

263. THE IMPACT OF ARTIFICIAL INTELLIGENCE ON THE AUTOMOTIVE SECTOR: FROM AUTONOMOUS DRIVING SYSTEMS TO SMART MANUFACTURING EFFICIENCY

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This paper examines the impact of artificial intelligence on the automotive industry. It analyzes cutting-edge approaches to autonomous driving and identifies current barriers to their widespread adoption.

Over the last six years, Artificial Intelligence (AI) has become deeply integrated into every aspect of human life. While people delegate professional tasks, personal data, and money to AI systems, not everyone is ready to entrust their lives to them. The deployment of AI in public transportation infrastructure has progressed at a more measured pace compared to its rapid adoption within the corporate sector.

While autonomous taxis were previously considered as a theoretical concept, several companies have recently transitioned to commercial deployment. Waymo employs a sensor-fusion foundation model that integrates Vision-Language Models for high-level semantic reasoning, enabling the system to interpret complex traffic situations. In contrast, Tesla's approach focuses on Vision-only neural networks, where Occupancy Networks replace traditional LiDAR-based mapping. This strategy relies on massive datasets to train the system's perception and decision-making layers simultaneously, aiming for Level 4 autonomy via the Cyber cab platform [1]. Despite the advanced technology of modern systems, it is impossible to rely on them entirely. At present, the operation of autonomous vehicles is limited to local test zones, and their large-scale integration into the overall transportation infrastructure appears difficult to achieve in the short term. Furthermore, the heavy reliance on complex, interconnected artificial intelligence systems makes modern vehicles extremely vulnerable to cybersecurity threats, raising alarming concerns about remote hacking, malicious vehicle control, and serious data privacy breaches.

In addition to external navigation systems and autonomous features, artificial intelligence helps improve cabin ergonomics through intelligent interfaces. Integrated natural language processing and interior computer vision frameworks are used to cultivate a responsive environment. Facial recognition systems and biometric sensors autonomously calibrate seat configurations, climate control, and multimedia preferences [2]. AI-driven Driver Monitoring Systems can track ocular movements and head kinematics to identify early indicators of fatigue. Mercedes-Benz has partnered with Google to integrate the Gemini model into its MBUX virtual assistant. It is tuned for the automotive industry and can reference information from Google Maps Platform to give users more detailed and personalized conversational responses about navigation, points of interest and more [3].

In manufacturing, AI is implemented at production stages, including predictive equipment maintenance, quality assurance, and industrial design. For instance, BMW uses automated optical inspection systems (such as AIQX) to verify the precise installation of components and emblems, ensuring strict adherence to assembly standards [4]. The transition to fully autonomous assembly lines, made possible by these technologies, leads to a significant reduction in operating costs and an increase in production efficiency. Bugatti has used artificial intelligence to optimize the shapes of its components. In areas such as upper suspension, this has enabled the creation of organic microstructures designed for maximum strength and minimum weight [5].

In conclusion, AI is the engine driving the future of the car industry. When autonomous navigation, smart user interfaces, and smart production work together, they make the ecosystem more efficient, safe, and long-lasting. However, there are no plans for the widespread adoption of autonomous vehicles in the near future. This paper highlights that the global automotive industry needs to keep integrating AI technologies in order to grow.

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