AUTOMATION OF URBAN INFRASTRUCTURE BASED ON PREDICTIVE MAINTENANCE AND IoT

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Abstract: Modern cities face challenges related to the operation and maintenance of critical infrastructure, including transport networks, energy systems and water supply facilities. The use of Predictive Maintenance technologies in combination with the Internet of Things (IoT) allows ensuring the uninterrupted operation of urban systems, increasing resource efficiency and reducing repair and maintenance costs. The article discusses the concept of Predictive Maintenance for urban infrastructure, the principles of its implementation and the impact on the sustainability of urban development.

Keywords: Predictive Maintenance, IoT, urban infrastructure, automation, Smart City, digital transformation.

With the development of the concept of "smart cities", the automation of urban infrastructure is gaining particular importance, which contributes to the efficient use of resources and an increase in the level of comfort of residents. Traditional methods of servicing urban systems are often reactive, which leads to unplanned downtime, significant financial costs and even threats to public safety. The use of Predictive Maintenance allows you to monitor the condition of urban facilities in real time, predict possible malfunctions and prevent their occurrence. Combining this technology with IoT provides flexibility in management and integration of various urban services into a single digital ecosystem. In the context of growing urbanization and the need to reduce the negative impact on the environment, automated infrastructure management is becoming a key factor in sustainable urban development.

Predictive Maintenance technology is based on the use of IoT sensor networks to collect data on the condition of urban facilities and the application of machine learning and artificial intelligence algorithms to analyze the information obtained. In urban infrastructure, this concept can be applied in various areas, including the management of transport networks, monitoring the condition of road surfaces, optimizing the operation of lighting systems and energy supply.

One of the key elements of the implementation of Predictive Maintenance is the integration of sensors and IoT devices into critical infrastructure facilities. For example, smart sensors in water supply systems can monitor pressure, leaks and water pollution levels, transmitting this data to a single control center. Similarly, in transport infrastructure, sensors placed on roads and bridges can monitor vibrations, loads and the level of wear of the surface, allowing to prevent emergencies and carry out maintenance in advance.

The use of IoT in Predictive Maintenance involves the use of analytical platforms that process large amounts of data and perform automatic analysis of trends and patterns. For example, artificial intelligence systems can predict the probability of elevator failure in multi-story buildings or detect overloads in power supply systems. This allows utilities to quickly respond to potential problems, reducing the cost of emergency repairs and increasing the reliability of urban systems.

One of the advantages of Predictive Maintenance is the reduction of the human factor in infrastructure maintenance. Automated systems can operate continuously, monitoring and controlling the condition of objects in real time. This allows not only to optimize maintenance costs, but also to reduce the negative impact of urban infrastructure on the environment. For example, effective management of urban power grids helps reduce energy consumption, and timely maintenance of sewage systems helps prevent water pollution.

However, the widespread implementation of Predictive Maintenance requires addressing a number of technical and organizational issues. The main challenges include security and data protection, as attackers may try to gain access to critical city systems. Also important are issues of technology compatibility, standardization of data exchange protocols, and the economic feasibility of integrating IoT solutions into existing city infrastructure.

CONCLUSIONS. Automation of urban infrastructure based on Predictive Maintenance and IoT is a promising direction for the development of smart cities. The use of advanced technologies for analyzing and predicting the state of critical urban facilities allows to increase the efficiency of resource management, minimize emergency situations and improve the quality of life of residents. Despite a number of challenges associated with the implementation of these technologies, the advantages of their use are obvious. Further research in the field of Predictive Maintenance will allow to improve forecasting algorithms, ensure a high level of reliability of urban systems and contribute to the sustainable development of modern megacities.

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