Research on the Realization and Application of Intelligent IoT Platform for Electrical Equipment under Industrial Internet

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Abstract. In the context of the industrial Internet, the new generation of information technologies such as the cloud, large, and mobile smart areas are becoming more mature and widely used. Intelligent manufacturing leads the transformation of manufacturing methods. The new development concept represented by "modern smart supply chain" is also getting more and more attention. Therefore, building a smart supply chain has become a new research direction, and building a smart IoT platform for electrical equipment is conducive to building a modern smart supply chain system. The current research on the intelligent IoT platform for electrical equipment is mainly in the platform structure design and key technologies, and there is a lack of implementation and application research on the intelligent IoT platform for electrical equipment. Therefore, this article will conduct research from the realization and application status of the intelligent IoT platform for electrical equipment, the problems in the implementation process, the key technologies and solutions used to solve the problems, etc., to provide a good basis for the construction and application of the intelligent IoT platform for electrical equipment. Provide reference for development.

Keywords: industrial Internet; electrical equipment; smart IoT; realization; application.

1. Introduction
In recent years, while the new generation of information technology has become increasingly mature and widely used, new development concepts represented by the "modern smart supply chain" have also received more and more attention, creating wisdom supported by big data, networked sharing, and intelligent collaboration. Supply chain system has become a new research direction. The "Made in China 2025" plan states that "intelligent manufacturing based on cyber-physical systems, such as smart equipment and smart factories, is leading the transformation of manufacturing methods." Accelerating the promotion of manufacturing innovation and development, improving quality and efficiency, is the realization of the transformation from a large manufacturing country to a strong manufacturing country. The inevitable way. With the industrial Internet as the background, building a smart IoT platform for electrical equipment is conducive to building a modern smart supply chain system.
For power grid companies, the intelligent IoT of electrical equipment is of great significance to power grid companies’ internal and external business expansion and the electrical equipment manufacturing industry. Grid companies are connected to suppliers through the intelligent IoT platform for electrical equipment, extending the quality control of electrical equipment to the manufacturing process. This will be conducive to the establishment of a quality control mechanism with a high degree of mutual trust and efficient coordination between the supply and demand sides. For suppliers, the intelligent IoT platform for electrical equipment can provide suppliers with industry-finance integration and other big data analysis value-added services. It is not only conducive to guiding the technological transformation and capacity upgrade of the electrical equipment manufacturing industry, but also provides a scientific basis for the extensive access of my country’s smart IoT data. For the government, the intelligent IoT platform for electrical equipment provides data support for the government to grasp the level of construction and operation of the intelligent IoT for electrical equipment and the maintenance and operation benefits. The construction and realization of the intelligent IoT platform for electrical equipment effectively supports the government's efficient and accurate decision-making. In short, the construction and realization of the intelligent IoT platform for electrical equipment effectively supports the government's efficient and accurate decision-making. In short, the construction and realization of the intelligent IoT platform for electrical equipment is to promote the upgrade of intelligent online quality control of electrical equipment on a larger scale. This is not only conducive to the realization of intelligent manufacturing supervision, quality evaluation, supplier coordination, production capacity allocation, industry benchmarking, etc. of electrical equipment, but also conducive to the realization of intelligent IoT for multiple categories of electrical equipment.

However, the current research on the intelligent IoT platform for electrical equipment mainly focuses on the design of the platform technology architecture, and there is a lack of research on the realization and application verification of the intelligent IoT platform for electrical equipment. Therefore, this article discusses and researches the realization of the intelligent IoT platform for electrical equipment, the problems encountered in the realization process, and the solutions and solutions to provide references for the construction and development of the intelligent IoT platform for electrical equipment.

2. Literature review

Industrial Internet is the only way to build a modern industrial ecosystem and realize advanced intelligent development, and it is also a key foundation for intelligent manufacturing. The Industrial Internet can not only give full play to the potential of industrial equipment, processes, and materials to improve production efficiency and optimize resource allocation, but it is also the key to creating differentiated products and realizing value-added services. In order to solve the problem of energy efficiency of the Internet of Things, Wang et al. [1] proposed an energy-saving architecture of the Industrial Internet from the energy-saving perspective, and the simulation results proved the advantages of the architecture. Sisinni et al. [2] provides a systematic overview of the Industrial Internet. While analyzing its development opportunities, it also elaborates on the challenges that the Industrial Internet will face in terms of energy efficiency and real-time performance. Li et al. [3] proposes a user privacy protection protocol scheme for the industrial Internet to ensure the communication security of the industrial Internet environment. The emergence of the Industrial Internet has paved the way for real-time big data storage, access and processing in the cloud environment. At the same time, the large amount of data generated brings troubles to data processing. Kaur et al. [4] proposed the introduction of edge computing to deal with the network congestion caused by the influx of large amounts of data. Hui et al. [5] recognizes that data transmission security is very important in the industrial Internet, so it proposes to use a new chaotic secure communication scheme to solve the security problem of data transmission. In addition, the effective allocation of computing resources and operators is also crucial for the industrial Internet of Things for intelligent production systems. In order to meet the complexity and variability of user needs in time, xu et al. [6] proposed a hierarchical trustworthy resource allocation and trustworthy computing algorithm based on Vickrey-Clarke-Groves (VGC), which was used between industrial Internet devices and gateways. Wireless communication. Huang et al. [7] proposes a reliable and effective data sharing scheme suitable for industrial Internet of Things, which provides a reference for ensuring the safety of data transmission.
The IoT platform has gradually penetrated into various fields. The indoor air quality monitoring platform based on the Internet of Things relies on the Internet of Things and cloud computing technology to monitor indoor air quality anytime and anywhere, and classify and visualize indoor air quality [8].

The medical IoT platform can realize remote health monitoring, use a multi-layered architecture to sense and collect patient and environmental information, and achieve the effect of improving user experience through information storage and data analysis [9]. Automobile manufacturers adopt the latest digital technology to manufacture convenient and safe self-driving cars, and the IoT platform is responsible for the functions of data collection, processing and prediction [10]. The literature proposed a framework of IoT platform based on PROMENADE, which is applied in smart cities to analyze and process traffic data generated by IoT devices. However, there are relatively few researches on the realization of intelligent IoT in equipment or electrical equipment. Marosi et al. [11] uses process monitoring to ensure the production quality of industrial equipment, and uses status monitoring to prevent unplanned shutdowns. Yang et al. [12] combines process monitoring to form an online equipment monitoring data set, and uses data fusion technology, principal component analysis and BP neural network to predict equipment health trends and failure types. Similarly, fabricio et al. [13] proposed a monitoring system for industrial electrical equipment based on the Internet of Things, aimed at real-time monitoring of its operating status, in order to achieve the purpose of early detection of deviations and faults. In these studies, the role of the Internet of Things is mainly focused on the monitoring of the equipment production process. The application scope and research horizon of the Internet of Things are relatively single. Few studies have established an intelligent IoT platform for electrical equipment to achieve the intelligentization of the electrical equipment supply chain.

Based on the above literature review, the current research on the intelligent IoT platform of electrical equipment under the Industrial Internet mainly focuses on the design of the platform technology architecture, and there is a lack of research on the realization and application verification of the intelligent IoT platform of electrical equipment. Therefore, this article discusses and researches the realization of the intelligent IoT platform for electrical equipment, the problems encountered in the implementation process, the solution technology and solutions, etc. The research structure of this article is as follows: Part 3 firstly realizes the realization of the intelligent IoT platform for electrical equipment and the application status. Subsequently, Part 4 introduces the problems in the implementation and application of the platform. Part 5 puts forward the key technologies to be applied to solve related problems. The sixth part proposes corresponding solutions to the problems in the implementation and application of the platform. The last part is not only to summarize the work done in the article, but also to put forward my own understanding of future research directions.

3. Realization and application status of intelligent IoT platform for electrical equipment

3.1. Overall platform implementation

The electrical equipment intelligent IoT platform (EIP) for the industrial Internet mainly includes five modules: supplier data collection center, intelligent IoT gateway, intelligent IoT category management center, intelligent IoT management system, and intelligent IoT data aggregation and application; The supplier’s business/production system is an external system; each category data module and the headquarters data center can aggregate and transmit relevant data; at the same time, the system can also interact with other service systems; and there are firewalls and The server and the corresponding internal and external network isolation device can ensure the safety of the system. Its overall structure is shown in Fig. 1.

The supplier data collection center is located on the supplier side, which can centrally aggregate, store and manage real-time production process data and factory test data in the electrical equipment production line; the smart IoT gateway can use edge computing to standardize, clean, preprocess, and Screening, aggregation, authenticity verification, encryption and forwarding; the smart IoT category management center can implement business functions such as quality evaluation, smart manufacturing supervision, order tracking, and online support related to each category; the smart IoT management
system can collect and distribute various categories in a timely manner. Category of IoT data; Smart IoT data aggregation and application can provide suppliers/third-party service companies with value-added services such as holographic portraits, dynamic optimization of production processes, safety control of production and operation, and supply chain financial services.

The operation of the platform and the realization of its functions mainly include the following steps: First, obtain the production data, experimental data, video data, etc. of various categories of electrical equipment through the supplier data collection center and the supplier’s production/business system, and then combine the data It is transmitted to the smart IoT gateway part; second, the smart IoT gateway processes the collected data of each category of the supplier and sends it to the smart IoT management system; third, after receiving the data from the gateway, the smart thing The management system integrates the smart IoT category management center and sends it to the smart IoT data collection and application center through the headquarters data center; fourth, the smart IoT category management center and the smart IoT data collection and application center can transfer data Provided to users after processing. Here, users can achieve quality evaluation, intelligent manufacturing supervision, order tracking and other functions through the Smart IoT Category Management Center, and can also obtain value-added services such as holographic portraits and dynamic optimization of production processes through the Smart IoT Data Convergence and Application Center.

Fig. 1 The overall architecture of the intelligent IoT platform for electrical equipment

3.2. Platform application status

The application status of the intelligent IoT platform for electrical equipment is basically good. We will explain the application status of the platform from the following aspects.

1) System capacity

The number of system registered users of the platform is about 500 in the early stage of launch; the maximum number of online users can reach 100 in the early stage of launch; the amount of system structured data is about 500GB in the early stage of launch; the amount of unstructured system data in the early stage of launch Approximately 1TB; business throughput is about 50 transactions/minute when business is normal, up to 200 transactions/minute when business peaks; business throughput growth forecast: about 100 transactions/minute when business is normal in three years, and business peaks Up to 500 pens/minute.

2) Response time

The average response time for homepage visits is within 3 seconds; the average response time for system login is within 5 seconds; the average response time is no more than 5 seconds when performing simple queries, adding and deleting services; performing complex integrated services (When including query, add, delete and other operation requests at the same time), the average response time does not exceed 8 seconds; the average response time of basic submission operations does not exceed 5 seconds; the average response time of special submission operations does not exceed 8 seconds; the average response time of basic query operations No more than 5 seconds; the average response time of complex
query operations does not exceed 8 seconds; the average response time of basic statistical reports does not exceed 8 seconds; the average response time of monthly statistical reports does not exceed 20 seconds; the average response time of annual statistical reports does not exceed 30 seconds; The processing time of the format report does not exceed 20 seconds; the processing time of the graphical report does not exceed 30 seconds.

3) Database performance
The average response time of basic SQL is less than 3 seconds when business is normal, less than 5 seconds when business peaks, and the average response time is no more than 5 seconds; the average response time of complex SQL is no more than 300 seconds; the average CPU occupancy rate is the most tolerable. When the number of concurrent users continues to run for 2 hours, the system runs smoothly, the business failure rate does not exceed 0.1%, the average CPU usage rate is less than 80%, the memory usage rate does not increase significantly and the memory returns to the initial value after 1 hour; 80% of the maximum number of concurrent users running continuously for 4 hours, the system runs smoothly, the business failure rate does not exceed 0.1%, the average CPU occupancy rate is less than 80%, the memory occupancy rate does not increase significantly and the memory is restored after 1 hour Initial value; storage or built-in disk group IOPS is about 1000 when the business is normal, about 3000 when the business is peak, the network throughput of a single database host is 5Mbps when the business is normal, and 20Mbps when the business is peak.

4) Application server performance
The average CPU occupancy rate is less than 80% during peak business hours, and the average memory occupancy rate is less than 80% during peak business hours; the network throughput of a single server is about 5Mbps during normal business hours and about 20Mbps during peak business hours.

4. Problems in the implementation and application process

4.1. Device integration access problem
1) Equipment diversity
   The electrical equipment products involved in the platform are diverse, and they are different in data protocol, format and content.
   2) Conversion requirements
   The communication protocols, data formats, and languages used by various electrical equipment are not exactly the same. Therefore, the platform cannot transmit data and must be converted through the gateway.

4.2. Data collection and integration issues
1) Data collection problem
   On the one hand, there are multiple protocol standards in the field of electrical equipment data collection, including Profibus, Modbus, CAN, LonWorks, HART, Profinet, EthernetIP, etc. The standards of various protocols are not unified, and compatibility is difficult. Collection brings certain difficulties; on the other hand, the real-time requirements for data collection of electrical equipment are constantly increasing. The existing collection technology can no longer meet the real-time collection and upload of data, and there is a delay problem.
   In addition, in data transmission, the data information of electrical equipment involves privacy and security issues. Therefore, many equipment lack corresponding data interfaces, and there are certain difficulties in data interconnection and transmission. In addition, the transmission process of electrical equipment involves a huge amount of data and data types. Many, the existing data transmission technology can no longer meet.
   2) Multivariate and heterogeneous data integration issues
   The electrical equipment involved in the smart IoT platform has a large amount of data, many types, different data formats, and data quality, and the data sources of these data are independent and closed to
each other, resulting in data gaps. It is difficult to communicate, share, and integrate with each other, so
the data integration of the platform also faces great challenges.

4.3. Platform standardization issues
In the current application of the intelligent IoT platform for electrical equipment, due to the significant
individual characteristics of industries and enterprises, the obvious differentiation of interconnection
mechanisms, and the different focus of business needs, there is no complete and applicable standard
system that has not been formulated, and there is a lack of unified coordination and integration. Organize
work.

For the single-industry application of the intelligent IoT platform for electrical equipment, it is not
only necessary to connect with international advanced technical specifications, especially the relatively
mature technical fields such as operation management and information interaction developed abroad,
but also to pay attention to the uniformity and coordination of standards, and In view of the particularity
of the intelligent IoT of electrical equipment, it is urgent to design a standard system that adapts to the
development of the intelligent IoT of electrical equipment in my country to ensure the completeness and
application of future standards.

4.4. Industry synergy problem
In terms of internal collaboration, the life cycle management concept has not been fully implemented,
the degree of electrical equipment data structure is uneven, full integration is insufficient, and internal
cross-disciplinary information sharing is insufficient, which affects the business collaboration
development of the electrical equipment intelligent IoT platform.

In terms of external collaboration, one is that the tracking of supplier performance is mainly offline,
which has poor timeliness and integrity, low efficiency, and high communication costs; second, the
current supplier-side data is mainly passed through the line manually. The following methods are used
for collection, and real-time monitoring cannot be achieved, and the authenticity of the data is difficult
to guarantee.

4.5. Platform security issues
1) Safety compliance
   The intelligent IoT platform for electrical equipment is the core system of the electrical equipment
   quality supervision and manufacturing business of the State Grid Materials Department. It must meet
   the requirements of relevant national safety laws and regulations, and must be constructed and applied
   in accordance with relevant laws and regulations Carry out construction.

2) Data security
   The intelligent IoT platform for electrical equipment will store all production and test data during
   the manufacturer's production process. These data will not only support the business development of the
   intelligent IoT platform for electrical equipment, but will also conduct further analysis and mining. In
   order to prevent the leakage of confidential data, it is necessary to build a data lifecycle guarantee system
   for important business data.

3) Business continuity guarantee
   The intelligent IoT platform of electrical equipment realizes 7*24 uninterrupted service provision.
   Therefore, the redundancy and disaster tolerance design of the system architecture must be fully
   considered in the safety design to ensure that there is no single point of failure or performance
   bottleneck. In the event of a major failure, core business data can be restored, and the business recovery
   cycle complies with actual business requirements.
5. The key technology used to solve the problem

5.1. Edge computing

Edge computing refers to the use of an open platform that integrates network, computing, storage, and application core capabilities on the side close to the source of things or data to provide nearest-end services nearby. Its applications are initiated on the edge side to generate faster network service response and meet the basic needs of the industry in real-time business, application intelligence, security and privacy protection. Edge computing is between physical entities and industrial connections, or at the top of physical entities.

In view of the problems of data analysis and processing delay and network congestion in the realization and application of the intelligent IoT platform of electrical equipment in the industrial Internet environment, edge computing technology can be introduced. Develop intelligent IoT gateways based on edge computing technology, and apply edge computing to data format and content standardization, edge data storage filtering and compression, equipment command conversion and control, and computing model operation. The intelligent IoT gateway based on edge computing technology is deployed on the factory side of each supplier, which not only realizes the conventional extensive IoT access, but also provides edge computing capabilities. Provide services such as smart IoT, edge analysis, real-time alarm, and intelligent decision-making at the front end, and complete the access and analysis of the production test data of the access supplier. The edge intelligent IoT gateway shares the computing tasks of the electrical equipment intelligent IoT platform, while reducing network transmission pressure and improving the overall efficiency of the electrical equipment intelligent IoT platform. Using edge computing technology to study the coordination method between the edge agent of electrical equipment and the category center is helpful to realize the edge agent, information sharing and business collaboration of various regions of electrical equipment.

5.2. Data processing technology

Data processing technology refers to large-scale data processing services based on distributed architecture. Data processing technology provides the platform with high-efficiency storage, calculation and analysis capabilities for massive data through a large-scale and scalable parallel computing framework.

The data processing technology that realizes the above-mentioned functions mainly includes the analysis technology of strong mechanism business, the processing technology of low-quality data, and the high-efficiency data processing technology. The analysis technology of strong mechanism business refers to the controllable process of industrial process based on "strong mechanism". There are a large number of theoretical models that portray dynamic processes such as physics, chemistry, and biochemistry in the real world. In addition, there are also a lot of closed-loop control/regulation logics to make the process approach the design goal. The processing technology of low-quality data uses the scale of the data to make up for the low-quality data. High-efficiency data processing technology refers to the high-efficiency analysis and processing of data under industrial application mode. In terms of real-time processing, it is necessary to be able to support low-latency complex event detection for large-scale data conditions. In terms of offline analysis, the front-end analysis and modeling should be well integrated with the back-end industrial big data platform to support the mining of big data.

5.3. Big data analysis

Big data analysis refers to the analysis of large-scale data. The basic characteristics of big data can be summarized as large amount of data, fast speed, multiple types, value, authenticity, etc. The intelligent IoT platform for electrical equipment will not only face the challenges of diversification of access devices, but also the challenges brought by big data in terms of data collection, transmission, and integration.

By carrying out equipment quality data big data analysis, actively pushing quality information of each link to suppliers, establishing a product quality coordination mechanism, realizing online active
feedback of quality information and tracking the implementation of supplier rectification, supervising suppliers to strictly control quality and improving production Craftsmanship, and continuously improve the quality of materials. Apply "Internet +" thinking to access multi-source data across systems. Based on big data analysis and mining, the full life cycle management of electrical equipment can be realized. At the same time, iterative optimization and innovative development of platform functions will help improve the level of supply chain operation and management. Carry out multi-dimensional big data analysis and design a big data analysis model to comprehensively analyze the comprehensive technical capabilities of suppliers. Sharing the results of big data value mining can guide the construction and operation of the power grid internally, and guide the technical transformation and capacity upgrade of the electrical equipment manufacturing industry externally. In addition, the value mining of big data can further stimulate the vitality and motivation of the supply chain, which can better meet the needs of internal and external users and generate greater economic benefits.

5.4. Secure cooperative transmission and control technology
The safe and coordinated transmission and control of data are related to whether the intelligent IoT platform of electrical equipment can communicate safely and normally. For this reason, Message Queuing Telemetry Transport (MQTT) and Web Service technologies can be used on the edge to transmit device status and real-time data.

The MQTT protocol is a protocol designed for communication between a large number of remote sensors and control devices that have limited computing power and work on a low-bandwidth, unreliable network. The MQTT protocol requires only a very small communication overhead, and supports various popular programming languages and easy-to-use clients. In addition, the MQTT protocol can meet network transmission requirements in unstable environments. Through the MQTT two-way control protocol, equipment management and control and edge intelligent analysis are realized. The MQTT technology is used for data transmission, and the data transmission is double-authenticated and encrypted through the calling process and the transmission process to ensure the security of data access and transmission. Web Service technology enables different applications running on different machines to exchange data or integrate with each other, without the need for additional, specialized third-party software or hardware. Simply put, WebService is a cross-programming language and cross-operating system platform remote call technology. With the help of Web Service, the transmission and exchange of equipment status and real-time data can be realized.

6. Solution

6.1. Solution to equipment integration access problem
Based on the previous analysis of the equipment integration and access problems of the intelligent IoT platform for electrical equipment, the industry characteristics and the complex conditions of various industrial, communication, and network protocols should be fully considered, and cloud computing, big data, Internet of Things, mobile Internet, and artificial intelligence and blockchain have established solutions that include direct access and indirect access, which are two device integration access methods.

Direct access: Conventional electrical equipment can be divided into two types: CNC and non-CNC. CNC electrical equipment can be directly connected to the smart IoT platform through the industrial Internet gateway; non-CNC electrical equipment can install smart collection terminals and connect sensors in the equipment, and directly access the smart IoT platform through a customized switch.

Indirect access: The electrical equipment first forms a network locally and connects to the company's local production management system and equipment status monitoring system. After that, the smart IoT platform is integrated with the local information system to realize the indirect access of electrical equipment.
6.2. Data collection, integrated problem solution
1) Adopt various data collection methods and data visualization tools

In terms of data collection, a variety of data collection methods can be used: such as TCP/IP protocol Ethernet mode, general Ethernet mode, data collection card, configuration software collection, RFID mode and manual auxiliary mode, etc.

2) Establish a heterogeneous data integration algorithm

To realize the application of the intelligent IoT platform for electrical equipment, it is necessary to first realize the integration of multiple heterogeneous data of electrical equipment. Considering the actual needs of the platform, a corresponding heterogeneous data integration algorithm can be established based on XML (eXtensible Markup Language, extensible markup language) data exchange technology. XML is a markup language that can structure electronic documents and data. It can be used to describe heterogeneous data and analyze it for data interaction. In this algorithm, first define the heterogeneous data categories that need to be integrated, and then define the XML parsing script for processing the data of the category according to the category.

6.3. Platform standardization problem solution

Sort out the current status of the development of the industrial Internet and its application standards at home and abroad, and combine the development needs of the electrical equipment industry, a standard system architecture for the industrial Internet is proposed, which is constructed and analyzed from the three standard directions of basic commonality, key technologies and application services.

Basic commonality is the prerequisite and basis for the development of standards, which mainly regulates versatility and systemic performance requirements. The key technical standards start from the application service requirements and plan the relevant technical applications involved in the construction of system services. The application service standard mainly regulates the application service implementation goals, technical requirements and construction process of the platform. The specific standard system architecture of the intelligent IoT for electrical equipment is shown in Fig.2:

![Fig. 2 Standard System Framework of Intelligent IoT for Electrical Equipment.](image)

6.4. Solutions to Industry Collaboration Problems

In the application of the intelligent IoT platform for electrical equipment, with the help of artificial intelligence, big data analysis, virtual factory and other technologies, the whole business data integration and analysis control model is used to conduct integrated analysis and collaborative management and
control of the information and data of each link, and build a full cloud. The service process of the industrial chain forms a new industrial interconnection ecology of smart IoT, improves the level of automation, improves production efficiency, and saves labor costs. The specific service process is shown in Fig. 3. According to the overall process of the whole industry chain service implementation described in the figure, process organization and process configuration are carried out, which realizes the connection between the supply and demand of the electrical equipment industry and the cloud collaborative manufacturing Support services for the entire industry chain.

![Flow chart of the whole industry service of the electrical equipment industry](image)

Fig. 3 Cloud service process for the entire industrial chain of the electrical equipment industry

6.5. Platform security problem solution

On the basis of realizing business functions, taking into account technical and economic efficiency, based on encryption authentication technology, adopt security warning, data encryption, data desensitization, behavior analysis and other measures, from boundary security, host security, data security, application security, network security, and security Several aspects such as management establish a platform security protection plan to ensure the stable operation of the platform, as shown in Fig.4:
7. Conclusion

This paper conducts corresponding research on the realization and application verification of the intelligent IoT platform for electrical equipment, mainly analyzes the problems encountered in the implementation process, and proposes corresponding solutions and solutions for each problem, which is the intelligent IoT platform for electrical equipment. Provide reference for the construction and development of the project. In the process of platform implementation and application, there are corresponding problems in device integration access, data collection and transmission integration, platform standardization, industry collaboration, and platform security, such as the diversity of access devices, the heterogeneity of data, and protocols. Therefore, we use edge computing, data processing, big data analysis, secure collaborative transmission and control and other corresponding technologies to propose corresponding solutions, and then provide technical solutions for the promotion and application of the intelligent IoT platform for electrical equipment on the support.

Through the application research of the intelligent IoT platform for electrical equipment under the Industrial Internet, we have discovered some problems in the implementation and application of the platform. These problems not only appear in the application process of the intelligent IoT platform for electrical equipment, but also it also exists in other research systems that aim to create a "modern smart supply chain". Here we put forward key technologies and solutions to solve the problem, which not only paved the way for the promotion, application and development of the intelligent IoT platform for electrical equipment, but also created an entire research system for the industrial Internet-oriented "modern smart supply chain". contribution.

The development of the intelligent IoT platform for electrical tooling under the Industrial Internet provides new ideas for building a "modern smart supply chain". Intelligent IoT systems in the form of platforms will appear in all walks of life in the future, and the idea of the Industrial Internet will also combine with the new generation of information technology to provide new power for the upgrading and transformation of traditional industries. Future research will not be limited to the field of electrical equipment. The application research of smart IoT platforms will be extended to other fields. The smart supply chain system supported by big data, networked sharing, and smart collaboration will flourish in other industries.
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