

Research on Intelligent Warehouse Management System Based on RFID

Ma Junhong^{1,*}

¹*Xi'an International University, Xi'an, Shaanxi, China, 710077*

**Corresponding author. Email: maxiaofei913@163.com*

ABSTRACT

The research of warehouse management system based on RFID technology plays an important role in the information processing of logistics industry in China, and has a great impact on the accuracy of warehouse information storage management. In this paper, the related technology of warehouse management system is studied, the intelligent warehouse management system based on radio frequency technology is built, and the software and hardware system is designed. The application of this intelligent system will reduce the manual workload, make the inventory statistics and management more efficient, convenient for relevant personnel to query and use, and also provide the procurement department with more reasonable procurement strategy to provide real-time updated accurate reference data, energy saving and efficiency improvement.

Keywords: *Internet of Things, logistics, warehousing systems, RFID technology.*

1. INTRODUCTION

For logistics management, the establishment of a more warehouse management system is very necessary in the system, one is because of warehouse management system in the whole logistics supply chain plays a vital role, the other is for warehouse management system is a link between producers and consumers, to the entire logistics system and even economic development plays an important role. For the present logistics management system in China, it is mainly divided into two categories: one is the information management realized by the combination of traditional information management system and artificial memory; the other is the automatic warehouse management system that USES electronic label to completely replace the barcode on the goods. Among them, the first method is relatively time-consuming and labor-intensive, and it is easy to have problems in the actual use process, which not only greatly affects the correctness of the storage of warehouse information, but also reduces the efficiency of the storage work to a large extent, and also has a certain impact on the development of the enterprise. The second method is relatively better. Using electronic label to replace the barcode on the goods automated warehouse management system, to a great extent, increases the speed of inquiry and the accuracy of inventory count, and also improves the speed of goods flow in and out of storage, which provides a good help for the management and record of logistics information.

2. RESEARCH BACKGROUND

2.1. Research status at home and abroad

The logistics industry is known as the "gold industry" in the 21st century. As an important link of logistics, warehousing has been exploring in the direction of intelligence. At present, China is vigorously carrying out economic construction, all the research and work should serve for the overall construction goal of the country. Warehousing is an important part of economic construction at present. Intelligent warehousing management can not only promote the production efficiency of enterprises, but also better meet the supply demand of the market. Modern warehouse management system needs to be a dynamic, real-time control and supervision of intelligent integrated service system with innovative perception, reasoning, checking and problem solving capabilities. Many companies have already took the lead in foreign production manufacturing application of the intelligent warehouse management technology, such as vehicles and aircraft manufacturing, to manage the vehicle on nearly 100000 parts, guarantee the production without omissions, more and more domestic manufacturing and logistics enterprises and research institutes of aeronautics and astronautics in the application and related technologies for different scenarios, to improve the management level.

With the development and popularization of sensor equipment, embedded system and wireless communication, Internet of Things (IOT) technology has received great attention and widespread application all over the world. For example, smart home, smart electrical

appliances, and even smart factory, goods have the ability of network interconnection, and realize some automatic opening, playing, recording and other functions through remote operation of instructions. The radio frequency identification technology, RFID technology is the Internet important members of the core technology, and its main function is through the non-contact automatic identification technology to identify information sources and so on, namely through radio communication, realize the tag identification number as well as the data memory read and write operations, and also have the ability to identify multiple tags at the same time. Therefore, its application in the warehouse management system not only effectively promotes the correctness of warehouse information, but also plays a positive role in the processing of goods flow information.

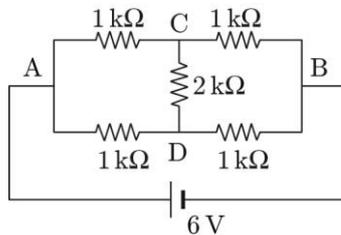


Figure 1 (a) Probabilistic automata M_1 (b) probabilistic automata M_1 and (c) DFA P^{err} for the safety property P

2.2 The basic architecture of RFID technology

RFID technology is radio frequency identification technology, that is, people often used in life electronic tags. In the field of technology application, the electronic module in the initial stage is carried out by the transponder for information transmission and reply, but with the development of science and technology in China, the transponder has been improved and gradually known as smart tag or electronic tag. Its main function is to identify information sources through non-contact automatic identification technology, that is, through radio communication, to achieve the label identification code and memory data read and write operations, and also has the function of identifying multiple labels at the same time. Therefore, its application in the warehouse management system not only effectively promotes the correctness of warehouse information, but also plays a positive role in the processing of goods flow information. For example, the current RFID technology is gradually being used in the transportation and management of military logistics, which plays an important role in reducing the cost of military materials and improving the combat effectiveness of the military. In the case of the Iraq war, the US military realized the tracking of logistics by loading rf satellite chips on the containers in the Gulf, and then fully realized the control of the operational process, which greatly improved the combat effectiveness of the military.

RFID technology uses radio frequency signals to realize contactless information transmission through space coupling (alternating magnetic field or electromagnetic field) and to achieve the purpose of identification through the transmitted information. Generally speaking, RFID system is composed of transmitter, receiver, microprocessor, antenna and label. Transmitters, receivers and microprocessors are usually packaged together, collectively known as readers (Readers), so RFID systems can be divided into three groups: readers, antennas and tags. RFID works in a similar way to radar. At first, the reader sends out electronic signals through the antenna, the tag transmits the internally stored identification information after receiving the signals, and the reader receives and recognizes the information sent back by the tag through the antenna. Finally, the reader sends the identification results to the host.

2.3 Intelligent warehouse management system structure based on RFID

The system is composed of three parts: item information recognition channel, face recognition fingerprint password access control system and warehouse management integrated software system. The channel can automatically identify the item information when the device enters and leaves the warehouse, without manual registration, improving work efficiency. Face recognition fingerprint password access control system can prevent irrelevant personnel from going in and out of the warehouse at will, improve the level of security management of the warehouse. The warehouse management software system can realize the statistics of material warehousing, lending, inventory quantity, location, user information, calibration inspection expiration reminder and other functions. The three parts cooperate with each other to realize the automatic management of material taking and returning. The authorized user information will automatically match the material information recorded in the channel through the fingerprint access control system, so as to realize the automatic record of personnel and equipment in and out.

The main interface of the system has three main functions: administrator login, location query, goods in and out of storage, which can display some information (such as personnel information, personnel passage record, temperature and humidity monitoring information, etc.).

1) Administrator login module: This module can realize that different users (administrator users or ordinary users) have different permissions.

Ordinary users can only browse and modify personal information.

The administrator user interface shall contain the following functions: staff management, warehouse management, expiration reminder, device management, device access record function.

2) Employee management: adding, deleting, modifying and checking the company's department information and employee information.

- 3) Warehouse management: add, delete, modify and check the warehouse information.
 - 4) Expiration reminder: Modify and check the inspection information of the instrument.
 - 5) Dangerous goods management: The management of dangerous goods requires the addition, deletion, modification and inspection of articles.
 - 6) Entry and exit records of dangerous goods: it is necessary to check the entry and exit of goods and their basic information in real time.
- In addition, Excel can be exported for the employee table, dangerous goods table and dangerous goods inbound and outbound records.

2.4 The Application fields

The system has the functions of automatic correlation of personnel and equipment information, automatic record of equipment in and out of storage, automatic display and reminder of storage location, etc., and it can cooperate with the access control system to ensure the safety of the warehouse and improve the management efficiency of dangerous goods.

The rfid technology adopted can also be applied in the following areas:

- 1) automatic production areas;
- 2) better settlement contro;
- 3) products anti-counterfeiting field;
- 4) authorization information management;
- 5) reduce supply chain cost.

The Internal structure of hardware system

RD542 reader, infrared sensor module, power supply and computer communication interface board and buzzer are installed in the main antenna equipment box. RD542 is the core component of the whole set of channels.

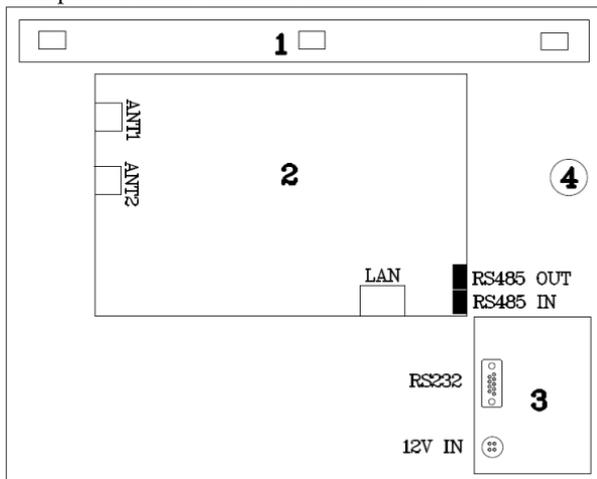


Fig.1 The Internal structure of main antenna

The illustration:

- 1. Infrared sensing module;
 - 2. RD542 reader;
 - 3: Main antenna power supply and computer communication interface board;
 - 4: Buzzer;
 - ANT2: Connect the secondary antenna rf feeder;
 - RS232: Main antenna and computer communication interface, computer RS232 interface, serial port line connection;
 - 12V IN: the main antenna power supply 12V input interface, the 12V OUT interface for connecting the secondary antenna, and the aviation head power cord connection;
 - LAN: Network connection port;
 - RS485 IN: The synchronous line interface, the RS485 OUT interface connecting the main antenna of the adjacent channel, and the RS485 synchronous line connection;
 - RS485 OUT: The synchronous line interface, the RS485 IN interface connected to the main antenna of the adjacent channel, and the RS485 synchronous line connection.
- A DC 12V power adapter, a RADIO frequency line and a DC 12V power interface are installed in the sub-antenna equipment box. The internal structure of the secondary antenna is as follows:

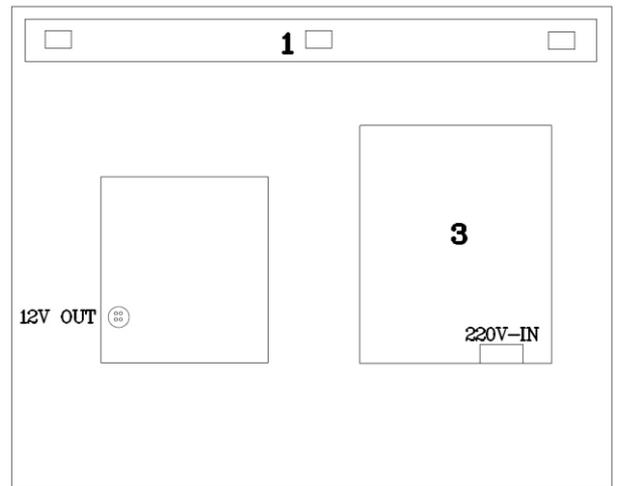


Fig.2 The Internal structure of the secondary antenna

The illustration:

- 1. Infrared sensing module;
- 2: DC 12V power supply output board;
- 3: AC 110 ~ 240V power input board;
- 12V OUT: DC 12V power output interface, 12V IN interface connected to the main antenna;
- 220V-in: AC 110 ~ 240V power input interface.

3. CONCLUSION

Intelligent warehouse management technology based on RFID can not only be used for the management of instruments and electronic components, but also has rigid demands in scientific research institutes and automated production enterprises such as vehicles, ships, aviation,

aerospace and other manufacturing fields. It is a very good application scenario of RFID in the Internet of Things. In some military applications, it can meet the safety information management needs of dangerous goods, and can be used in the information storage system of dangerous goods and weapons, so as to solve the current information management of military weapons and equipment and civilian dangerous goods. It can be checked on the Internet to prevent accidents. Improve the safety level of dangerous goods storage and logistics, the whole process is controllable. In the event of a safety accident, the cause of the accident and the types of articles can be determined as soon as possible, and targeted measures can be taken to ensure the safety of people's lives and property.

REFERENCES

- [1] Pei Yingmei. Research on construction of Warehouse Management System based on RFID technology [J]. *Science&Technology Vision*, (2019)
- [2] Zhang Xinyu. Application of RFID technology in Warehouse Management [J]. *Automation and Instrumentation* (2017)
- [3] Dai Xiaorui. Design and Application of materials Procurement Tracking System based on TWO-DIMENSIONAL code Internet of Things Technology[J]. *Digital Technology & Application*, (2019)
- [4] Li Jun. Research and design of intelligent monitoring system of dangerous goods transportation based on the Internet of things[D]. *Chang' an University, Xi' an*, (2018)
- [5] P. Xu, Y. Su, Design and Implementation of landscape system for East and West Huashi Street in Beijing based on virtual reality technology, *Applied Mechanics and Materials*, 263(2012)1849-1852.
- [6] Geng C., Zhao Z., Xue Z.; Xu P., Xia, Y., Preparation of Ion-Exchanged TEMPO-Oxidized Celluloses as Flame Retardant Products *Molecules*, , .24(2019)947