INDIAN SMART CITIES AND AI-BASED TRANSPORTATION NETWORKS: INTEGRATION OF AI IN URBAN MOBILITY PLANNING

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ABSTRACT

India's Smart Cities Mission aims to enhance urban living through technology-driven infrastructure and services. Artificial Intelligence (AI) plays a pivotal role in transforming transportation systems within these smart cities. This paper explores the integration of AI in urban mobility planning, examining its potential to improve efficiency, reduce congestion, and promote sustainability. The study highlights key applications, challenges, and future prospects of AI in India's transportation networks.

INTRODUCTION

Urbanization in India has led to an unprecedented demand for efficient transportation systems. The Smart Cities Mission, launched in 2015, envisions technology-driven urban development to address these challenges. AI, with its capabilities in data analysis, predictive modelling, and automation, offers innovative solutions for urban mobility planning. This paper investigates the role of AI in achieving the goals of smart transportation in Indian cities.

Current Landscape of Transportation in Indian Smart Cities

Indian cities face issues such as traffic congestion, air pollution, and inadequate public transportation. Smart cities like Pune, Bengaluru, and Ahmedabad are implementing AI to address these challenges. Initiatives include smart traffic management systems, AI-powered public transit optimization, and real-time data analytics for urban mobility.

Pune City:

Pune, one of India's fastest-growing cities, faces severe traffic congestion due to rapid urbanization, increasing vehicle density, and inadequate infrastructure. The city's roads, often narrow and poorly maintained, struggle to accommodate the rising number of private vehicles, leading to frequent bottlenecks and long commuting hours. Encroachments, haphazard parking, and the lack of an efficient public transportation system further aggravate the situation. Peak hours witness heavy congestion, especially in areas like Hinjewadi, Kothrud, and FC Road. While metro expansion and road-widening projects aim to ease traffic woes, poor traffic discipline and insufficient law enforcement remain persistent challenges, making daily travel a frustrating experience for Pune's residents.

Pune's traffic congestion has significantly worsened, positioning it among the most congested cities globally. According to the TomTom Traffic Index Report 2024, Pune ranks fourth worldwide and third in India for traffic congestion.

Key statistics from the report include:

- Average Travel Time: It takes approximately 33 minutes and 22 seconds to travel 10 kilometers in Pune.

- Congestion Level: The city experiences a congestion level of 34%, indicating that travel times are 34% longer than during baseline non-congested conditions.

- Annual Time Lost: Residents lose about 108 hours per year during rush hours due to traffic delays.

- Average Speed: During rush hours, the average speed is recorded at 20 km/h in the morning and 17 km/h in the evening.

These statistics highlight the pressing need for effective traffic management and infrastructure development in Pune to alleviate congestion and improve urban mobility.

Bengaluru City:

"Bengaluru's traffic congestion has been a long term challenge, which impacts daily passengers and the city's overall functioning. According to the TomTom Traffic Index - 2024, Bengaluru is ranked as the world's third slowest city for traffic, with an average travel time of 30 minutes and 10 seconds to cover a 10-kilometer distance. This marks an increase of 50 seconds from the previous year." (Thadhagath, P. V. (2025b, January

12). Bengaluru ranked as India's 2nd slowest city in terms of traffic in 2024, Kolkata takes lead. *Hindustan Times*.)

In terms of congestion levels, Bengaluru stands at 63%, indicating that travel times are 63% longer than during baseline non-congested conditions. Commuters in the city lose approximately 132 hours annually due to traffic delays, with average speeds during rush hours recorded at 19 km/h in the morning and 17 km/h in the evening. (*Bengaluru traffic report | TomTom Traffic Index*. (n.d.).)

A significant contributor to this congestion is the Silk Board junction, one of the busiest intersections in India. Studies have shown that during peak hours, the average speed of vehicles at this junction is as low as 4.48 km/h, highlighting the severity of traffic bottlenecks in the area.

Efforts to mitigate traffic congestion in Bengaluru include infrastructure projects such as the construction of flyovers and the expansion of the Namma Metro network. However, the rapid pace of urbanization and increasing vehicle ownership continue to pose significant challenges to improving traffic conditions in the city.

Ahmedabad City:
Ahmedabad, one of Gujarat's largest and most populous cities, faces significant traffic congestion due to rapid urbanization, increasing vehicle ownership, and inadequate road infrastructure. The city's expanding commercial and residential hubs have led to a surge in private vehicles, often resulting in long traffic jams, especially during peak hours. Key areas such as SG Highway, Ashram Road, and Maninagar experience frequent bottlenecks due to poor traffic management, encroachments, and unregulated parking. The rising number of two-wheelers and auto-rickshaws, along with a lack of lane discipline, further worsens the situation, making daily commutes time-consuming and stressful for residents.

Despite efforts to improve traffic flow through flyovers, widened roads, and the Ahmedabad Metro project, challenges persist due to insufficient public transportation options and ineffective traffic rule enforcement. Many commuters still rely on private vehicles due to the limited reach and efficiency of the city's bus network. Additionally, heavy traffic near marketplaces and industrial areas creates pollution and safety hazards. Addressing these issues requires stricter traffic regulations, better urban planning, and a well-integrated public transport system to reduce dependency on private vehicles and improve mobility in the city

Case Study: Pune's Smart Traffic Management
Pune has deployed AI-driven traffic signal systems to reduce congestion. These systems use real-time data from sensors and cameras to optimize signal timings, resulting in a significant reduction in travel time and emissions.

Applications of AI in Urban Mobility Planning
1. **Traffic Management**: AI-driven traffic control systems analyze real-time data to manage congestion efficiently. For instance, adaptive traffic signals powered by AI can adjust signal timings based on traffic flow.

2. **Public Transit Optimization**: AI enhances route planning and scheduling for buses and metros, ensuring timely and efficient services. Predictive analytics helps in anticipating peak demand and deploying additional resources.

3. **Shared Mobility Services**: AI enables ride-sharing platforms to optimize routes and reduce travel costs. Integration with public transport networks enhances last-mile connectivity.

4. **Autonomous Vehicles**: Although in its nascent stage in India, autonomous vehicle research is gaining momentum. AI facilitates navigation, obstacle detection, and real-time decision-making.

5. **Sustainability Initiatives**: AI assists in reducing emissions through efficient route planning and promoting electric vehicle (EV) adoption. AI-driven systems analyze energy consumption patterns to optimize EV charging infrastructure.

Challenges in AI Integration
1. **Data Availability and Quality**: AI systems require large volumes of high-quality data, which is often unavailable or fragmented in Indian cities.

2. **Infrastructure Gaps**: Limited digital infrastructure hampers the implementation of AI-driven solutions. Ensuring connectivity and sensor deployment is crucial.

3. **Cost and Funding**: The high cost of AI technology and its integration poses financial challenges for municipal bodies.

4. **Privacy Concerns**: The use of surveillance systems and data analytics raises concerns about citizen privacy and data security.

Policy Recommendations
1. **Data Governance**: Establish frameworks for data collection, sharing, and security to support AI applications.

2. **Public-Private Partnerships**: Encourage collaborations between government agencies and technology providers to fund and implement AI solutions.

3. **Capacity Building**: Train urban planners and engineers in AI technologies to enhance implementation capabilities.

4. **Regulatory Frameworks**: Develop policies to address ethical and safety concerns associated with AI in transportation.

FUTURE PROSPECTS

AI is poised to revolutionize urban mobility in India. Advancements in machine learning, Internet of Things (IoT), and 5G connectivity will further enhance AI applications. The integration of AI with emerging technologies like blockchain can improve transparency and efficiency in transportation networks.

CONCLUSION

AI-based transportation networks hold immense potential for addressing urban mobility challenges in India's smart cities. By leveraging AI, cities can achieve efficient traffic management, optimized public transit, and sustainable development. However, overcoming challenges such as data gaps and infrastructure limitations is essential for successful integration. With strategic planning and investment, AI can transform India's urban mobility landscape, aligning with the broader goals of the Smart Cities Mission.

REFERENCES

1. Ministry of Housing and Urban Affairs (2021). Smart Cities Mission Guidelines.

2. National Institution for Transforming India (NITI Aayog) (2020). AI for All: Advancing India's AI Agenda.

3. Singh, R., & Gupta, A. (2022). "AI in Urban Transportation: Case Studies from Indian Smart Cities." Journal of Urban Mobility, 14(2), 89-104.

4. World Bank (2020). Data-Driven Urban Mobility in Developing Countries.