDFT, a number of tones, N_{RT} , are reserved for the spectrum monitoring purposes. These tones are reserved for the whole time except the time of the training symbol(s) in order not to change the preamble waveform, which is used for synchronization at the receiver. The proposed OFDM frame is shown in Fig. 1. Notice that we allocate the reserved tones dynamically so that their indices span the whole band when successive OFDM symbols are considered in time. The tones are advanced by Δ_r positions every OFDM symbol. When the last index of the available sub-carriers is reached, the spanning starts again from the first sub-carrier. Hence, by considering small values for Δ_r, the reserved tone sequence injected to the energy ratio spans the whole band. The reasons for this scheduling are: (1) The primary user may have some spectrum holes because of using OFDM as well. If the reserved tones from the SU are synchronized with those spectrum holes in the PU side, then the algorithm will fail. On the contrary, if the PU uses a traditional single carrier modulation technique like QAM, this issue does not have a harm effect on the algorithm since the PU signal has a flat spectrum over the entire band. (2) The reserved tones typically occupy narrow band and the primary to secondary channel may introduce

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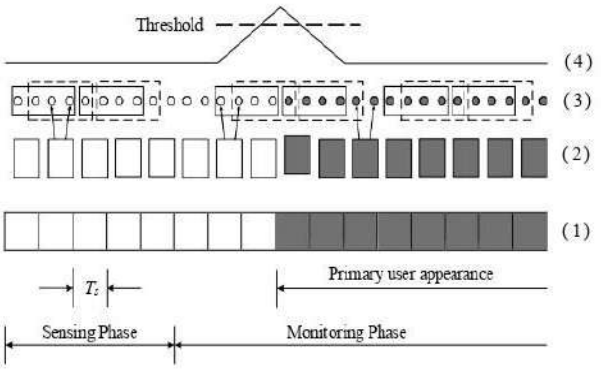

Fig. 2. Energy Ratio processing details. (1) The time domain sequence for the OFDM blocks. (2) Frequency domain samples. (3) Reserved tones processing with two sliding windows for $N_{RT} = 2$ and $N = 4$. (4) Decision making variable, X_k.

notch characteristics to this narrow band resulting in detecting lower primary power level, which is referred to the narrow band problem. Therefore, it is recommended that the reserved tones are rescheduled by changing the value of Δ_r over time to mitigate the channel effect and to protect the reserved tones from falling into primary holes. Of course, all SUs should know the code for this scheduling in prior.

Based on the signal on the reserved tones at the receiver, the secondary user can monitor the band and test the primary user appearance. In fact, the traditional radiometer may be employed to measure the primary signal power and the secondary noise power by accumulating the energy of those reserved tones. As a consequence, the primary signal power can be detected if this energy exceeds a predefined threshold. However, this approach does not necessary guarantee the primary user detection as the spectral leakage of the neigh bouring sub-carriers will affect the energy at the reserved tones even for no in-band primary signal [13]. Here, we propose another decision making criterion that has a powerful immunity for this power leakage. In fact, the power leakage, the ICI resulted from the residual CFO and SFO errors, and even the effect of NBI can be overcome by our approach.

The overall algorithm is illustrated by Fig. 2. It is assumed that the primary signal appears after some time during the monitoring phase. At the secondary receiver, after CP removal and frequency domain processing on the received signal, the reserved tones from different OFDM symbols are combined to form one sequence of complex samples. Two consecutive equal-sized sliding windows are passed over the reserved tone sequence in the time direction. The energy of the samples that fall in one window is evaluated and the ratio of the two energies is taken as the decision making variable and hence the name *energy ratio*.

The algorithm aims to check the change in variance on the reserved tones over time. In a mathematical form, let Z_i be the i^{th} sample of the reserved tone sequence. The decision making variable, X_k, can be defined as given by (2) where N is the number of samples per window, U_k is the energy of the second window, V_k is the energy of the first window, and k is an integer such that $k = 1, 2, 3, \ldots$

$$X_k = \frac{U_k}{V_k} = \frac{\sum_{i=N+k}^{2N+k-1} Z_i^2}{\sum_{i=k}^{k+N-1} Z_i^2} \quad (2)$$

It should be mentioned that the reserved tones processing done by the *energy ratio* algorithm starts from the beginning of the sensing phase. Meaning that, the decision making variable is evaluated during both sensing and monitoring phases. However, it provides decisions only during monitoring phase. During the sensing phase, if the decision from the spectrum sensing algorithm is that the PU is inactive, then the *energy ratio* algorithm has been properly calibrated to be able to detect the appearance of the PU during monitoring phase. Calibration means that both sliding windows are filled with pure unwanted signals. During the monitoring phase, the receiver monitors the reserved tones by evaluating the parameter, X_k. If it exceeds a certain threshold, then the secondary user assumes that there is a power change on the reserved tones which perhaps due to the primary user appearance and it is time to vacate the band. If not, the secondary user can continue transmission. Indeed, if there is no primary user in band, then the energy of each window still involves only the strength of the unwanted signals including the noise, the leakage from the neighboring sub-carriers, and the effects of ICI produced by the residual synchronization errors. Therefore, if N is large enough, the ratio will be very close to unity since the strength of the unwanted signals does not offer significant changes over time.

Once the primary user appears, the second window will have two types of signaling which are the primary user interference and the unwanted signals. Meanwhile, the first window will only maintain the unwanted signals without the primary user interference. The ratio of the two energies will result in much higher values when compared to one. The value will of course depend on the primary user power. When the two windows slide again, the primary signal plus the unwanted signals will be observed by the two windows and the decision making variable returns to the initial state in which the ratio is close to unity. Thus, we can expect that the decision variable produces a spike when the primary user is detected. Otherwise, it changes very slowly maintaining the *energy ratio* close to one as shown in Fig. 2 part (4).

This approach can resist the different impairments involved in the received signal on the account of reducing the throughput of the secondary user by the ratio of the number of reserved tones to the number of useful tones. However, this reduction can be easily overcome since OFDM systems allow adaptive modulation where good conditioned sub-carriers are loaded with higher modulation order.

For the previous discussion, it is assumed that the primary user should appear at the boundaries of the OFDM blocks. Therefore, the reserved tones should have the full power, that is supposed to be for those sub-carrier indices, of the primary user when it is active. In reality, the primary user may appear any time within any OFDM block in the monitoring phase. In this case, we have to consider two effects. (1) The FFT window applied by the SU receiver will have a time-shifted version of the PU signal which involves a phase

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rotation to the PU sub-carriers. Since the energy is the useful parameter for our algorithm, the phase shift is acceptable to happen with no effect on the algorithm. (2) The power on the reserved tones will not have the full power transmitted by the primary user on those sub-carriers since part of the signal is truncated. However, the next OFDM symbol will have that full power. Similar to the near-far problem, if the PU power is large enough, then the reserved tones form the first OFDM symbol, in which PU signal appears, are considered to be full. Otherwise, the reserved tones from this OFDM symbol are considered as noise if $N \gg N_{RT}$.

IV. Energy Ratio Analysis For AWGN Channels

To verify the algorithm, we first analyze the *energy ratio* technique assuming perfect synchronization and neglecting the leakage power effect. However, these issues will be considered and their effects will be studied in the next section. Throughout the analysis, we assume that the signal to be detected does not have any known structure that could be exploited. Therefore, the reserved tone sequence is modelled via a zero-mean circularly symmetric complex Gaussian distribution (this is also true in case of frequency selective fading channels as discussed in section VI). The target of this analysis is to find the receiver operating characteristics (ROC) represented by the probability of detection, P_D, and probability of false alarm, P_{FA}. The detection probability is the probability of detecting a primary signal when it is truly present while the false alarm Probability is the probability that the test incorrectly decides that the primary user is present when it is actually not.

Since we are dealing with a two state model in which the channel is assumed to be idle or busy by the primary user, then we wish to discriminate between the two hypotheses H_0 and H_1 where the first assumes that the primary signal is not in band and the second assumes that the primary user is present. Using the *energy ratio* algorithm, one can define these hypotheses as given by (3) where it is assumed that the samples contained in the first window have a variance of σ_v^2 and the samples enclosed by the second window have a variance of σ_u^2.

$$\begin{aligned} H_0 &: X = \frac{U}{V}, \quad \sigma_u^2 = \sigma_v^2 \\ H_1 &: X = \frac{U}{V}, \quad \sigma_u^2 > \sigma_v^2 \end{aligned} \tag{3}$$

The performance of the detector is quantified in terms of its ROC curve, which represents the probability of detection as a function of the probability of false alarm. By varying a certain threshold γ, the operating point of a detector can be chosen anywhere along the ROC curve. P_{FA} and P_D can be defined as given by (4) and (5), respectively.

$$P_{FA} = Prob\ X > \gamma \mid H_0 \tag{4}$$

$$P_D = Prob\ X > \gamma \mid H_1 \tag{5}$$

Clearly, the fundamental problem of detector design is to choose the detection criteria, and to set the decision threshold γ to achieve good detection performance. Detection algorithms are either designed in the framework of classical statistics, or in the framework of Bayesian statistics [14]. In the classical case, either H_0 or H_1 is deterministically true, and the objective is to maximize P_D subject to a constraint on P_{FA}; this is known as the Neyman-Pearson (NP) criterion. In the Bayesian framework, by contrast, it is assumed that the source selects the true hypothesis at random, according to some priori probabilities. The objective is to minimize the so-called Bayesian cost. In this work, the former approach is followed. First, the Probability Density Function (PDF) and the Cumulative Distribution Function (CDF) of the decision variable are derived. Next, both the detection and the false alarm probabilities are evaluated in closed-forms.

A. Energy Ratio PDF and CDF Evaluation

Since the samples of the reserved tone sequence follow a zero-mean circularly symmetric complex Gaussian distribution, then the energy contained in one window will follow a Chi-Square distribution and the PDFs for the random variables U and V can be written as given by (6) and (7), respectively [15].

$$f_U(u) = \frac{1}{2^N \sigma_u^{2N} \Gamma(N)} u^{N-1} e^{-u/(2\sigma_u^2)}, \quad u > 0 \tag{6}$$

$$f_V(v) = \frac{1}{2^N \sigma_v^{2N} \Gamma(N)} v^{N-1} e^{-v/(2\sigma_v^2)}, \quad v > 0 \tag{7}$$

The CDF for the random variable X and hence the PDF, can be evaluated as given by (8) and (9), respectively, where the two random variables U and V are assumed to be independent. It is obvious that the PDF for X follows a scaled F-distribution with mean $m_X = \Gamma(N-1)\Gamma(N+1)/\Gamma^2(N) \times \sigma_u^2/\sigma_v^2$ and variance $Var(X) = \Gamma(N-2)\Gamma(N+2)/\Gamma^2(N) \times \sigma_u^2/\sigma_v^2$. The CDF for X can be derived in a closed-form as given by (10), where $I_b(N, N)$ is the regularized incomplete beta function with the parameters b and N.

B. P_{FA} and P_D Evaluation

To obtain the ROC, we develop the classical NP criterion in which the detection probability is maximized while the false alarm probability is maintained at a fixed value. Since the probability of false alarm for the *energy ratio* algorithm is given by (11), one can obtain the threshold γ subjected to a constant P_{FA} as given by (12) where $I_b^{-1}(N, N)$ is the inverse incomplete beta function with parameters b and N.

$$P_{FA} = Prob\ X > \gamma \mid H_0 = 1 - I_{\frac{(\gamma)}{(1+\gamma)}}(N, N) \tag{8}$$

$$\gamma = \frac{I^{-1}_{1-P_{FA}}(N, N)}{1 - I^{-1}_{1-P_{FA}}(N, N)} \tag{9}$$

Once the primary user becomes available in the band, the second window will contain the power of the primary user in addition to the power of the noise whereas the first window will contain only noise and hence, the receiver noise variance is represented by σ_v^2. Therefore, $\sigma_u^2 = \sigma_v^2 + \mathrm{PNR} \times \sigma_v^2$ where PNR is the ratio of the primary user power to the secondary user noise power at the secondary user receiver. Hence, the detection probability can be expressed in terms of PNR as,

$$\begin{aligned} P_D &= Prob\ X > \gamma \mid H_1 = 1 - I_{\frac{(\sigma_v^2\gamma/\sigma_u^2)}{(1+\sigma_v^2\gamma/\sigma_u^2)}}(N, N) \\ &= 1 - I_{\frac{(\gamma/(1+PNR))}{(1+\gamma/(1+PNR))}}(N, N) \quad \square \end{aligned} \tag{10}$$

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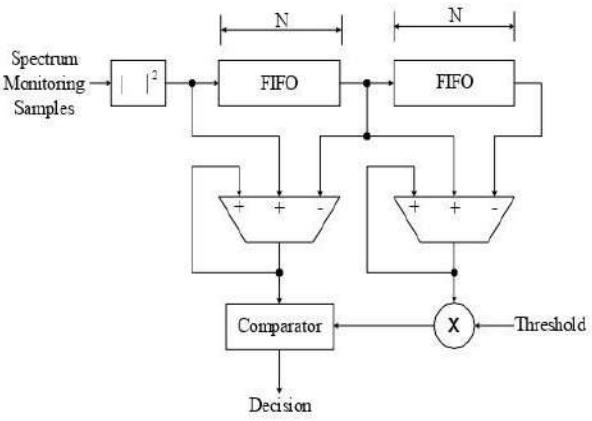

Fig. 3 Proposed architecture for the energy ratio algorithm

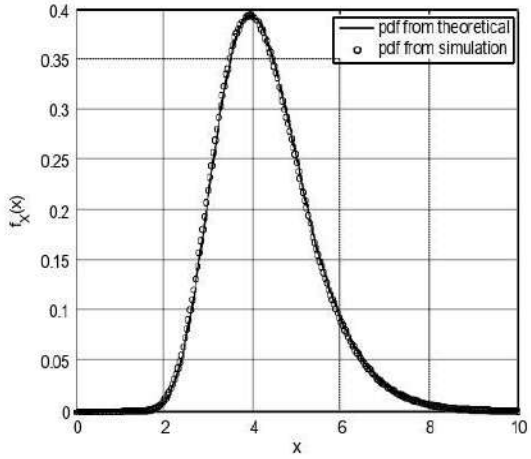

Fig. 4. Simulated PDF versus analytical PDF for the energy ratio decision making variable with N =32 and $10\log_{10}(\sigma^2/\sigma^2) = 5$dB

To enhance the detector performance in fading channels, multiple-antennas at the receiver side can be utilized. For Single-Input Multiple-Output (SIMO) or Multiple-Input Multiple-Output (MIMO) systems, if the number of receive antennas is N_{Rx}, there will be N_{Rx} available sets of reserved tones at the receiver for each OFDM symbol or equivalently $N_{Rx} \times N_{RT}$ reserved tones every OFDM symbol. The *energy ratio* monitoring technique will combine all these sets to form the reserved tone sequence. In this case, the confidence of primary user presence is increased by the diversity gain offered by the system. This allows for more robust decision compared to the SISO case. Effectively, applying SIMO or MIMO is equivalent to increasing the window size by a factor of N_{Rx}. If the same performance is required, the window size can be reduced by N_{Rx} which implies that the primary user power is sensed in less time when compared to the SISO case. Otherwise, increasing the window size directly increases the mean of the decision making variable under H_1 which allows for higher detection probability and less false alarm.

V. Complexity Overhead For Energy Ratio Algorithm

To evaluate the *energy ratio* from complexity point of view, we propose an architecture for the algorithm and then analyze the corresponding complexity and compare it to the traditional energy detectors. The proposed architecture is shown in Fig.3. First, the reserved tone sequence is injected to be squared. Next, two First-In First-Out (FIFO) memories are used to store the squared outputs in order to manage the energy evaluation for the two windows. The idea depends on the sliding concept for the windows where the total energy enclosed by one window can be evaluated by only adding the absolute squared of the new sample and subtracting the absolute squared of the last sample in the previous window as given by,

$$V(k) = \sum_{i=k}^{N+k-1} |Z_i|^2 = V(k-1) + |Z_{N+k-1}|^2 - |Z_{k-1}|^2 \quad (23)$$

The ratio may not be evaluated directly, instead we can multiply the energy of the first window by the threshold and the multiplication output is then compared to the energy of the second window. We conclude that the proposed architecture typically uses double the components applied for the traditional energy detector. Moreover, traditional spectrum sensing which is applied prior to spectrum monitoring surely involve multipliers and accumulators. To further reduce the complexity, these modules can be reused and shared with the *energy ratio* algorithm during spectrum monitoring as sensing and monitoring are non-overlapped in time.

VI. Simulation Results

In the simulation, we used an OFDM system that employs a total of N_s = 1024 sub-carriers, 224 of which are used as guard bands on both ends of the signal band. There are 32 pilot sub-carriers and N_{RT} = 4 reserved tones, distributed across the entire 800 sub-carriers. Therefore, the throughput reduction due to reserved tones is only 0.5% which is an inconsiderable amount for high data rates. The cyclic prefix is N_g = 64 samples long and the sampling frequency is 16MHz. The sub-carrier spacing is then Δf = 15.625 KHz which is large enough to neglect the phase noise distortion and the time domain windowing effect. Unless otherwise specified, the frame has two consecutive training symbols, 256 OFDM data symbols, and the reserved tone spacing Δ_r = 2. The data for both primary and secondary transmitters is modulated by 16-PSK mapper and the secondary power to noise ratio in the absence of primary signal is assumed 9dB. When the system operates under non-perfect synchronization, the maximum acceptable CFO is assumed to be 400KHz, the CFO is 320KHz, and the sampling clock offset is assumed to be 100 ppm.

A. Analytical Verification

Fig. 4 shows a comparison between the PDF given by (9) and the one obtained from simulation where we have used $10\log_{10}(\sigma_u^2/\sigma^2) = 5$dB and an energy ratio window N = 32. To obtain the simulated PDF, 10^7 circularly symmetric Gaussian distributed samples are generated and scaled properly for both windows. The samples are then applied to the *energy*

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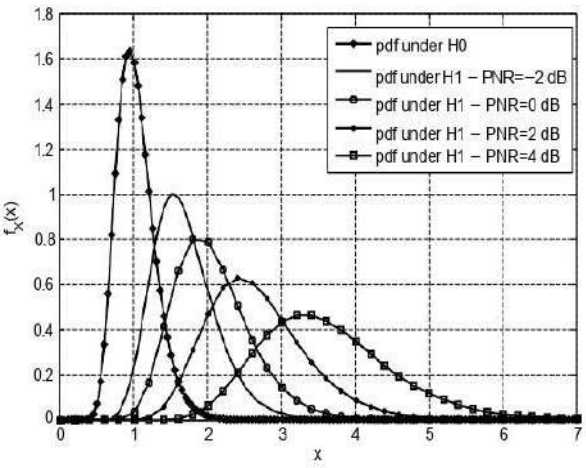

Fig. 5. Conditional PDF under H_0 and conditional PDF under H_1 for PNR=-2, 0, 2, and 4 dB

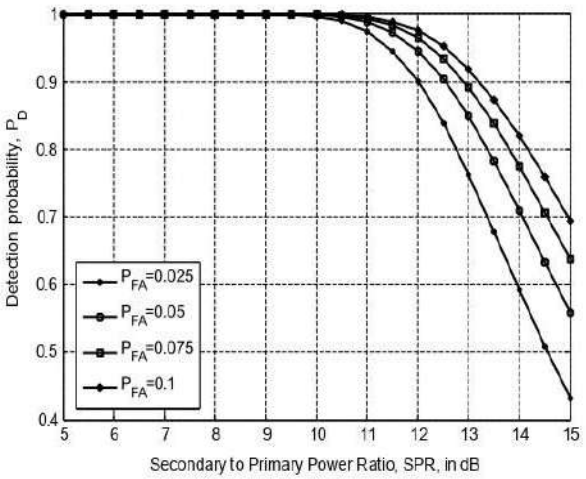

Fig. 6. The detection probability at fixed false alarm probability under perfect synchronization and neglecting the power leakage effect

ratio algorithm and the PDF is obtained by considering the histogram of the decision making variable. It is obvious that the analytical results are in excellent agreement with the simulated ones.

Next, the hypothesis test is to be verified by exploring the conditional PDF under both H_0 and H_1. In fact, when there is no primary user in band, the decision variable follows only one unique PDF that is shown in Fig.5. Under H_1, the conditional PDF depends on the PNR ratio. Four additional curves are also shown in Fig. 5 for the conditional PDF under H_1 with four different PNR values (-2, 0, 2, and 4 dB). It is clear that the decision variable can distinguish between no primary user case and primary user presence based on the PNR.

B. Receiver Characteristics

The detection probability for four different false alarm probabilities is shown in Fig. 6. The horizontal axis denotes the secondary to primary power ratio (SPR) which is related to the primary to secondary noise ratio (PNR) such that $PNR\big|_{dB} = SNR\big|_{dB} - SPR\big|_{dB}$, where SNR is the secondary power to noise power ratio. It is to be noticed that, PNR is the ratio that determines the performance of the *energy ratio* algorithm whereas SPR is assumed to be the main parameter by which a monitoring algorithm is evaluated.

The ROC for the *energy ratio* for different values of SPR is shown in Fig. 8. These results are obtained by simulating the OFDM system twice, one when primary signal is present and the second when it is absent. The system is run over 10^5 realizations and the probability of detection or false alarm is evaluated. The threshold is set based on the theoretical value given by (12). In order to compare the proposed monitoring algorithm with the receiver statistics technique found in [9], the OFDM system is simulated such that the system parameters match the simulation environment followed by [9]. The simulation is run for 4-QAM under SNR = 6dB, P_{FA} =0.04, and N =128. Fig. 9 shows the simulation results for the detection probability of the *energy ratio* algorithm in comparison with the results obtained in [9]. In addition of having fast detection, it is noted that the *energy ratio* shows a better performance than the receiver statistics algorithm.

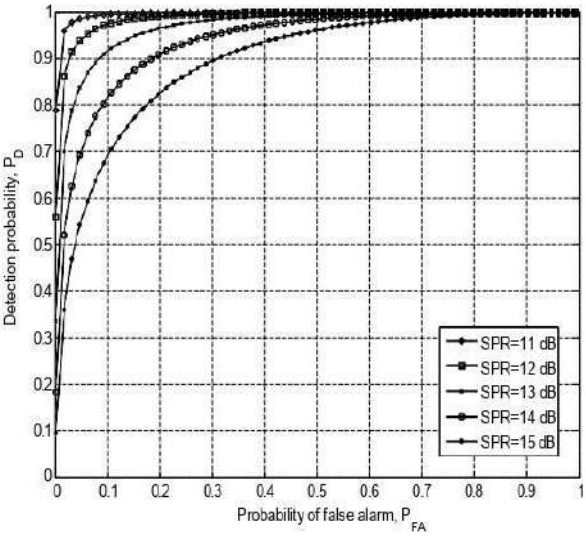

Fig. 7. Receiver operating characteristics for different SPR values under perfect synchronization and neglecting the power leakage effect

C. OFDM Challenges

The power leakage is modelled by applying oversampling to the frequency domain signal, where the number of points at the receiver DFT is four times the number of points used at the transmitter. Time domain Hanning window with folding is applied at the receiver to limit the NBI and power leakage. Also the phase of the time domain samples is rotated by $2\pi\varepsilon n$ to model the receiver CFO where n is the time index. Moreover, the received signal is re-sampled at time instances that are multiple of $(1 + \delta)T_s$ to model the receiver SFO. The preamble detection and the exact frame timing are assumed to be perfect. Here the time domain preamble is used to estimate and compensate for the CFO. The CFO compensated signal is converted to the frequency domain via DFT. The SFO, $\hat{\delta}$, and the residual CFO are further estimated by applying the least squares algorithm discussed in V-B2. Moreover, the time domain signal is re-sampled according to the delay $\hat{\delta}$ to compensate for the SFO.

Fig. 9 shows the mean square error for the estimated CFO

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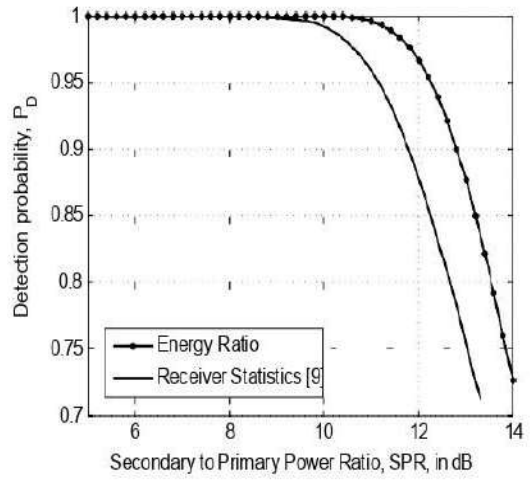

Fig. 8. Comparison between energy ratio and receiver statistics algorithms in case of QPSK, SNR = 6 dB, P_{FA} = 0.04, and N =128

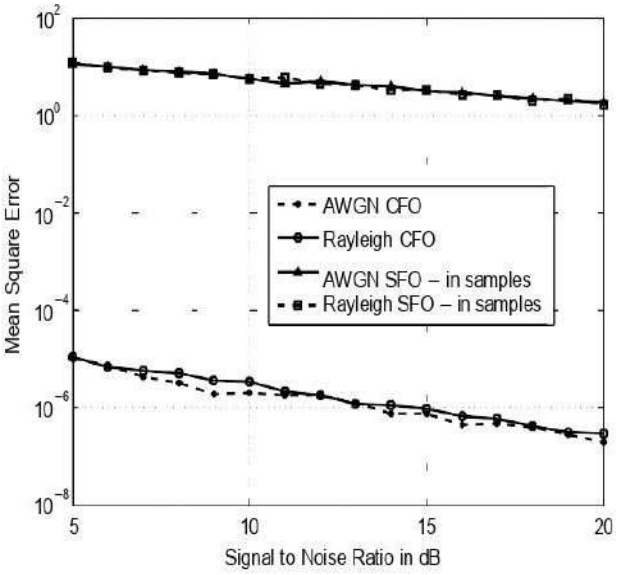

Fig. 9. MSE for both CFO and SFO estimation under AWGN and frequency selective fading channels. The MSE for SFO is measured in samples.

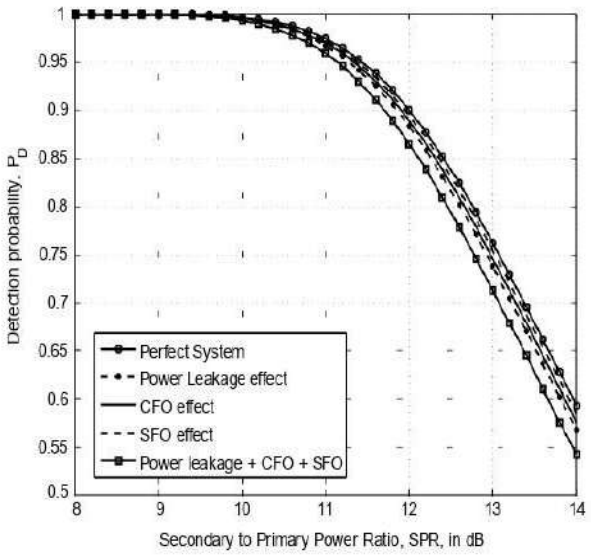

Fig. 10. Power leakage, CFO, and SFO effects on the energy ratio algorithm at P_{FA} = 0.025

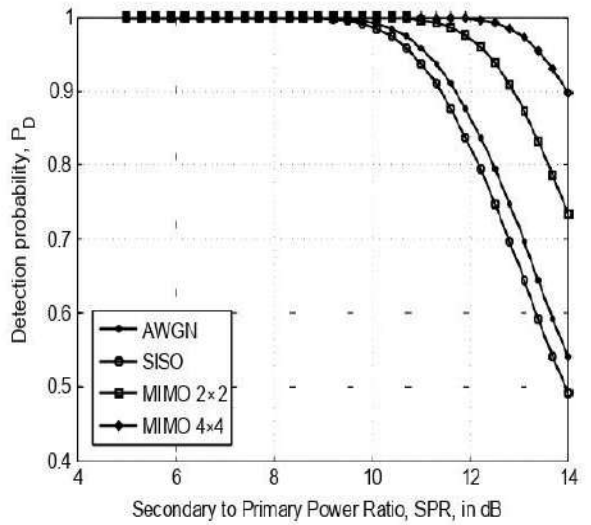

Fig. 11. Frequency selective fading channel effect on energy ratio for SISO and MIMO systems taking power leakage and ICI into consideration, P_{FA} = 0.025 and N = 128

and SFO. From these results, we can see that the residual fractional CFO and SFO at 9dB are 9 10^{-3} and 5 10^{-6}, respectively. This implies SNR degradation of $SNRD_{CFO}$ = 0.0092 dB for CFO, and $SNRD_{SFO}(1023)$ = 0.003 dB for SFO at the last sub-carrier. This shows the advantages of the powerful estimation techniques we have chosen for the OFDM synchronization engine.

To examine the combined effects of OFDM impairments, the detection probability for the *energy ratio* is simulated in the presence of power leakage, CFO, and SFO as shown in Fig. 10. The signal is oversampled four times by applying 4096 points DFT at the receiver in order to allow the emulation of the continuous spectrum. The sub-carriers are then selected by sampling this spectrum every four samples. Since the sub-carrier since shape becomes more narrow because of the Hanning window, the introduced ICI by the residual CFO and SFO errors has a very small noticed degradation. Therefore, if windowing, CFO and SFO estimations and compensations are applied, the power leakage to neighboring sub-carriers does not introduce severe degradation to the PU detection. As we claimed earlier, the *energy ratio* is shown to be robust to OFDM challenges as only minor degradation in detection performance is noted compared to the perfect case. For instance, the overall loss due to all impairments is only 0.4 dB at a detection probability P_D = 0.9.

D. Effect of Frequency-Selective Fading

To study the effect of frequency-selectivity on the proposed energy ratio technique, the channel is modelled as a linear time-varying filter whose impulse response, $h(n)$, is obtained by: [1] N_g circularly symmetric Gaussian samples with unit variance. The number of channel taps is defined by the cyclic prefix length as we assume that the cyclic prefix fully defines the channel maximum excess delay. [2] The samples are scaled to fit the required power delay profile which is assumed to be

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Exponentially decaying. Thus, the channel tap l is scaled by $exp(-l)$for $l = 0, 1, 2, ..., N_g$ –The OFDM system is simulated in frequency selective channel for different SPR. In Fig. 12, we show the effect of frequency selective fading channel on the *energy ratio* performance for SISO, 2× 2 MIMO, and 4× 4 MIMO systems. The fading channel effect is compared with the AWGN channel where a minor degradation is noticed due to the narrow band problem. From these results, it is clear that having more receive antennas will offer great enhancement to the detection accuracy of the *energy ratio* detector.

VII. Conclusion

We proposed a spectrum monitoring algorithm that can sense the reappearance of the primary user during the secondary user transmission. This algorithm, named "*energy ratio*" is designed for OFDM systems such as Ecma-392 and IEEE 802.11af systems. We also derived the detection probability and the probability of false alarm for AWGN channels in order to analyze the performance of the proposed algorithm. Simulation results indicate that the detection performance is superior to the receiver statistics method. For computational complexity, the *energy ratio* architecture is investigated where it was shown that it requires only about double the complexity of the conventional energy detector. When frequency-selective fading is studied, the *energy ratio* algorithm is shown to achieve good performance that is enhanced by involving SIMO or MIMO systems. We have proven that the multiple receive antenna system will further result in a better detection accuracy by emulating the increase in sliding window size. Therefore, our proposed spectrum monitoring algorithm can greatly enhance the performance of OFDM-based cognitive networks by improving the detection performance with a very limited reduction in the secondary network throughput.

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AN INVESTIGATION OF POWER QUALITY CONCERNS IN LV DISTRIBUTION NETWORK AND EXPLORATION OF SUITABLE MITIGATION MEASURES

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ABSTRACT
The traditional power supply system mainly dealt with linear loads. However, with the aggressive creep-in of electronic loads in the modern era of digitalization, supply systems are experiencing Power Quality issues. The significant concerns observed are harmonics, voltage sag/swell, dip, long transients, transients, poor power factor, unbalancing in voltage, supply interruptions[1], etc. The research presented in this paper is a case study for investigating different Power Quality concerns for an 11 kV supply system (HT consumer) at an educational institute campus where the connected load includes multiple electronic gadgets and is of significant magnitude. The site-specific Power Quality concerns are studied thoroughly and its mitigation measures have been identified and reviewed in the work.

Keywords: Power Quality, HT consumer, Mitigation Measures

I. INTRODUCTION
In Distribution Systems, the Power Quality is very poor due to the non-linearity nature of electronics devices. HT consumer is taken as a reference. Government College of Engineering is the HT consumer in the Distribution System. It is fed by the express feeder from the 33/11 kV substation. It is the educational institute having various types of loads such as linear, non-linear, residential single phase, heavy machinery in the laboratories, etc. A thorough study is made about the different Power Quality issues in LT side of the consumer. The input voltage of the consumer is 33 kV and the transformer steps down the voltage of 440 V which feeds various buildings like, administrative building, library, workshops, staff quarters, hostels, various departments of which building is fed by a separate feeder.

II. MATERIAL AND METHODS
The referred institute is connected with the Power Quality Analyzer for the LT side of the transformer having the voltage of 440 V (Line-to-Line). It is kept connected in the system for 18.42 hours from the first day up to 14.38 hours of the next day. The recording time interval is kept at 1 minute. The waveforms of different Power Qualities[2] issues are studied, i. e., i) voltage sag/swell, ii) voltage imbalance, iii) flicker, iv) harmonic distortion, v) frequency, etc.

A. **Observations:** It is observed that there are power quality issues in the system of which transient interruptions, under voltage are not observed. Some of which are summerised as follows *Voltage Sag/Swell*[2]: The graph is between percent of nominal voltage versus time in microseconds. For time duration less than 10 microseconds, the voltage decreases from 80 to 90 % and this happens 5 times during the entire period for which the data is collected. For time duration less than 10 microseconds, the voltage rises from 110 % to 120 %.

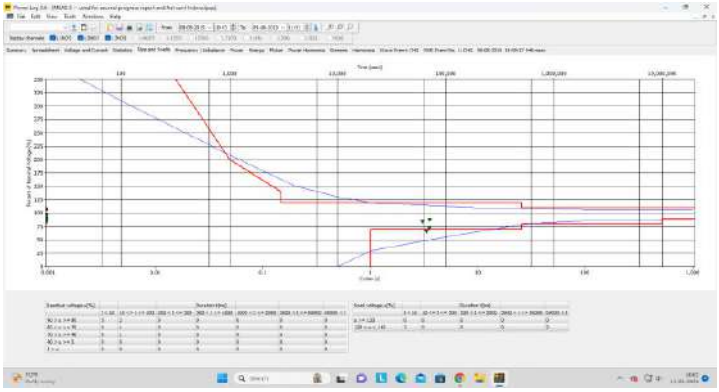

Fig. 1: Waveform of voltage sag/swell

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B. **Voltage Imbalance:** Due to imbalance in the loads on each phase, voltage becomes unbalanced, hence currents in magnitude may differ in all the phases [3]. The waveform for negative sequence voltage in % is shown in blue color and that for negative sequence current in % is shown in green color. It is observed that there is an imbalance in current during the closer time of the institute and starting time as the major loads are switched off and on in office hours as shown in fig. No. 2. From 12 am to 6 am, the imbalance is 7.5 to 12.5 % and sometimes, it is crossing the maximum permissible limits i. e. 10%. The imbalance is observed in negative sequence voltage as 0.64 % which is also beyond the maximum permissible limits of 0.2 %.

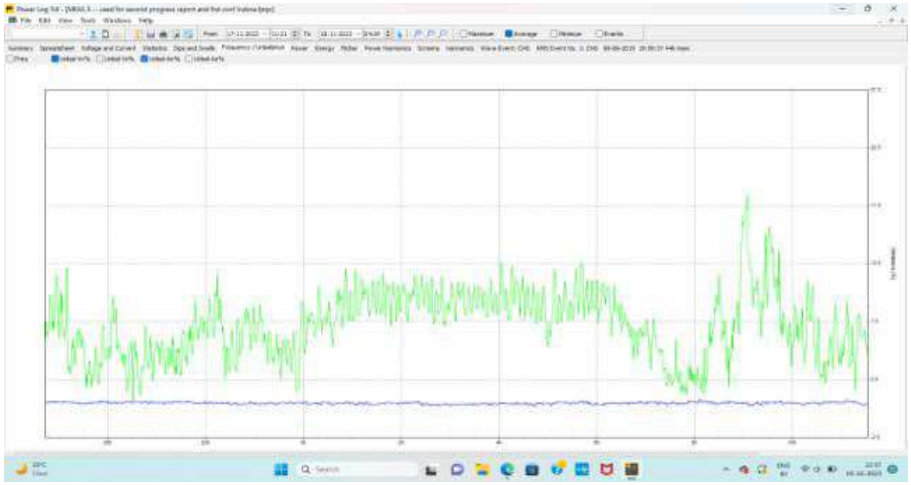

Fig. 2: Waveform of voltage imbalance

C. **Harmonic Distortion:** The Total Harmonics Distortion is due to the odd multiples of the frequency waveforms present in the system[5]. The leftmost graph in fig. No. 3 is showing the total Harmonics present in the system. The subsequent, third and fifth and seventh Harmonics are shown. The historiography is the graph between the Harmonics for voltage waveform for R, Y and B phases and the neutral which are shown in blue color. Harmonics present for current waveform for R, Y and B phases and the neutral current waveform which is shown in red color. It is observed that the THD in voltage to neutral waveform, the maximum value in % is 327.67 and that for current waveform in neutral also 327.69%.

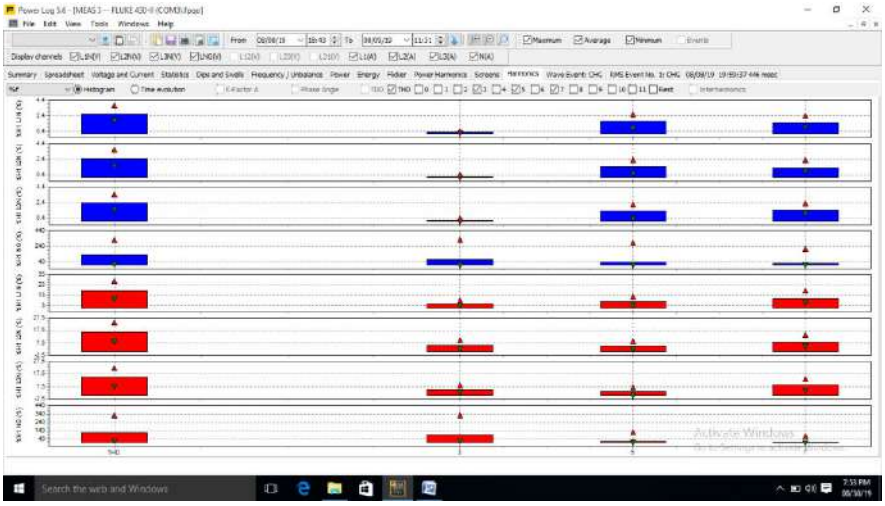

Fig. 3: Waveform of harmonic distortion

A. **Power:** It shows the active, reactive and apparent power as shown in fig. No. 4. The consumption of power suddenly comes to very less due to office closing at around 6 pm. So, large loads are switched off and the institute consumes less power. The residential load and hostel loads are there in the system. The power is consumed very less after 6 pm and remains less till morning around 6.30 am the next day, where the power consumption starts increasing as the residential load is put on the circuit[6]. The graph shows waveform for active power, reactive power and apparent power for R, Y and B phases and the total power consumed by the institute. Also, maximum power consumed, average power consumed and minimum power consumed are indicated by red, black and green color respectively. It is observed that the average active power consumption is around 12 kW, reactive power consumption is around 17 kVAR and apparent power consumption is around 20 kVA.

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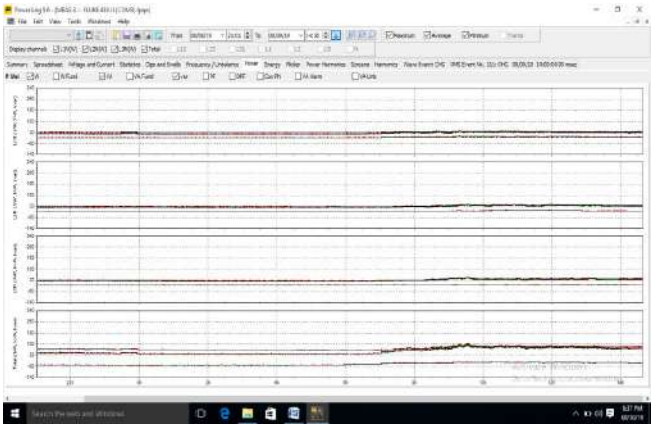

Fig. 4 Waveform of Power

B. **Power Factor:** It was observed that from the closer time of the institute till the next morning around 7 am, the power factor is very poor ranging from 0.28 to 0.60 for R-phase, 0.44 to 0.6 for Y-phase and 0.55 to 0.65 for B-phase. It means that during the light loads, only quarters and hostels are consuming the power[7].

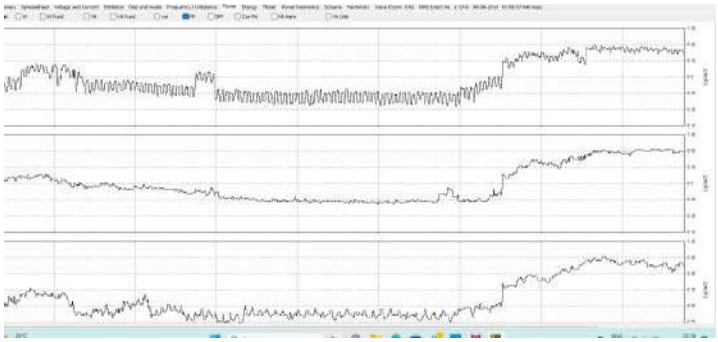

Fig. 5 Waveform for power factor

C. **Energy:** The red color indicates the active energy, blue color indicates the reactive energy and green color indicates the apparent energy as shown in the fig. No. 6. From the diagram and waveform, it is observed that the active energy increases after around 6 pm and hence the apparent energy, but reactive energy drops down. Also, it is observed that the energy consumed is not steady and is due to non-uniform usage of electrical apparatus in various sections of the institute[8].

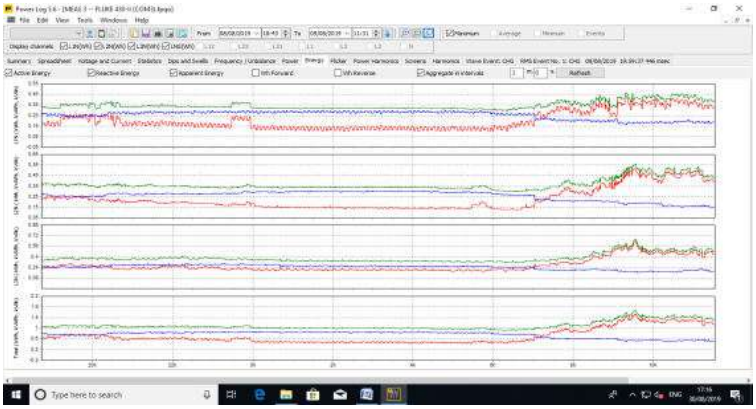

Fig. 6: Waveform of Energy

D. **Wave Events and Transients:** Fast rise-time high voltage pulses superimposed on the supply voltage[9]. The campus is full of a variety of loads, i. e. Electrical Machineries, pumps for water management, mechanical machineries, non-linear loads in every department, residential loads, street lights, air conditioners, LCD projectors in the classrooms, Computers more than 800 in number, CCTV cameras, data center for campus wide networking, etc. Hence, switching on and off of these loads causes great effect on the quality of the power. It is caused by a number of factors, including the residual effects of lightning strikes, power factor correction capacitor switching and inductive load switching. Total 116 wave events are observed. In the figure, voltage is on the y-axis and time is on the x-axis. The wave event occurs on Y-phase at 19.59.37.

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III. MITIGATION METHODS

Variety of electric power improvement devices has evolved over the span of years in order to protect equipment from the disturbances. Now-a-days, the DSTATCOM[10] is widely used in the distribution system, but, the few are mentioned below:

The following equipments are used in the Mitigation methods:

A. **Transient Voltage Surge Eliminator or Suppressors (TVSS):** It gives protection from surges which originate in the high voltage system by shunting them to ground into the low voltage system[11].

B. Filters: Noise Filters prohibit the undesirable frequency noise or current from reaching the susceptive equipment. It uses the combination of both the capacitors and the inductors and provides a path of lower impedance to basic frequency and path of higher impedance to greater frequencies. Harmonic Reduction Filter: The filter plays a major role in reducing the unexpected harmonics.

C. Passive Filters [12] provide a lower impedance path to the harmonic frequencies. Active Filters reduce the harmonics by including equal amounts of current or voltage distortion in the system which cancels the actual distortion in the circuit but in opposite magnitude.

D. Isolation Transformers [13]: Basically, it is used for the separation or isolation of the susceptible loads from the transients and from noise that are drawing from the main supply.

E. Voltage Controller or Regulator: These are designed to automatically maintain a constant voltage level. It keeps control over the output voltage in normal as well as in severe conditions of input voltage variations. These are installed at those places where voltage of the input side varies, but the total power failure is quite substantial[14].

F. Motor Generator Set: M-G set comprise of motor and generator. They are coupled mechanically via the same shaft. It gives protection from coming disturbances, voltage transients and sags.

G. Uninterruptible Power Supply: It provides security in the blackout condition or in the case of power cut, gives regularity in power flowing to the load in an instance of transient interruptions and also provides protection from noise surges on the basis of technology employed.

H. Custom Power Devices [15]: To overcome the power quality issues various measures have been taken which includes the uses of passive filters, active filters, CVT, tap changers, etc. but due to their disadvantages these are discarded. Hence, customer power devices are introduced. They provide stable power to the consumers and also raise the service quality of the distribution system.

I. Reconfiguring Type: They are Thyristor or GTO base devices intended for limiting the fault current as well as providing braking of circuit. These are classified as follows:

1. **Static Transfer Switch (STS):** It is a device which is connected between the AC supply mains and inverter to provide attemptable AC power. It gives approximately 20 times quicker transfer of load, as compared to conventional automatic transfer switches. The dis-advantages of STS are high transfer time.
2. **Static Current Limiter (SCL):** These are mainly used to limit high values of fault current and offer high impedance in fault condition and low impedance in normal condition.
3. **Static Circuit Breaker (SCB):** It is a device used in distribution systems for protection purposes. It operates faster than a mechanical circuit breaker. It employs GTO or thyristor switching technology. The circuit has high sensitivity which ensures safety from electric flash and from short circuit conditions. It operates very fast in microseconds
4. **Compensating Type [16]:** These Mitigation Measures are used for power factor improvement, for filtering purpose, balancing of load current, regulating voltage. These are classified as Dynamic Voltage Restorer (DVR), Distribution Static Compensator (DSTATCOM), Unified Power Flow compensator (UPFC).

IV. CONCLUSION

Inrush current is not observed. The third harmonic is observed to be more prominent. Due to the imbalance in the three phases, Y-phase, is more loaded than the other, the frequency is not maintained at constant value throughout the duration of the said period. The RMS events occur during the office hour's start and close timings. During the light loads in the night hours, the power factor is very poor. The mitigation Measures are reviewed thoroughly and the best suitable mitigation methods is to use DSTATCOM, which improves reactive power, harmonics and variation in voltage. Hence, it is most suitable for the studied HT consumer.

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A CONVOLUTION AND PRODUCT THEOREM FOR THE FRACTIONAL GABOR TRANSFORM

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ABSTRACT
The fractional Gabor transform, which is a generalization of the Gabor transform, has many applications in several areas, including signal processing and optics. The fractional Gabor transform offer a useful tool for guiding optimal filter design in the fractional Fourier transform domain in signal processing. The purpose of this paper is to introduce a convolution structure for the fractional Gabor transform that preserves the convolution theorem for Gabor transform and is also easy to implement in the designing of filters. Also some special type of convolution called product of two functions is given in the form of theorem and some properties of convolution are given.

***MSC**-- 44,46F12.*

Keywords: Gabor transform, fractional transform, convolution, fractional Gabor transform convolution.

I. INTRODUCTION

The fractional Fourier transform has become the focus of many research papers, because of its recent application in many fields, including optics and signal processing. The brief account of its application is discussed in [3],[6] and [9]. The one dimensional fractional Fourier transform with parameter $\propto$ of $f(x)$ denoted by $R^{\alpha} f(x)$ performs a linear operation, given by the integral transform,

$$\left[R^{\alpha} f(x)\right](\xi) = \mathrm{F}_{\alpha}(\xi) = \int_{-\infty}^{\infty} K_{\alpha}(x,\xi) f(x) dx$$

Where $K_{\alpha}(x,\xi)$ is the kernel as given in [2].

Many properties of the fractional Fourier transform including its product and convolution theorem have been derived by Zayed [10]. A new convolution structure for fractional complex Mellin transform, defined and derived by [5]. A fractional Gabor transform proposed in [1] is a generalization of the conventional Gabor transform [4] based on the Fourier transform to the Windowed fractional Fourier transform. A convolution theorem for Gabor transform is given in [8], using which the extended Gabor transform [7] is defined for windowed function.

Motivated by the above work in this paper we have introduced a new convolution structure for fractional Gabor transform, which is generalization of the Gabor transform. Also some special type of convolution called product of two functions is given in the form of theorem and some properties of convolution are given.

Definition: The fractional Gabor transform with angle $\propto$ signal $f(x)$ is defined as,

$$\left[G_{\alpha} f(x)\right](u) = \mathrm{G}_{\alpha}(u,t) = \int_{-\infty}^{\infty} f(x) K_{\alpha}(x,u,t) dx \qquad (1)$$

Where $K_{\alpha}(x,u,t) = a e^{i\left(x^2+u^2\right)b} e^{-\frac{(x-t)^2 c}{2}} e^{-iuxc}$

With $a = \sqrt{\dfrac{1-i\cot\alpha}{2\pi}}, b = \dfrac{\cot\alpha}{2}, c = \csc\alpha$.

Throughout this paper the constants a, b and c will denote the above values.

The paper is organized as follows,

In this paper in section II we introduce a new convolution structure for generalized fractional Gabor transform and give convolution theorem. In section III theorems based on convolution product is defined and prove.

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Section IV gives some properties of convolution and gives the result of convolution of some special type of functions. Section V concludes the paper. Notation and terminology used as in [11].

II. CONVOLUTION

Let us introduce the new convolution structure for fractional Gabor transform as follows.

A. Definition:

Let $f(x)$ and $g(x)$ be any two integrable functions, we define the convolution operation "$*$" as,

$$(f*g)(x)=\int_{-\infty}^{\infty} f(y)g(x-y)e^{y(x-y)\csc\alpha}e^{-\frac{t^2}{2}\csc\alpha}dy \tag{2}$$

The fractional Gabor transform given in (1) is,

$$[G_\alpha f](u)=a\int_{-\infty}^{\infty} f(x)e^{i\left(x^2+u^2\right)b}e^{-\frac{(x-t)^2c}{2}}e^{-iuxc}dx \tag{3}$$

Where $a=\sqrt{\dfrac{1-i\cot\alpha}{2\pi}}, b=\dfrac{\cot\alpha}{2}, c=\csc\alpha$.

Let us introduce the following definition for convolution.

B. Definition:

For a function $f(x)$, let us define the function

$$\overline{f(x)}=f(x)e^{ibx^2} \tag{4}$$

For any two function f and g, we define the convolution operation "$\bullet$" by

$$h(x)=(f\bullet g)(x)=ae^{-ibx^2}\left(\overline{f}*\overline{g}\right)(x) \tag{5}$$

Here "$\bullet$" denotes fractional Gabor type convolution and "$*$" is the convolution operation for the Gabor transform, as in equation (2).

C. Convolution Theorem

Let $h(x)=(f\bullet g)(x)$ and $[G_\alpha f](u)$, $[G_\alpha g](u)$, $[G_\alpha h](u)$ denotes the fractional Gabor transform of f , g and h respectively then $[G_\alpha h](u)=e^{-ibu^2}[G_\alpha f](u).[G_\alpha g](u)$.

Proof: Using equation (3)

$$[G_\alpha h](u)=a\int_{-\infty}^{\infty} h(x)e^{i\left(x^2+u^2\right)b}e^{-\frac{(x-t)^2c}{2}}e^{-iuxc}dx$$

$$=a\int_{-\infty}^{\infty} ae^{-ibx^2}\left(\overline{f}*\overline{g}\right)(x)e^{i\left(x^2+u^2\right)b}e^{-\frac{(x-t)^2c}{2}}e^{-iuxc}dx$$

Using equation (2) and (4)

$$=a^2\int_{-\infty}^{\infty} e^{iu^2b}e^{-\frac{(x-t)^2c}{2}}e^{-iuxc}\left[\int_{-\infty}^{\infty} f(y)e^{iby^2}g(x-y)e^{ib(x-y)^2}e^{y(x-y)c}e^{-\frac{t^2}{2}c}dy\right]dx$$

Put $x-y=v \;\rightarrow\; dx=dv$

$$[G_\alpha h](u)=a^2\int_{-\infty}^{\infty} e^{ibu^2}e^{-\frac{(y+v-t)^2c}{2}}e^{-iu(y+v)c}\left[\int_{-\infty}^{\infty} f(y)e^{iby^2}g(v)e^{ibv^2}e^{yvc}e^{-\frac{t^2}{2}c}dy\right]dv$$

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$$= e^{-ibu^2}\left[a\int_{-\infty}^{\infty} f(y)e^{i(y^2+u^2)b}e^{-\frac{(y-t)^2c}{2}}e^{-iuyc}dy\right]\left[a\int_{-\infty}^{\infty} g(v)e^{i(v^2+u^2)b}e^{-\frac{(v-t)^2c}{2}}e^{-iuvc}dv\right]$$

$$[G_\alpha h](u) = e^{-ibu^2}[G_\alpha f](u)[G_\alpha g](u).$$

III. CONVOLUTION PRODUCT

Let us introduce the following definition

Definition: For any function $f(x)$, let us define the function $\overline{\overline{f(x)}}$ as

$$\overline{\overline{f(x)}} = f(x)e^{-ibx^2} \tag{6}$$

As $*$ is the convolution operation for Gabor transform defined in [11] as

$$(f * g)(x) = \int_{-\infty}^{\infty} f(y)g(x-y)dy \tag{7}$$

Likewise we define another operation $\otimes$ for any two functions f and g by,

$$(f \otimes g)(x) = ae^{ibx^2}\left(\overline{\overline{f}} * \overline{\overline{g}}\right)(x) \tag{8}$$

Theorem 1: Let $[G_\alpha f](u)$ and $[G_\alpha g](u)$ denotes the fractional Gabor transform of f and g respectively. Then

$$\{[G_\alpha f]\otimes[G_\alpha g]\}(u) = \frac{a^2\pi}{2ci}G_\alpha\left\{f(x)\left[g(x)e^{-\frac{(x-t)^2c}{2}}\right]e^{ibx^2}\right\}$$

Proof: From above definition using equation (8)

$$\{[G_\alpha f]\otimes[G_\alpha g]\}(u) = ae^{ibu^2}\left[\left(\overline{\overline{G_\alpha f}}\right) * \left(\overline{\overline{G_\alpha g}}\right)\right](u)$$

Using equation (6) and (7)

$$= ae^{ibu^2}\int_{-\infty}^{\infty} e^{-ibx^2}[G_\alpha f](x)e^{-ib(u-x)^2}[G_\alpha g](u-x)dx$$

But from the definition of fractional Gabor transform, we obtain

$$\{[G_\alpha f]\otimes[G_\alpha g]\}(u) = ae^{ibu^2}\int_{-\infty}^{\infty} e^{-ibx^2}\left[a\int_{-\infty}^{\infty} f(z)e^{i(z^2+x^2)b}e^{-\frac{(z-t)^2c}{2}}e^{-ixzc}dz\right]e^{-ib(u-x)^2}[G_\alpha g](u-x)dx$$

$$= a^2e^{ibu^2}\left[\int_{-\infty}^{\infty} f(z)e^{iz^2b}e^{-\frac{(z-t)^2c}{2}}e^{-ixzc}dz\right]\int_{-\infty}^{\infty} e^{-ib(u-x)^2}[G_\alpha g](u-x)dx$$

Put $u-x=v \Rightarrow dx=-dv$

$$= a^2e^{ibu^2}\left[\int_{-\infty}^{\infty} f(z)e^{iz^2b}e^{-\frac{(z-t)^2c}{2}}e^{-ixzc}dz\right]\int_{-\infty}^{\infty} e^{-ibv^2}[G_\alpha g](v)(-dv)$$

In view of the inversion formula for the fractional Gabor transform as,

$f(x) = \frac{1}{\pi i}\int_{-\infty}^{\infty} G_\alpha(u)\overline{K_\alpha(x,u,t)}du$, where

$$\overline{K_\alpha(x,u,t)} = \left(\frac{\csc\alpha}{2}\right)\left(\frac{1-i\cot\alpha}{2\pi}\right)^{-1/2} e^{i\frac{(x^2+u^2)\cot\alpha}{2}}e^{\frac{(x-t)^2\csc\alpha}{2}}e^{iux\csc\alpha}$$

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It can be reduce to,

$$\{[G_\alpha f]\otimes[G_\alpha g]\}(u)=\frac{a^2\pi}{2ci}\left[a\int_{-\infty}^{\infty}f(z)\left[g(z)e^{-\frac{(z-t)^2c}{2}}\right]e^{ib\left(z^2+u^2\right)}e^{-\frac{(z-t)^2c}{2}}e^{-iuzc}dz\left(e^{ibz^2}\right)\right]$$

$$=\frac{a^2\pi}{2ci}G_\alpha\left\{f(x)\left[g(x)e^{-\frac{(x-t)^2c}{2}}\right]e^{ibx^2}\right\}.$$

Theorem 2: Let $[G_\alpha f](u)$ and $[G_\alpha g](u)$ denotes the fractional Gabor transform of f and g respectively. Then

$$\left[G_\alpha(f\otimes g)e^{-4iby(x-y)+\left(-y^2+xy-\frac{t^2}{2}\right)c}\right](u)=e^{-ibu^2}[G_\alpha f](u).[G_\alpha g](u)$$

$$=e^{ibu^2}\left[\left(\overline{\overline{G_\alpha f}}\right)*\left(\overline{\overline{G_\alpha g}}\right)\right](u)$$

Proof: By definition of fractional Gabor transform

$$\left[G_\alpha(f\otimes g)e^{-4iby(x-y)+\left(-y^2+xy-\frac{t^2}{2}\right)c}\right](u)$$

$$=a\int_{-\infty}^{\infty}[(f\otimes g)(x)]e^{-4iby(x-y)+\left(-y^2+xy-\frac{t^2}{2}\right)c}e^{i\left(x^2+u^2\right)b}e^{-\frac{(x-t)^2c}{2}}e^{-iuxc}dx$$

Using equation (6), (7) and (8)

$$=a^2\int_{-\infty}^{\infty}e^{ibx^2}\left[\int_{-\infty}^{\infty}e^{-iby^2}f(y)e^{-ib(x-y)^2}g(x-y)dy\right]e^{-4iby(x-y)+\left(-y^2+xy-\frac{t^2}{2}\right)c}e^{i\left(x^2+u^2\right)b}e^{-\frac{(x-t)^2c}{2}}e^{-iuxc}dx$$

Put $x-y=v\ \Rightarrow dx=dv$

$$=a^2\int_{-\infty}^{\infty}e^{ib2(y+v)^2}\left[\int_{-\infty}^{\infty}e^{-iby^2}f(y)e^{-ibv^2}g(v)dy\right]e^{-4ibyv+\left(yv-\frac{t^2}{2}\right)c}e^{ibu^2}e^{-\frac{(y+v-t)^2c}{2}}e^{-iu(y+v)c}dv$$

$$=e^{-ibu^2}\left[a\int_{-\infty}^{\infty}f(y)e^{i\left(y^2+u^2\right)b}e^{-\frac{(y-t)^2c}{2}}e^{-iuyc}dy\right]\left[a\int_{-\infty}^{\infty}g(v)e^{i\left(v^2+u^2\right)b}e^{-\frac{(v-t)^2c}{2}}e^{-iuvc}dv\right]$$

$$=e^{-ibu^2}[G_\alpha f](u).[G_\alpha g](u)$$

$$=e^{ibu^2}\left[\left(\overline{\overline{G_\alpha f}}\right)*\left(\overline{\overline{G_\alpha g}}\right)\right](u).$$

IV. RESULT

The convolution defined in equation (5) satisfies the following properties:

1. The convolution is commutative that is $f\bullet g=g\bullet f$.
2. Also this convolution is associative that is $f\bullet(g\bullet h)=(f\bullet g)\bullet h$.
3. Convolution theorem when one particular function is delta function is easily proved.

V. CONCLUSION

We have introduced a new convolution structure for the fractional Gabor transform and convolution theorem is proved. Some special type of convolution is defined which named product convolution and proved two theorems for this type of convolution. Some properties of convolution are given.

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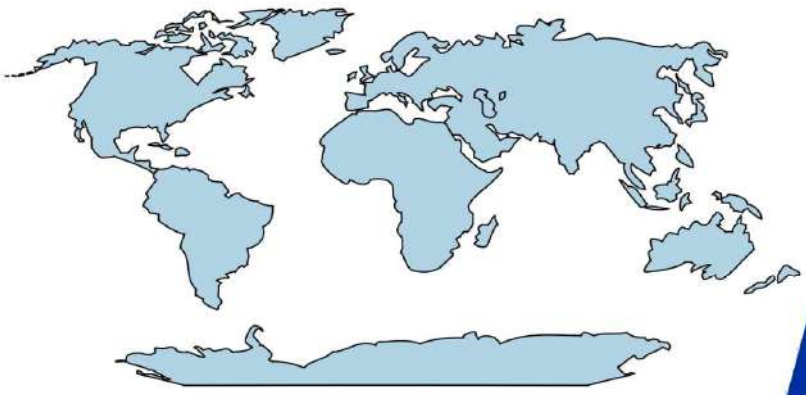

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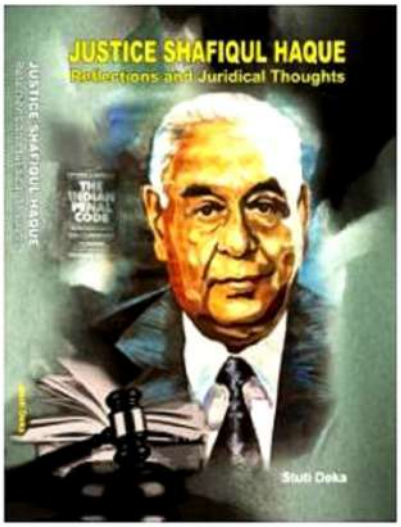

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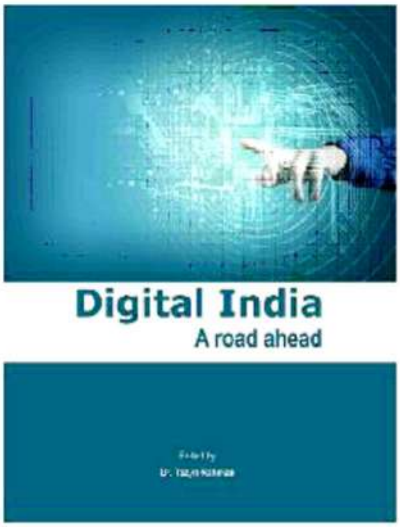

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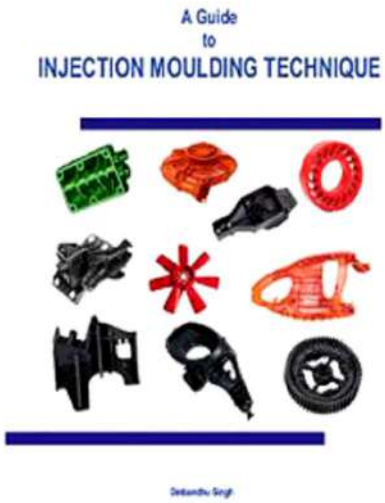

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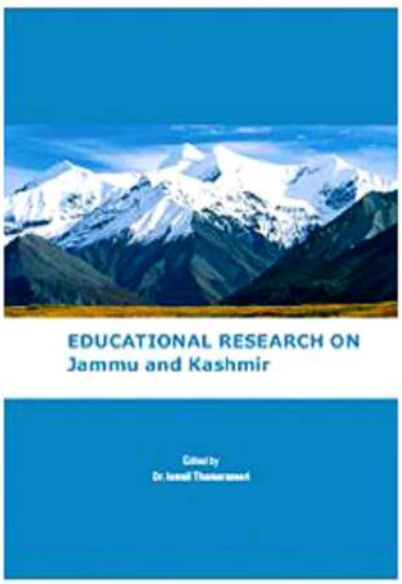

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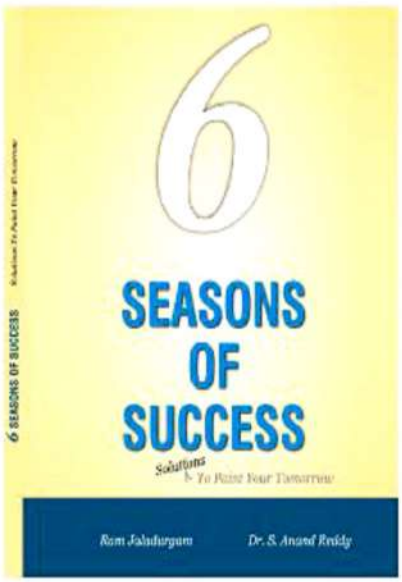

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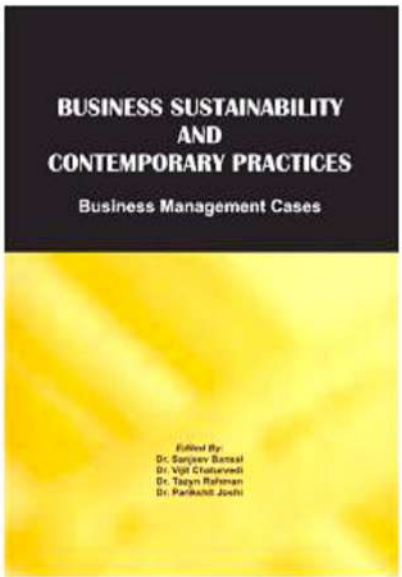

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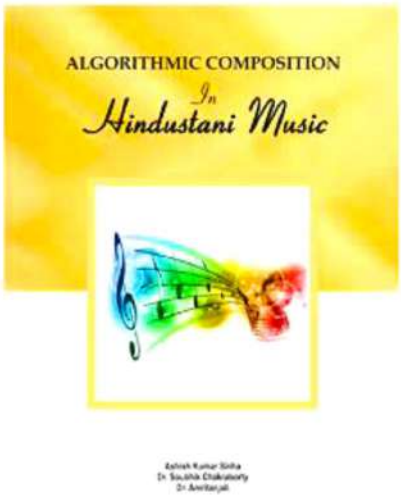

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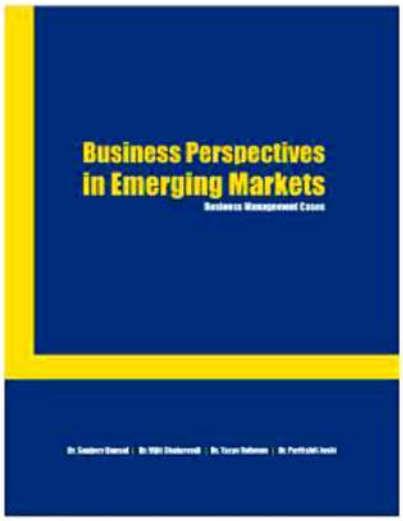

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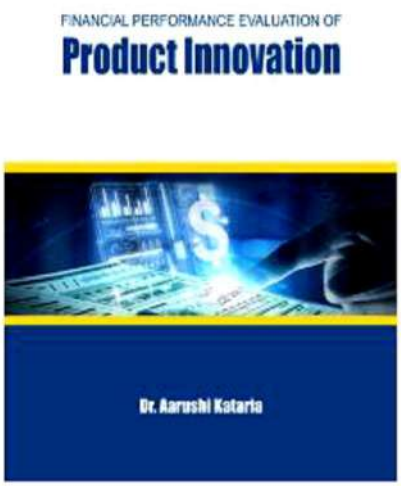

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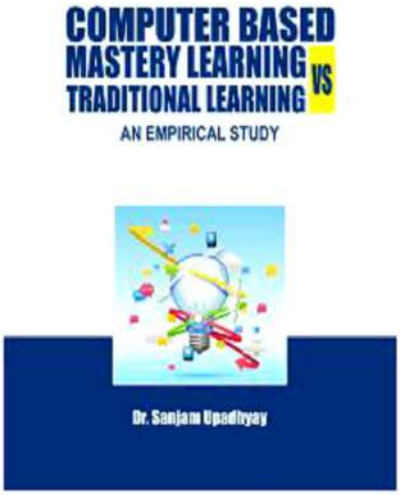

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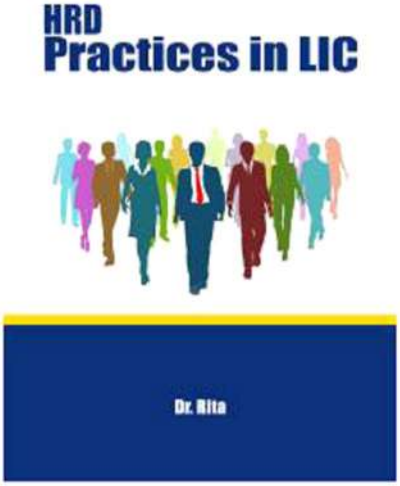

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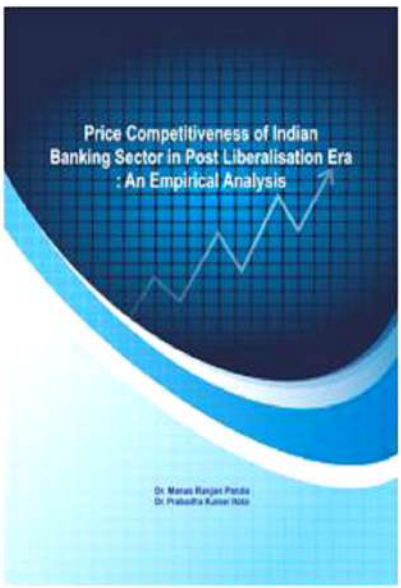

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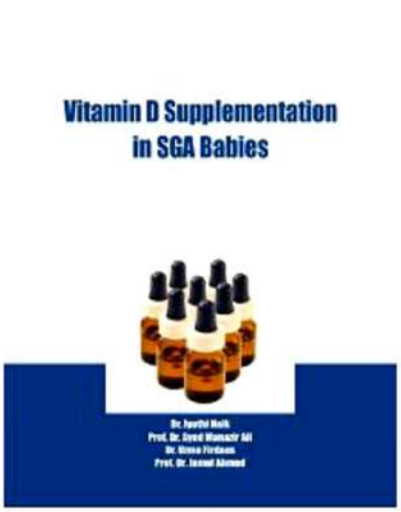

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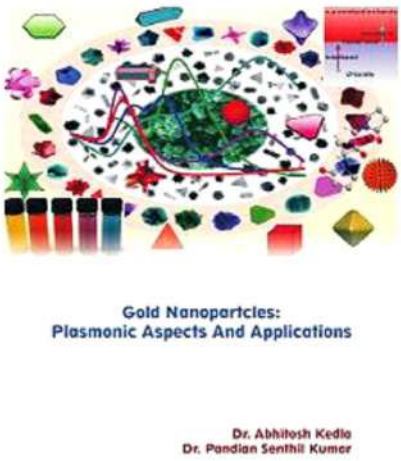

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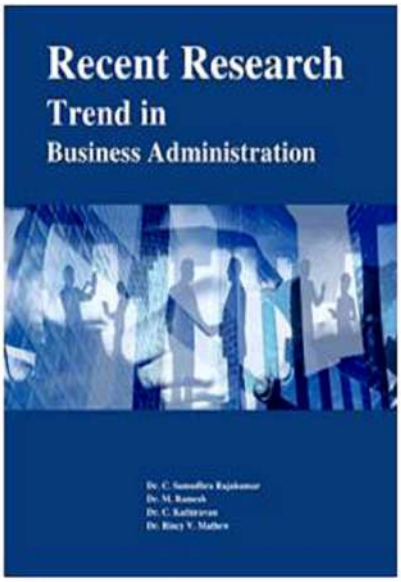

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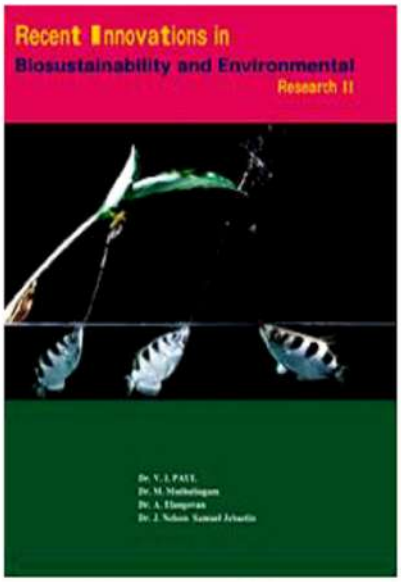

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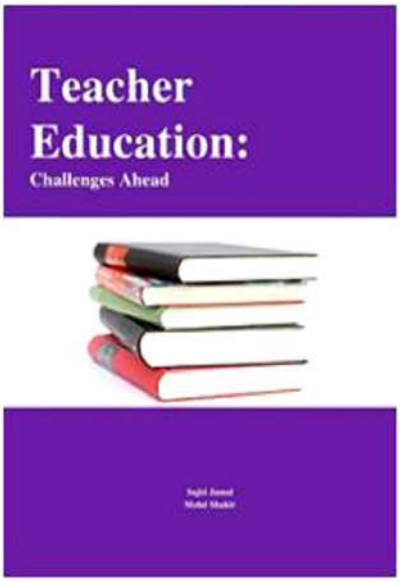

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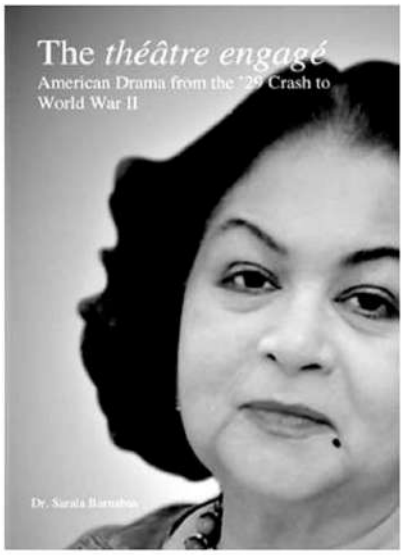

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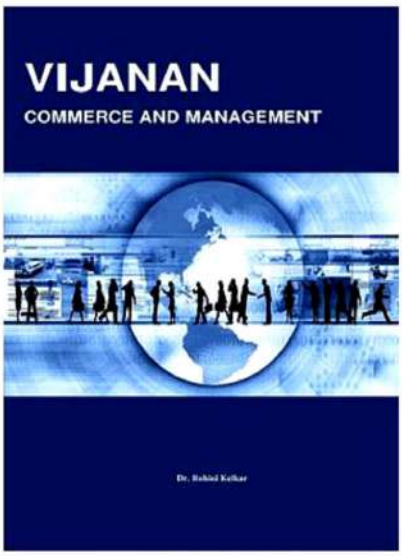

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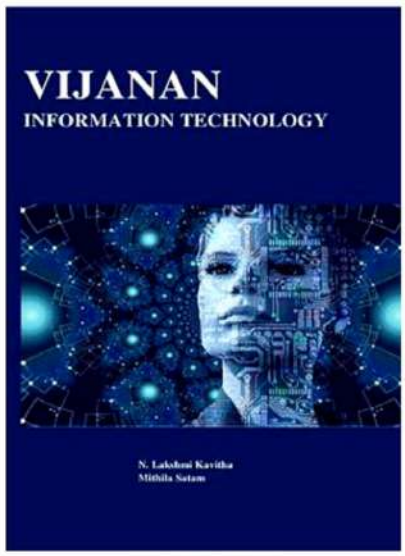

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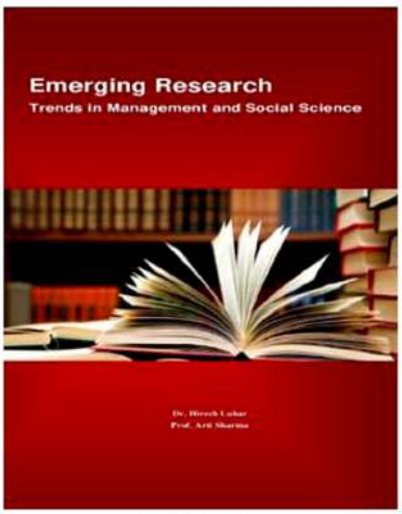

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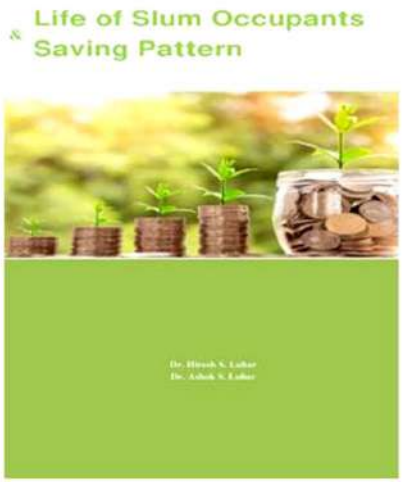

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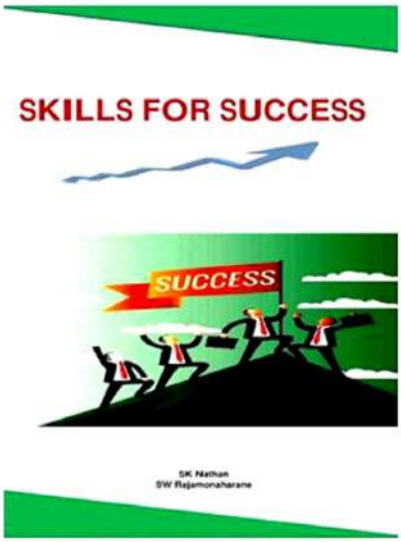

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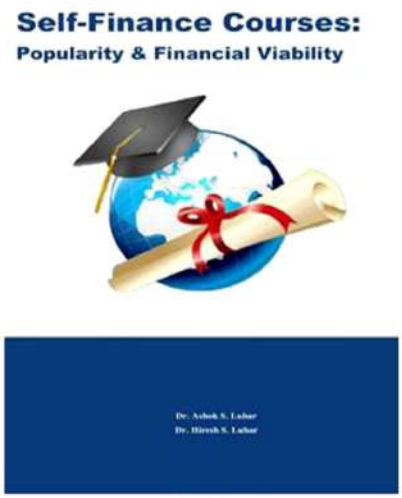

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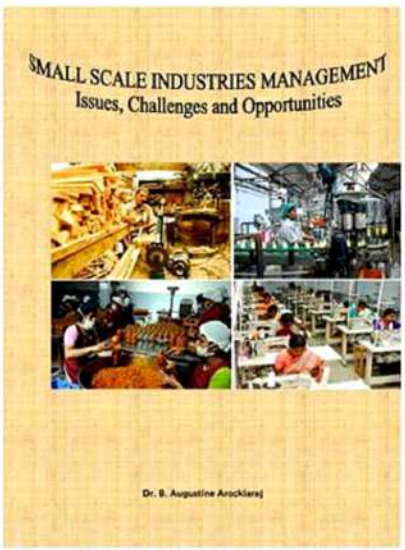

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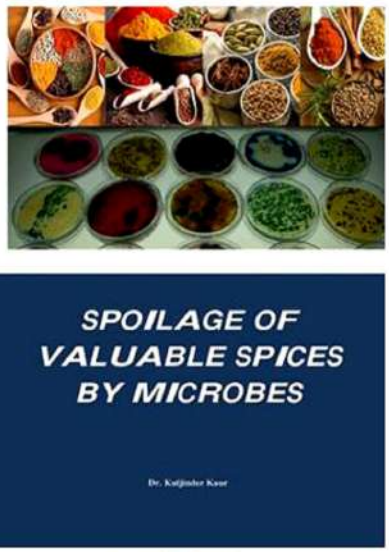

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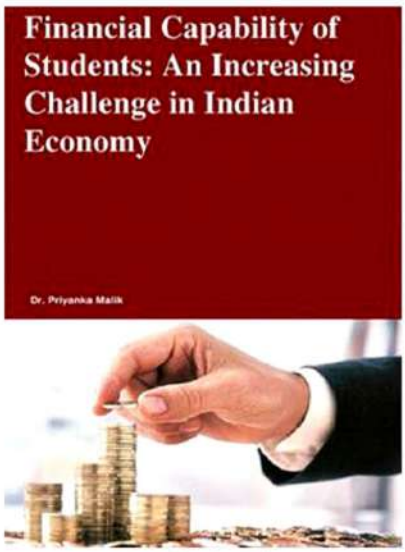

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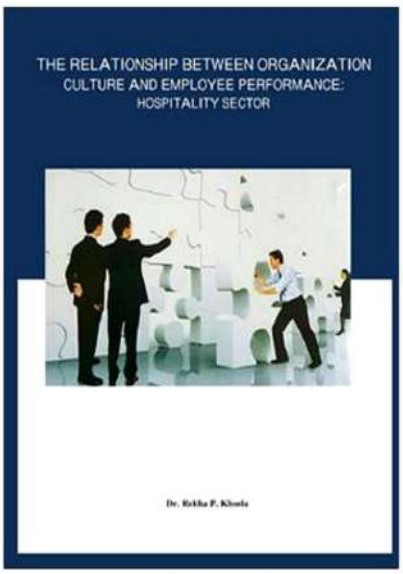

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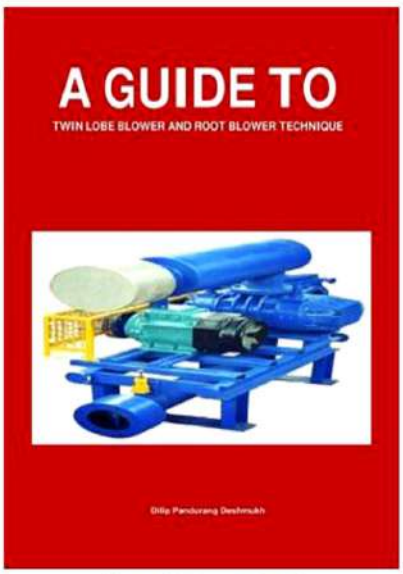

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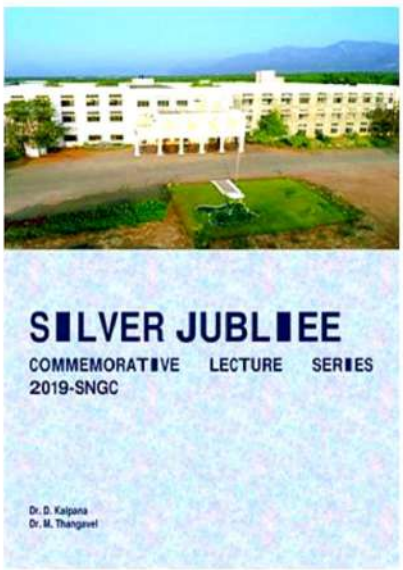

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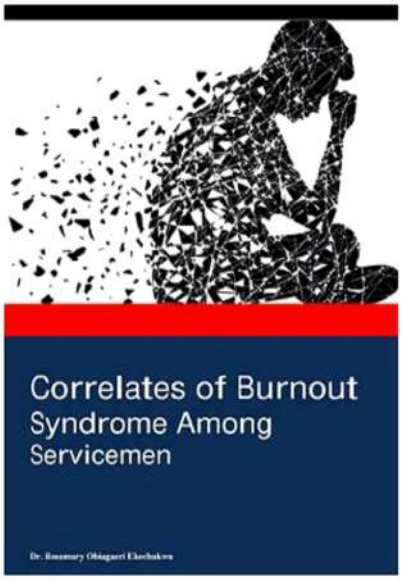

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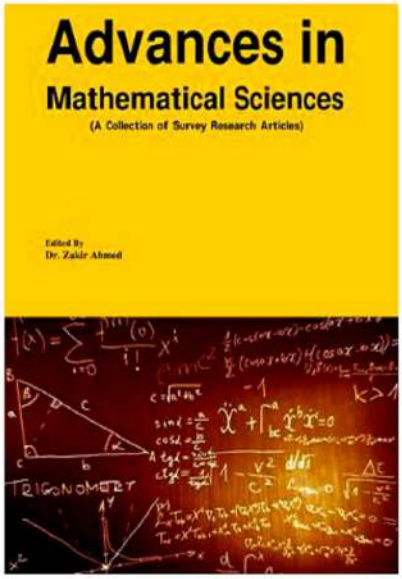

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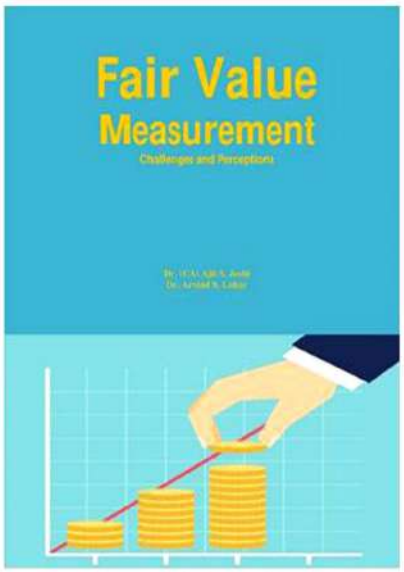

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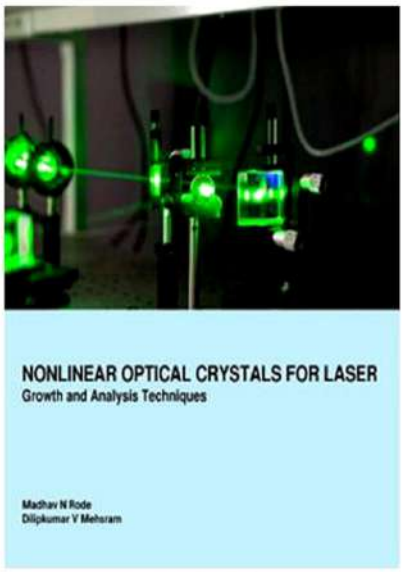

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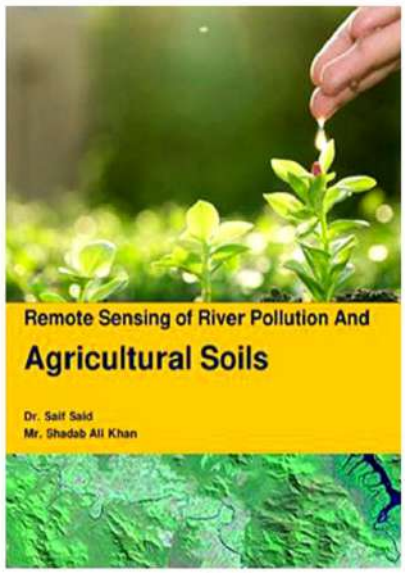

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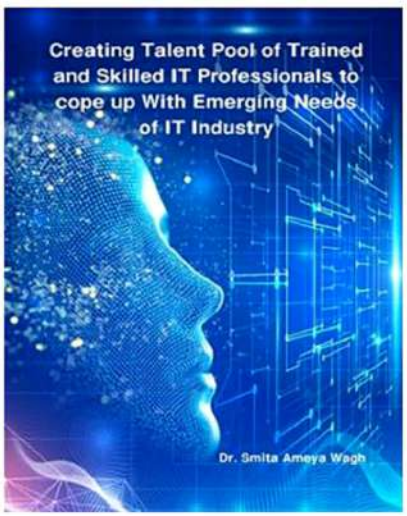

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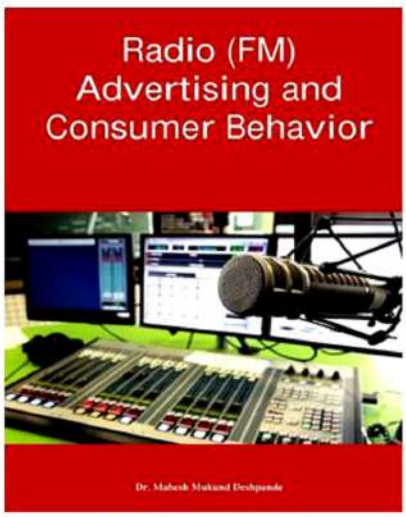

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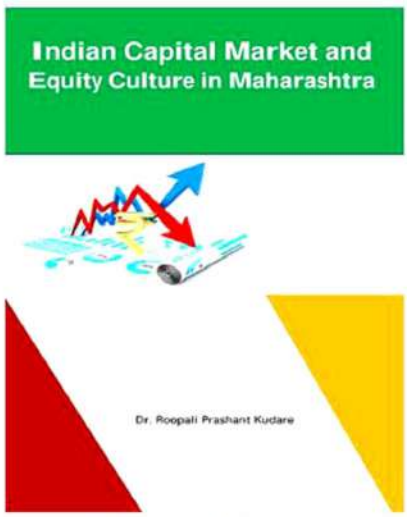

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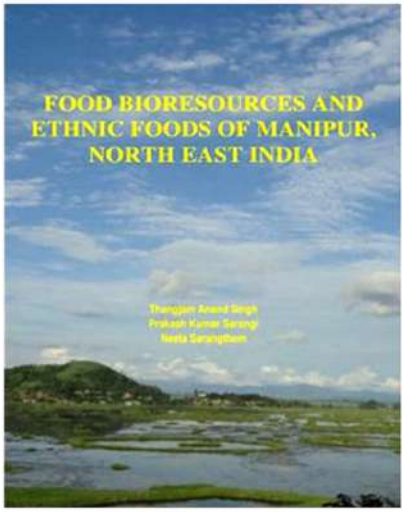

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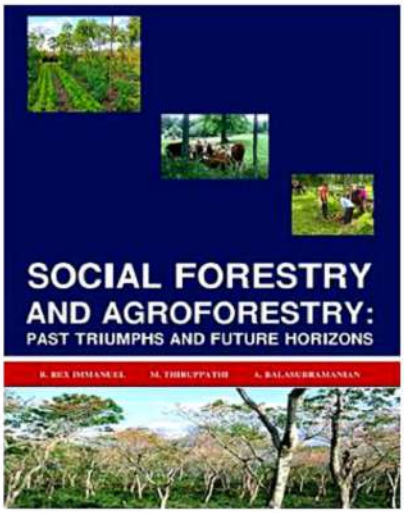

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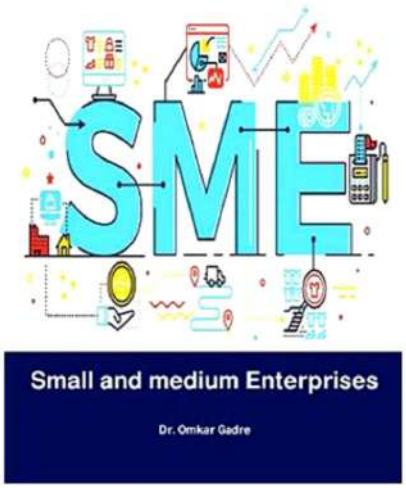

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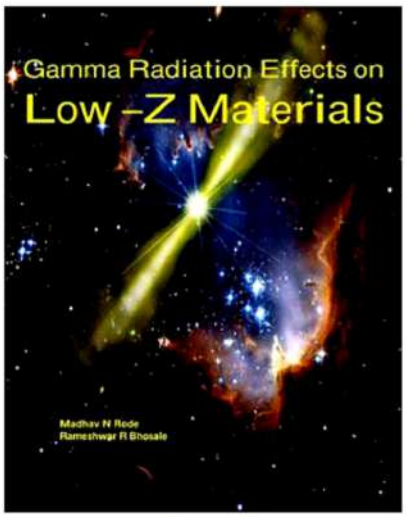

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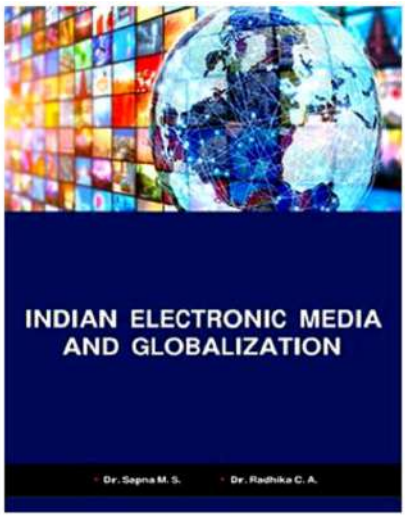

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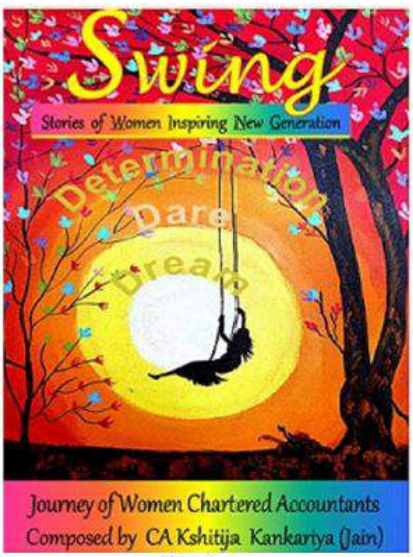

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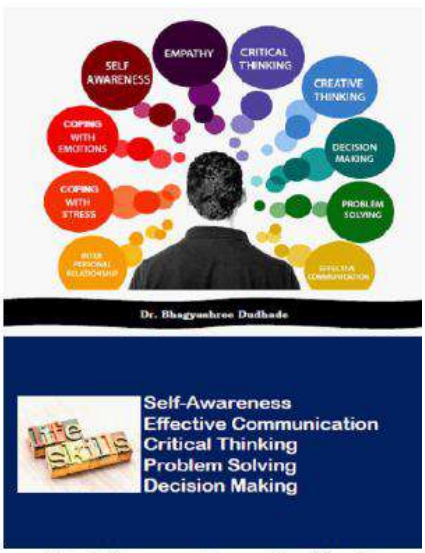

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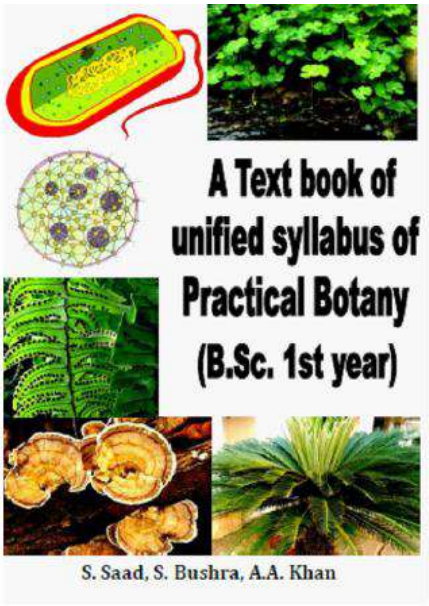

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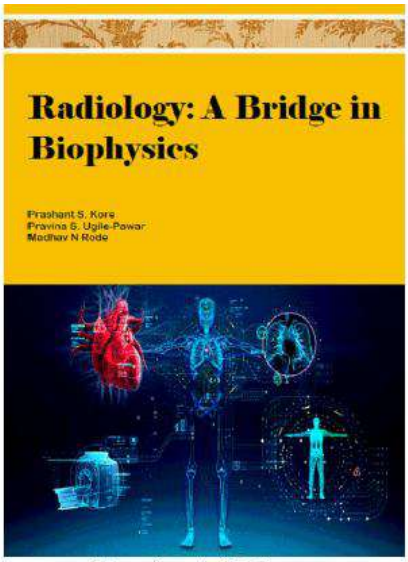

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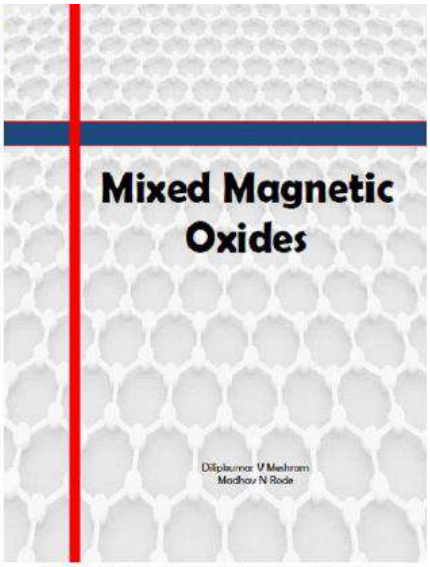

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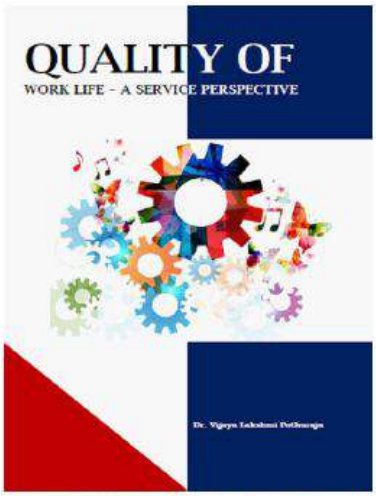

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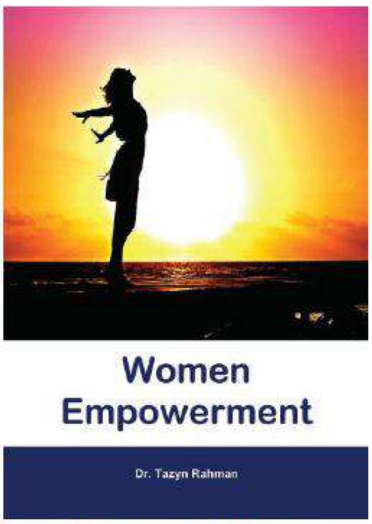

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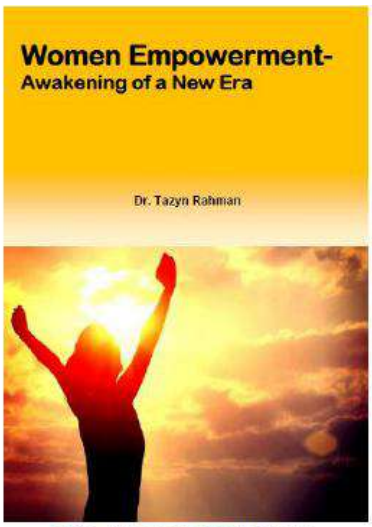

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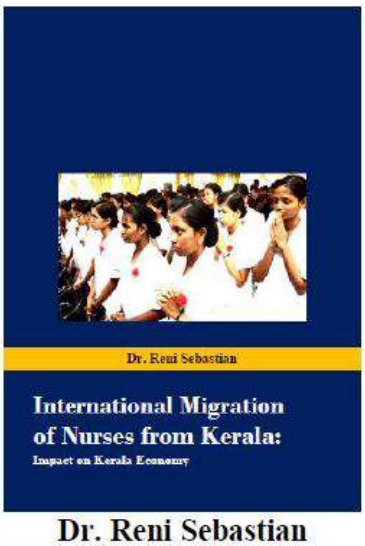

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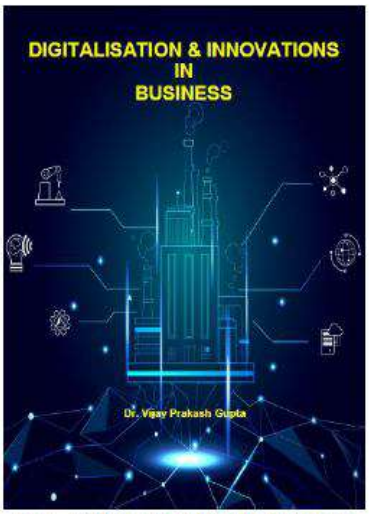

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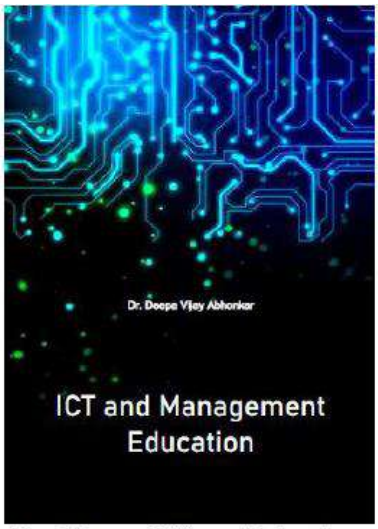

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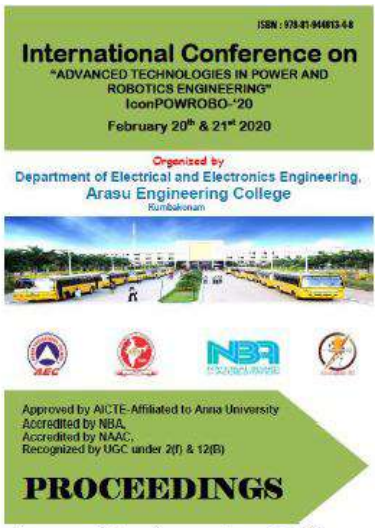

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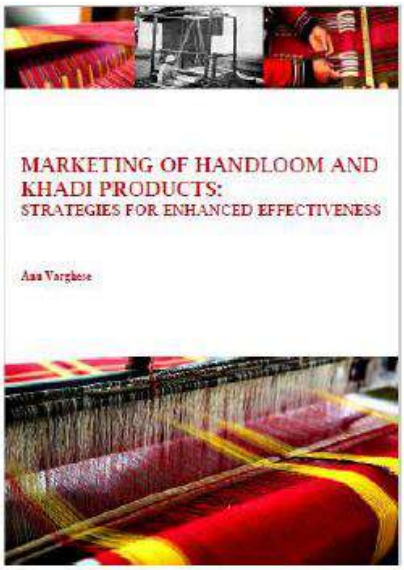

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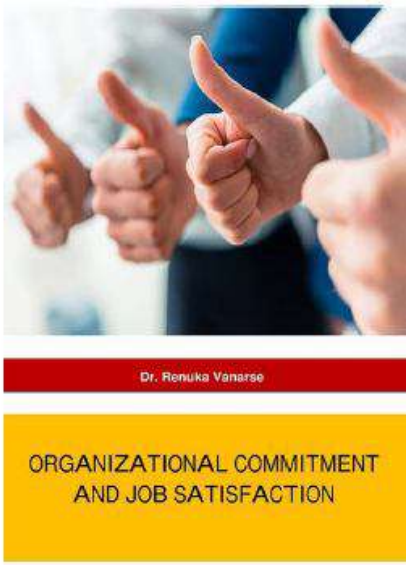

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