



## APPLICATION OF IOT (INTERNET OF THINGS) TECHNOLOGIES FOR TECHNOLOGICAL MACHINES

**Jo'raxanov Yusufjon Orifjon o'g'li** Student at Namangan State Technical University

**Abstract:** This article analyzes the role and importance of IoT (Internet of Things) technologies in increasing the efficiency of technological machines in modern industrial enterprises. The possibilities of real-time monitoring, remote control, forecasting of technical maintenance and optimization of production processes through IoT technologies are scientifically highlighted. In addition to the practical advantages of these technologies, problems such as implementation costs, cybersecurity risks and shortage of qualified personnel are also considered in detail. The results of the study show that the implementation of IoT technologies based on a strategic approach serves to increase the competitiveness of industrial sectors.

**Keywords:** IoT, Internet of Things, technological machines, digitization, remote monitoring, cybersecurity, Industry 4.0, artificial intelligence, Big Data, technical maintenance

In the process of digital transformation of modern industry, the importance of Internet of Things (IoT) technologies is increasing. In particular, the implementation of IoT solutions for technological machines is dramatically increasing the level of digital control, remote monitoring, analytical capabilities and automatic control in industrial enterprises. IoT technologies provide the opportunity to monitor the operating parameters of machines in real time, assess their performance status and optimize them. This article discusses the practical application of IoT technologies in technological machines, their advantages, impact on efficiency and existing problems from a scientific point of view.

IoT technologies mainly provide the opportunity to connect physical objects (machines, devices, sensors, actuators) to the Internet through special devices and modules. This allows for continuous monitoring of the performance, energy consumption, vibration, temperature, pressure and other parameters of technological machines. Currently, IoT-based monitoring systems are being implemented in such





industries as mechanical engineering, chemistry, food, oil and gas, pharmaceuticals, and automotive.

One of the main advantages of IoT technologies is its operability and flexibility. For example, if sensors on a technological machine on a production line detect that the temperature indicator has exceeded the norm, the system automatically takes appropriate actions: starts the cooling system, gives a safety signal or temporarily stops the machine. This allows you to eliminate the problem without human intervention.

In addition, IoT systems become more effective when integrated with artificial intelligence (AI) and machine learning algorithms. Machine performance data is collected and analyzed as Big Data. This makes it possible to predict emergencies, plan maintenance, control product quality, and improve energy efficiency.

IoT technologies for technological machines also improve the quality of service. Through the Predictive Maintenance model, the system detects in advance the action or parameter that will lead to a failure. For example, signals such as a change in the vibration frequency of the motor, an abnormal increase in temperature, or a decrease in pressure in the lubrication system are detected by the system and automatically reported to the maintenance team. As a result, the machine is repaired earlier without stopping and production continues uninterrupted.

IoT technologies also create the possibility of remote control. Enterprise management or maintenance engineers can monitor the performance of machines from anywhere via a mobile application or a special web platform, adjust parameters, or turn off the system remotely in case of emergency. This approach simplifies production, reduces human error, and increases safety.

However, there are a number of problems in implementing IoT technologies. Firstly, the high cost of technology, especially the cost of special sensors, IoT gateway devices, cloud servers and software, can be a serious obstacle for small businesses. Secondly, the problem of cybersecurity. Systems operating over the Internet can be vulnerable to malware, hacking attacks and data theft. Therefore, measures such as data encryption, authentication, secure networking (VPN) are important in IoT systems.

The third problem is the shortage of technical support and qualified personnel. Since IoT technologies require a high level of knowledge and experience, their implementation and operation require IT specialists and engineers with special qualifications. In the conditions of Uzbekistan, it is urgent to strengthen the personnel training system in this regard.





Nevertheless, the application of IoT technologies in technological machines is a promising direction, allowing for the digitization of production, real-time control and optimization of production processes. This will help increase efficiency in industrial sectors, save energy resources, stabilize product quality and ensure environmental safety of production.

The use of IoT technologies in technological machines plays an important role in the digital development of industrial sectors. With the help of these technologies, production processes can be more intelligent, safe and economical. The implementation of IoT solutions will increase the efficiency, reliability and operational capabilities of technological machines to a higher level. At the same time, aspects such as cybersecurity, cost and maintenance of IoT systems should not be ignored. The implementation of IoT technologies based on a comprehensive and strategic approach will serve the sustainable and innovative development of the industry.

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