Research on the Application of Artificial Intelligence Technology in Intelligent Operation and Maintenance of Industrial Equipment and System

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Abstract. With the rapid development of network communication technology, artificial intelligence (hereinafter referred to as AI) technology has been deeply optimized, which has been applied to all walks of life, especially industrial equipment system. At present, industrial automation equipment is reasonable judgment through algorithm, which is inseparable from AI technology. Through AI technology, modern industry has undergone earth shaking changes, which constantly promote the traditional industrial structure adjustment and optimization and upgrading. This is the continuous upgrading of the industrial structure and the promotion of AI. According to the architecture of reliability, availability, maintainability and safety, the security and availability of the system are guaranteed by reliability and maintainability, which requires us to improve the reliability of operation and maintenance of the system. This paper first analyzes the importance of AI technology in the industrial field. Then, this paper analyzes the Metro signal equipment system architecture. Finally, some key technologies are proposed.

Keywords: Ai Technology, Industrial Equipment and Systems, Intelligent Operation and Maintenance

1. Introduction
The reliability and maintainability of our equipment will need to be improved and maintained during the operation phase. However, unscientific equipment maintenance will reduce the reliability of equipment, which will increase unnecessary maintenance costs [1]. Taking subway as an example, the maintenance strategy of Metro signal equipment system mainly depends on experience, which will cause many problems, such as improper equipment maintenance method, unscientific resource allocation, high equipment failure rate and high maintenance cost [2-4]. Therefore, we must strengthen the research of AI technology, which can improve the intelligent operation and maintenance of the system [5, 6]. Therefore, we must use a scientific method to detect and control the reliability of equipment operation, which requires us to constantly improve the intelligence of the system [7].
2. The importance of AI technology in industry

2.1. Automatic integration of measurement data
Factories use measurement data to improve productivity and competitiveness. Through historical data, enterprises can determine the best operation process. Through data analysis, we can bring suggestions, improvement opinions or warnings, which will support decision-making. Therefore, enterprises can achieve efficient, productive, environmental protection, economic production. Intelligent equipment and system is an important part of industrial process and electrical system. The data generated by intelligent devices can be collected directly or by automatic system. An automation system can be used to control multiple production facilities at the same time. In the field of oil and gas application, experts can transmit the collected data through AI system when they are far away from the field, which will play an important role in the integrated system. The automation system can detect and analyze faults in advance, which will send reports to the operation and production planning system.

2.2. Internet sharing
Mobile technology and cloud services combine the industrial Internet of people, services and things, which creates new opportunities for industrial information sharing. Through cloud services or standardized security interface and remote access, all kinds of relevant data will be obtained from outside the factory, which will also be the next important stage of industrial development. Under this concept, everything is interconnected. As a result, information from all over the world will be combined in new ways. With factory level measurement data, we can significantly increase the amount of information to support decision-making, which can be used in new areas, such as the creation of new preventive maintenance services.

2.3. Service
In the face of sudden production equipment failure, the traditional maintenance method not only wastes a lot of valuable production time, but also increases the unnecessary maintenance cost. "Internet of things +" makes preventive diagnosis and maintenance possible. Predictability improves operational reliability and stability, which reduces the cost of industrial equipment and systems. At the same time, AI technology enhances security, which makes remote control easier. Digital solutions will fully integrate the existing digital product portfolio and service solutions.

3. Metro signal system equipment operation and maintenance management

3.1. System network topology
Browser / server mode is mainly used in system monitoring. Through the electric field, the system can collect the parameters representing the running state. After analysis and processing, it will be transmitted to the upper computer control center through the network, which will achieve the ultimate goal of equipment monitoring. The monitoring system designed in this paper is based on B / S mode, which allows authorized users to view and modify settings through web browsing. The system administrator is the developer and owner of the monitoring system, which can monitor all the operation parameters and characteristics of the access network in real time. At the same time, according to the real-time needs of customers, the monitoring system can maintain the system. The network topology of the monitoring system is shown in Figure 1.
3.2. Structure of signal system equipment maintenance management system

The signal system equipment management system is a distributed system installed in the line control center, which mainly adopts five layer system architecture, which are user layer, application layer, platform layer, infrastructure layer and perception layer, as shown in Figure 2.

![Figure 1. The network topology.](image)

![Figure 2. Signal system equipment maintenance management system architecture.](image)
4. Key technology of intelligent industrial equipment and system

4.1. Interconnection of complex heterogeneous systems
The information systems of intelligent factory include basic automation system, three-level measurement, real-time database system, analysis cabin, patrol positioning system, external operation training system, online sewage monitoring system, performance appraisal system, online training system, etc. These systems have problems such as different technical routes, inconsistent data and models. Therefore, it is easy to form many application islands in industrial equipment and system, which needs to overcome the key technology of heterogeneous system integration. Through AI technology, we can realize the integration and interconnection of the system.

4.2. Optimal control strategy design for dynamic characteristics of complex process
The production process of process industrial enterprises is complex, and the upstream and downstream processes of each device are closely related. Therefore, the coupling degree of material and energy between equipments is high, which will be very sensitive to disturbance. Therefore, it is easy to cause local interference between systems, which often propagates throughout the production process. The equipment, unit and production line of each process has its own optimization point, control point and safety constraint boundary, which will lead to the optimal operation point of single equipment. Therefore, we must coordinate and optimize the local optimization points of each process, which will make the whole process tend to the best optimization point. Therefore, the design of optimal control strategy for dynamic characteristics of complex process is the key problem of the whole unit production optimization control.

4.3. Analysis and optimization of energy efficiency of major energy consuming equipment
Due to the lack of energy efficiency evaluation model of heating furnace, compressor, pump and other major energy consuming equipment in enterprise production, it will lead to the intelligent operation and control based on experience. Therefore, enterprises need to establish joint modeling based on mechanism and data, which can draw equipment energy efficiency monitoring chart. Through real-time calculation, enterprises can evaluate the current energy efficiency of industrial equipment online, which will reasonably solve the problem of energy efficiency analysis and load optimization of equipment.

4.4. Fault diagnosis and operation optimization of key production equipment
Once the key equipment fails, it will cause huge economic losses, which may lead to safety accidents. Through the equipment operation status, inspection and maintenance records and other information, we can find the law of equipment change, which will give early warning of potential equipment failure. Therefore, in the intelligent factory, we can improve the efficiency of equipment operation.

4.5. Implementation of performance management concept
In the process of formulating performance management plan, enterprises have integrated various performance management concepts according to their own characteristics. In practice, most of the performance management ideas have not been effectively implemented. Through the quantitative refinement of indicators, we can decompose the strategy into indicators, which is an important technical difficulty. Therefore, we must improve performance management, which will improve the utilization of human resources of staff.

5. Conclusion
Intelligent factory is an ecosystem based on intelligent manufacturing developed by digital, networked and intelligent advanced technology, which can realize the supply of raw materials. Through AI technology, modern industrial structure has been gradually adjusted, optimized and upgraded.
Therefore, we must strengthen the research of AI technology, which can improve the intelligent operation and maintenance of the system.

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