

Conclusion

SaaS has evolved from a niche solution to a cornerstone of digital transformation, offering unmatched agility and cost savings. While challenges like data security and vendor lock-in require strategic planning, the industry's trajectory—driven by AI, UX, and global expansion—remains highly promising. As enterprises increasingly adopt cloud-first strategies, SaaS will continue to redefine how businesses operate, innovate, and compete in the digital age.

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UDC 004

RESEARCH ON THE EMPOWERMENT OF 5G TECHNOLOGY IN INTELLIGENT TRANSPORTATION SYSTEMS

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Abstract. *This article examines the transformative role of 5G technology in the development of intelligent transportation systems (ITS). By leveraging the unique features of 5G – such as ultra-high data rates, low latency, and massive connectivity – ITS can achieve real-time communication, enhanced traffic management, and improved road safety. The paper highlights core applications including vehicle networking, remote driving, and intelligent traffic control, as well as the integration of edge computing and artificial intelligence. It also addresses the challenges of infrastructure deployment, security, and user adoption. The findings suggest that 5G is not merely an upgrade in communication standards but a foundational enabler of smart, efficient, and sustainable transportation systems.*

Keywords: 5G technology, intelligent transportation systems, vehicle networking, real-time communication, autonomous driving, traffic management, edge computing, artificial intelligence, cybersecurity, smart mobility.

This article explores the empowering impact of 5G technology on intelligent transportation systems. It analyzes how key characteristics of 5G – such as ultra-high data transmission speed, extremely low latency, and massive device connectivity – contribute to the modernization and transformation of transportation infrastructure.

Intelligent transportation systems have become essential tools for addressing traffic congestion and improving road safety. However, current technological limitations – such as slow data transfer and the inability to connect large numbers of devices simultaneously – hinder the effectiveness of these systems. The emergence of 5G technology offers new opportunities for development, unlocking capabilities that

were previously unattainable.

Among the core applications of 5G in intelligent transportation is vehicle networking. High-speed communication between vehicles (V2V) and between vehicles and infrastructure (V2I) supports autonomous driving technologies, enhances situational awareness, and improves both safety and traffic flow. Additionally, 5G enables intelligent traffic management by transmitting large volumes of data in real time, including vehicle location, speed, and congestion patterns. This data helps traffic authorities optimize signal control and regulate traffic more efficiently.

Another transformative use of 5G is in remote driving and emergency rescue. Due to its low latency, 5G allows vehicles to be operated remotely in hazardous conditions, such as chemical spills or natural disasters. It also supports real-time communication for remote medical rescue operations, increasing responsiveness and potentially saving lives.

These technological advancements translate into tangible benefits. Real-time data interaction and intelligent traffic scheduling improve road throughput and reduce congestion. Enhanced communication between vehicles and infrastructure minimizes human error and contributes to accident prevention. As a result, both traffic efficiency and safety are significantly strengthened.

Despite these advantages, challenges remain. The deployment of 5G infrastructure is costly, particularly the construction of dense networks of base stations needed for reliable coverage. A reasonable layout combining macro and micro base stations is essential for cost-effective coverage expansion. Public-private partnerships and innovative funding models can help distribute financial responsibilities and accelerate deployment.

Security and privacy concerns also arise as intelligent transportation systems increasingly rely on the exchange of personal and vehicular data. To address these issues, it is critical to implement comprehensive security frameworks that include encryption, access control, and intrusion detection. In parallel, legal and regulatory systems must be modernized to safeguard users' privacy and ensure public trust in new technologies.

To fully realize the potential of 5G in intelligent transportation systems, it is essential to focus not only on technological integration but also on the modernization of physical infrastructure. Roads, traffic lights, intersections, and parking systems must be equipped with a variety of sensors, cameras, and communication modules to enable real-time interaction with vehicles and central management platforms. The synergy between physical infrastructure and digital networks forms the basis of smart cities, where transportation is seamlessly connected to other urban services such as energy management, environmental monitoring, and emergency response.

An increasingly important concept in this context is the digital twin. When applied to transportation networks, digital twins can model not only the static layout of roads and intersections, but also dynamic elements such as traffic flow, accident risks, and environmental impact. These simulations allow urban planners and engineers to test various development strategies in a virtual environment before implementing them in the real world, thus saving resources and improving overall effectiveness. For example, a digital twin of a city's traffic system can simulate the effect of new traffic rules, construction projects, or emergency events, helping decision-makers choose optimal solutions.

Furthermore, integrating 5G into public transportation systems offers substantial benefits for passengers and operators alike. Real-time vehicle tracking, adaptive route planning based on traffic conditions, and seamless communication with passengers through smart apps enhance user experience and encourage the use of sustainable transport modes. For transportation providers, 5G opens new opportunities for operational efficiency by enabling predictive maintenance, reducing downtime, and extending the lifespan of expensive assets like buses and trains.

It is also worth considering the global dimension of 5G deployment in transportation. Countries such as South Korea, Germany, and the United States are already conducting large-scale pilots and implementations of 5G-enabled traffic systems. These initiatives demonstrate the real-world feasibility of connected vehicle networks and showcase how public-private partnerships can accelerate innovation. International cooperation in developing common standards, interoperability protocols, and data protection frameworks will be crucial to ensure the scalability and security of these systems across borders.

In the long term, the integration of 5G, AI, IoT, and digital twins is expected to contribute to the development of autonomous mobility ecosystems – where human-driven and self-driving vehicles coexist harmoniously, interacting with smart infrastructure to reduce accidents and optimize traffic flows. This evolution will not only transform transportation, but also influence urban design, economic development, and societal behavior. In this context, investment in research, education, and regulatory reform becomes a strategic priority for governments and industry leaders worldwide.

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SMART MANUFACTURING: THE ROLE OF IOT AND AI IN MODERN PRODUCTION SYSTEMS

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Abstract. Smart manufacturing, driven by the Internet of Things (IoT) and Artificial Intelligence (AI), is revolutionizing industrial production by enabling real-time monitoring, predictive maintenance, and autonomous decision-making. This article explores the integration of IoT and AI in manufacturing, highlighting key technologies, benefits, and challenges. The discussion underscores how these advancements enhance efficiency, reduce costs, and support sustainable production practices.

Keywords: Smart manufacturing, Internet of Things, Artificial Intelligence, Digital Twins, Data Security.

The Fourth Industrial Revolution (Industry 4.0) has transformed traditional manufacturing into a data-driven, interconnected ecosystem. Central to this transformation are Internet of Things (IoT) and Artificial Intelligence (AI), which empower machines to communicate, analyze data, and optimize processes autonomously (Fig. 1). This article examines their synergistic roles in smart manufacturing and their potential to redefine global production standards, emphasizing the urgent need for adaptation in today's competitive landscape.

A more detailed examination of IoT and AI will now follow.



Figure 1 – AI + IoT Architecture

IoT

IoT connects physical devices, such as sensors and actuators, to collect and exchange data seamlessly. In manufacturing, IoT enables:

- Real-Time Monitoring: Tracking equipment performance and product quality to minimize downtime.
- Predictive Maintenance: Identifying potential failures before they occur, thus enhancing reliability.
- Supply Chain Visibility: Improving logistics and inventory management through enhanced data sharing. In combination with digital twins—virtual replicas of physical assets—IoT allows for real-time simulation, diagnostics, and optimization of manufacturing systems, supporting informed decision-making and continuous improvement.

AI

AI algorithms analyze vast datasets