Development of intelligent warehouse management system
based on Internet of things technology

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Abstract. With the development of electric power enterprises, the types and quantity of storage management materials are also increasing. With the rapid increase of warehousing frequency, warehousing management is very complex and diversified. The traditional manual warehouse operation mode has been difficult to meet the rapid storage management, which will seriously affect the operation efficiency of enterprises. By improving the intelligent warehouse management system, we must use RFID application technology, visualization technology, etc., which will improve the efficiency of material management. By reducing the cost of material management, we will achieve the optimal management of warehouse materials. Firstly, this paper analyzes the development trend of storage management and RFID technology. Then, the whole idea of system design is established.

Keywords: intelligent warehouse management system, Internet of things, Electric enterprise

1. Introduction
With the promotion of the integration strategy, power generation enterprises will face more severe challenges in the market. Warehouse management process is an important part of power generation enterprises, its accuracy and efficiency will directly affect the efficiency of enterprise management. Therefore, we must ensure that the timely and accurate inventory management is closely related to the operating efficiency of the enterprise. At the same time, power plant equipment and materials have many characteristics, such as large quantity, large amount and high safety. Traditional material management relies heavily on manual and paper operation mode, which can’t meet the needs of efficient, accurate, intuitive and convenient management [1]. By adapting to the severe market competition environment, we can reduce energy and increase efficiency, which requires improving the efficiency of material management. By reducing the cost of warehouse management, we can achieve management upgrading.
2. The development trend of storage management and RFID technology

2.1 Storage management trend of electric power enterprises
With the rapid development of Internet and information technology, electric power enterprises can improve their management level by using various software and information processing technology, which has become a trend. First, through information technology, we can automatically capture, identify and process inventory information. Second, through visualization technology, we can ensure that the material status can be read and queried at any time. Third, through intelligent means, we can automatically judge and screen, which will improve work efficiency [2].

2.2 Composition of RFID technology
Radio frequency identification (RFID), commonly known as "electronic tag", is a non-contact automatic identification technology that can automatically identify target objects and obtain relevant data through radio frequency signals. It has many advantages, such as high reliability, large storage capacity, convenient storage information change, etc. Typical RFID system is mainly composed of electronic tag, reader and application software system, as shown in Figure 1.

![Figure 1. Typical RFID system](image)

2.3 RFID technology principle
RFID uses RF signal to realize contactless information transmission through space coupling, which will achieve the identification purpose through the transmitted information. When the RFID system works, the reader sends out a query signal. After receiving the inquiry (energy) signal, part of the tag (passive) is rectified to DC power supply for the circuit in the tag to work. Part of the energy signal will be sent back to the reader after being modulated by the data information stored in the electronic tag.

3. Development of intelligent warehouse management system

3.1 Overall idea of system design
Optical wireless switching technology is the core technology of intelligent warehouse management system based on Internet of things technology. RFID technology and wireless sensor technology are the media of information exchange between warehouse management system and goods. Through RFID technology, we will realize the real sense of automation and intelligent warehouse management system. The system design is not only to realize the warehousing, query, bookkeeping, delivery and other functions of the General warehousing management system, but also to realize the intelligent functions of the intelligent warehousing, such as real-time monitoring, automatic warehousing, automatic warehousing, automatic matching, time tracing, automatic information acquisition, etc [3].

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The whole network system divides the network into three layers: sensor layer, network layer and application layer. The schematic diagram of intelligent storage system based on Internet of things technology is shown in Figure 2.

![Schematic Diagram of Intelligent Storage System](image_url)

**Figure 2.** The schematic diagram of intelligent storage system

### 3.2 Function Introduction of Intelligent Storage System

The functional architecture of the intelligent storage system is shown in Figure 3.

![Functional Architecture of Intelligent Storage System](image_url)

**Figure 3.** The functional architecture of the intelligent storage system

#### 3.3 Warehousing Management

Receipt: the system supports receipt and receipt operations in various business processes and business scenarios. The warehouse administrator is based on the delivery note information, which includes the purchase order number and other information. Pick up the goods quickly through the handheld scanning terminal. After the received goods are put into the waiting area, the user department shall be informed to inspect the goods on site. Acceptance management: according to the acceptance indicators, the warehouse keeper and relevant departments jointly complete the acceptance. The material acceptance record shall be printed by the hand-held terminal control printer. At the same time, the staff will take out the electronic signature of the acceptance personnel. Warehousing and putting on shelves:
after the acceptance, the warehouse administrator realizes one key warehousing and putting on shelves at the handheld terminal. By comparing the material information with the existing inventory, the system intelligently recommends the best bin for the warehouse administrator to choose [4]. At the same time, the staff shall hold the terminal to control and print the material code and bin code label of the materials, and record the material photo, material name and specification, arrival date, warranty period, quantity, batch number, maintenance information, manufacturer / supplier, storage location and other information.

3.4 Outbound management
Outbound: random QR code scanning information, the system automatically calculates the next bin picking path, which completes the outbound work. According to RFID card identification, we will track the situation of material ex warehouse, recycling, scrap, etc., which will manage the whole life cycle of materials, and provide data basis for analyzing the cost performance of imported, domestic and different brands of materials. Batch issue: the system supports reservation picking. The warehouse administrator can process the work order in batch through wave management and remove it from the shelves uniformly. The picking person receives the material directly on time without waiting. Optimization management of on shelf and off shelf path: identify the destination on the plan of the storage area and shelf by combining the warehouse function area, storage area, storage type and shelf identification with the on shelf and off shelf tasks of the system, and install the picking indicator light on each shelf to optimize the on shelf and off shelf path and improve the efficiency of the operators in and out of the warehouse. Cross warehouse management: cross warehouse management is mainly used for one-step delivery, inspection, receipt and delivery on site. It includes receipt and delivery of goods across the warehouse, result query, PDA download / upload, single step adjustment (exception handling).

3.5 Operation management in the warehouse
Bin sorting: in the system, you can directly drag the corresponding icon and confirm to complete the system dump. Inventory counting: carry out planned inventory of materials according to the specified warehouse, shelf, warehouse area and storage location, including initial inventory, re inventory, write off and profit and loss processing, etc.; carry out spot sampling of inventory materials, including initial inventory, re inventory, write off and profit and loss processing, etc., and generate reports systematically after inventory counting, which shall be reviewed by relevant departments.

4. Conclusions
The enterprise storage management system based on the Internet of things technology has a significant advantage over the traditional storage management mode. At present, the cost is high, and cannot be popularized nationwide. With the development of computer and network technology, the system will have a broad market prospect, which will become the mainstream system of enterprise storage management in the future.

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