INTEGRATION OF IOT AND AI IN SMART INDUSTRY SYSTEMS

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Abstract. In the Industry 4.0 era, manufacturing has become more intelligent and efficient through IoT and Artificial Intelligence. These technologies enable data collection, comparison, and optimization of production processes, making systems more flexible, safe, and efficient.

Keywords. Industry 4.0, Artificial Intelligence, Internet of Things

Introduction. In the Industry 4.0 era, manufacturing has become more intelligent and efficient through IoT and Artificial Intelligence. Previously, factories relied on simple mechanical systems that only executed commands, but today they have evolved into intelligent systems that collect and analyze data. IoT sensors continuously monitor production by measuring machine temperature, vibration, and condition, enabling early fault detection. The collected data is processed by Artificial Intelligence, leading to more accurate decisions and improved production management.

Industry 4.0 Technologies. Artificial Intelligence (AI) is a key element of Industry 4.0 manufacturing, improving efficiency through IoT data evaluation. Its main applications include predictive maintenance, which reduces downtime and costs, and quality control, where AI detects defects and minimizes human error. This is further enhanced in CNC systems, improving reliability and reducing processing errors[1, pg.33].

IoT and AI integration increases flexibility by automatically adjusting production and resources based on demand. Figure 1 shows the Industry 4.0 flow from data collection to smart manufacturing.

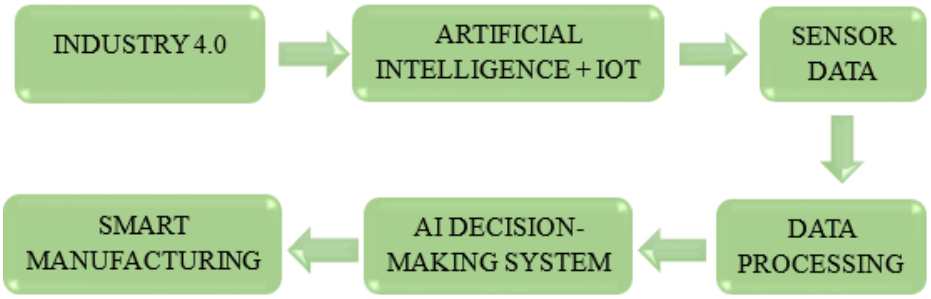


Figure 1. Industry 4.0 process flow (IoT and AI integration in smart manufacturing)

Human and Technology. Human-technology collaboration in the Industry 4.0 era is characterized not by job losses but by making work more efficient and safer. In a real industrial environment within the oil and gas sector, such as a production technician role, these technologies are directly applied in equipment performance monitoring, machine data evaluation, and supporting predictive maintenance processes, including intelligent diagnostic systems for monitoring and control[2,

pg.119]. This demonstrates that human-technology collaboration is not only theoretical but also actively implemented in real industrial environments.

The main goal of these systems is not to replace humans but to automate heavy and repetitive tasks, allowing people to focus on system operation, decision-making, creativity, and problem-solving.

The use of IoT and AI brings important economic and environmental advantages by improving energy efficiency, lowering costs, and reducing environmental impact. Early detection of production errors helps minimize waste and enhances the efficient use of resources. Studies on machining processes also confirm that improvements in surface quality and productivity through advanced methods lead to higher efficiency and better resource utilization in manufacturing systems. However, these technologies also bring challenges, including higher cybersecurity risks due to full connectivity and the need for employees to improve digital skills, while Table 1 compares human creativity and decision-making with AI and IoT automation and evaluates functions.

Table 1.

Human and technology collaboration in industry 4.0

Human	Technology (AI and IoT)
Creativity and decisions	Data processing and automation
Problem-solving and design	Fault detection and optimization
Strategy and innovation	Process control and efficiency

Conclusion. The integration of IoT and AI in manufacturing is a major transformation of production systems, creating highly automated smart factories with minimal human intervention. These technologies enable faster, higher-quality, and more cost-effective production while supporting sustainability through efficient resource use. Human roles shift from physical tasks to more creative and intellectual work. IoT and AI together form the foundation of the future industry.

REFERANCES

1. Bogatenkov S., Sazonova N.S., Yusubov N., Abbasova Kh., Dadashov R. Application of Artificial Intelligence for Computer Numerical Control (CNC) Machines // *Azerbaijan State Maritime Academy*, July 2025, pp. 38–42.
2. Bogatenkov S., Gabbasova O.P., Weimarn V.Yu. Artificial Intelligence for Control and Diagnostics of Measurement Channels // *Digital Industry: Current State and Development Prospects* 2023 (CISP'2023), Chelyabinsk, 2024, pp. 117–123.