

## ROBOTIC AND INFORMATION

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**ABSTRACT**

*This article discusses the fast-paced development of robotics and automation technologies, particularly their evolution, existing applications, and future applications. In manufacturing and healthcare, agriculture, and space exploration, robotics and automation are transforming industries, enhancing productivity, and improving human life. The research determines recent developments, advantages, disadvantages, and ethical implications of adopting these technologies in everyday life.*

**Keywords:** Robotic, Human life, Automation, Evolution

**1. INTRODUCTION**

Robotics and automation have been breakthrough technologies across several industries, with a drive for efficiency, accuracy, and innovation. Robotics is the development, building, functioning, and usage of robots—programmable machines capable of executing sophisticated operations independently or semi-autonomously. Automation, on the other hand, encompasses the use of control systems and technologies to operate equipment with little or minimal human interaction. The two technologies have transformed manufacturing, healthcare, agriculture, logistics, and the delivery of services.

The integration of automation and robotics has yielded greater productivity, reduced operation cost, and better safeguarding against hazardous work environments. Developing technology in the guise of AI, machine learning, sensor technology, and data analytics continues to expand robotic systems' capability, and robots become able to learn in dynamic settings and increasingly carry out more complicated tasks. As global industries keep evolving, the roles of automation and robotics become increasingly important, not only in industry but also in addressing society's challenges such as aging societies, labour shortages, and sustainable development.

This paper aims to explore the current trends, technological innovation, and uses of automation and robotics, and their impacts on work and society in the future.

**2. HISTORY AND EVOLUTION**

The concept of automated machines dates back to ancient civilizations, with rudimentary automation observed in water clocks and mechanical puppets. The term "robot" was first introduced in 1921 by Czech writer Karel Čapek. In the 20th century, the development of digital electronics and computers catalysed the growth of robotics. The first industrial robot, Uniate, was deployed in 1961 at a General Motors factory, marking the beginning of the robotic age in manufacturing.

**3. KEY COMPONENTS OF ROBOTICS**

- **Sensors:** Detect environmental conditions (e.g., temperature, proximity, light).
- **Actuators:** Provide movement or action (e.g., motors, hydraulic systems).
- **Controllers:** Process inputs and execute commands (e.g., microcontrollers).
- **Power Supply:** Powers the robotic system (batteries or direct power).
- **End Effectors:** Tools or devices attached to the robot's arm to interact with the environment (e.g., grippers, welding torches).

**4. TYPES OF ROBOTS**

- **Industrial Robots:** Used in assembly lines, welding, painting, and material handling.
- **Service Robots:** Assist humans in daily activities (e.g., cleaning robots, delivery bots).
- **Medical Robots:** Used in surgeries, diagnostics, and patient care (e.g., Da Vinci Surgical System).
- **Military Robots:** Used for reconnaissance, bomb disposal, and combat support.
- **Agricultural Robots:** Help with seeding, harvesting, and monitoring crop health.
- **Space Robots:** Used for exploration and maintenance in outer space (e.g., Mars rovers).

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## 5. APPLICATIONS OF AUTOMATION

- **Manufacturing:** Automation improves precision, speed, and safety. Robotics in manufacturing has led to smart factories (Industry 4.0).
- **Healthcare:** Automated diagnostics, robotic surgeries, and telemedicine are transforming patient care.
- **Transportation:** Autonomous vehicles and drones are reshaping mobility and logistics.
- **Agriculture:** Automated irrigation, drones for crop monitoring, and robotic harvesters increase yield and efficiency.
- **Retail and Services:** Self-checkout systems, inventory robots, and chatbots enhance customer service and operations.

## 6. BENEFITS OF ROBOTICS AND AUTOMATION

- Increased productivity and efficiency
- Improved quality and precision
- Enhanced safety in hazardous environments
- Reduction in operational costs
- Ability to work in environments hostile to humans (e.g., deep sea, space)

## 7. CHALLENGES AND LIMITATIONS

- High initial investment and maintenance costs
- Job displacement and workforce reskilling needs
- Technical limitations in adaptability and AI reasoning
- Cybersecurity risks
- Ethical and legal concerns (e.g., autonomous weapons, surveillance)

## 8. FUTURE TRENDS

- **AI and Machine Learning Integration:** Making robots smarter and more adaptable.
- **Human-Robot Collaboration:** Robots working alongside humans in shared environments.
- **Soft Robotics:** Robots made of flexible materials for safer interactions.
- **Swarm Robotics:** Coordinated behaviour among large groups of simple robots.
- **Robots in Daily Life:** Personal assistants, elderly care, and education.

## 9. ETHICAL CONSIDERATIONS

The integration of robotics and automation raises several ethical issues:

- Who is accountable for autonomous robot decisions?
- How do we ensure privacy and data protection?
- Should there be limitations on robotic weapon systems?
- How do we address inequality caused by automation-related job losses?

Governments, organizations, and researchers must collaborate to create policies and standards that ensure the responsible development and deployment of these technologies.

## 10. CONCLUSION

Robotics and automation have significantly evolved over the past decades, offering unprecedented opportunities across multiple sectors. While the benefits are vast, challenges remain that must be addressed through innovation, regulation, and ethical foresight. As technology advances, these systems will become more intelligent, accessible, and essential to everyday life, paving the way for a future where humans and machines work in harmony.

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