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Radio frequency identification review and development prospect research

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Abstract. Based on the existing literature and data, this paper starts from the principle of radio frequency identification technology, analyses the situation of the application field of RFID and predicts its development prospect. The results show that RFID technology is a kind of technology that uses the transmission characteristics of RF signals through space alternating electromagnetic coupling to identify targets and thus realize rapid automatic identification. Since it was developed and used in warfare in the mid-twentieth century, RF identification technology has developed rapidly and developed a variety of applications. Today, with the development of electronic technology and communication technology, RF identification technology already has a wide and irreplaceable role in medicine, military and food safety. It is not difficult to imagine that with more joint applications of new technology, radio frequency-related algorithm improvement, radio frequency tag price reduction, and other conditions, the technology will have a more extensive and profound application in the future.

Keywords: RFID, healthcare, algorithms, radio frequency.

1. Introduction

RFID originated during the Second World War. In the following 100 years, with the support of governments and capital, RFID technology quickly developed in the civil field [1]. RFID technology is in a stage of rapid development, is considered to be the most promising new technology in the 21st century, has a broad development prospect and higher speed development situation. Scholars at home and abroad have also carried out extensive and in-depth research on this technology and its applications. In foreign countries, various relevant research institutes and industry giants have already carried out lasting research on this aspect. For example, Intel, Microsoft, IBM and other companies have developed and designed a wide range of varieties in the field of RFID, which has formed a perfect industrial chain from middle low frequency to ultra-high frequency, middle low to high end, and from high cost to low cost [2]. At the same time, governments around the world are also actively introducing preferential policies, which strongly promote the development of the industry. Although there is still a gap between China and foreign countries in the RFID cutting-edge field, in a few fields, such as tag anti-conflict, antenna precision processing, design and manufacturing pipeline research has gradually surpassed the predecessors. At present, the volume of RFID tags is getting smaller and lower, and the price is getting lower and lower. It can be seen that RFID technology will have a greater application prospect and market in the future. At present, the research on RFID at home and abroad is mainly limited to specific application cases, and there is a lack of systematic review. For example, Zhang Yongcai et al. conducted

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research on literature location big data perception methods based on RFID technology; Kong Chunming et al. conducted a systematic study on RFID system clone label detection methods [3, 4]. The purpose of this paper is to analyze the status quo of RFID technology, conduct a systematic review of some application fields of RFID, and predict the future development direction of the technology.

2. Overview of radio frequency identification technology (RFID)

Radio frequency identification technology is a combination of electromagnetic theory application, antenna technology, wireless transceiver technology, microwave technology, and data encoding and decoding technology.

2.1. RFID system

A common complete RFID system consists of electronic tags, readers, antennas and application software systems (as shown in figure 1).

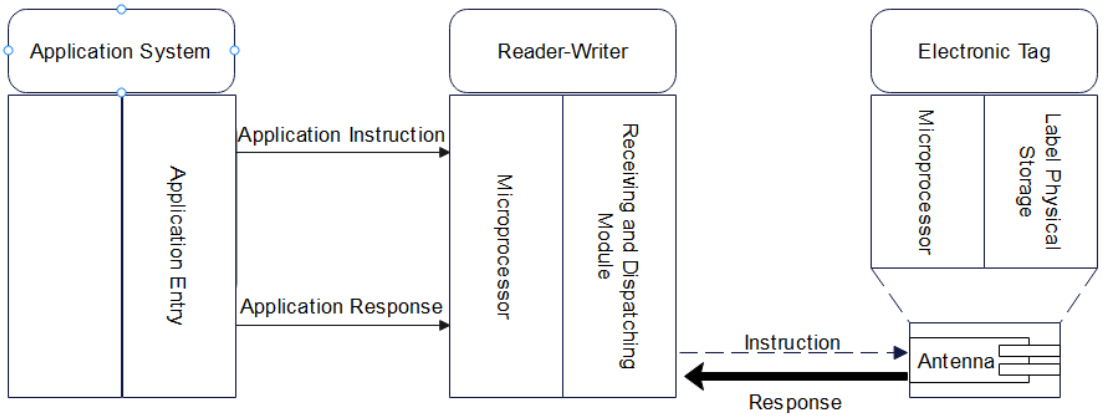

Figure 1. Components of RFID system.

Electronic labels mainly include radio frequency interfaces and chips. The specific structure is shown in figure 2. In the transmission of information, the electronic label is placed on the object to be identified, and the encoded data information is received and sent through the antenna and reader. According to the different sending and receiving frequencies, electronic labels can be divided into low frequency, high frequency, ultra-high frequency, and microwave frequencies. According to the power supply, electronic labels can be divided into passive, semi-active and active types. Different kinds of electronic tags have different reading distances, service lives and costs.

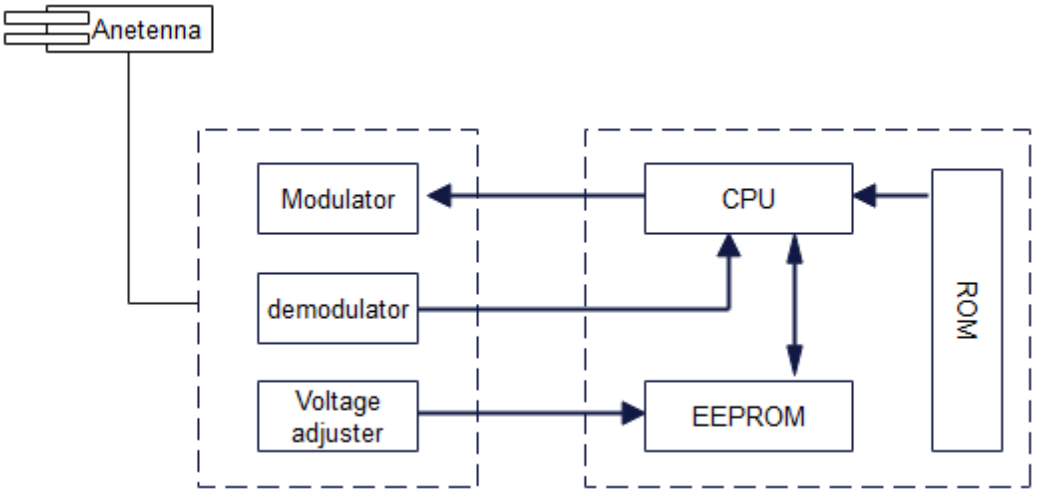

Figure 2. RFID electronic tag structure.

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The reader is mainly used to receive and write information to the electronic tag. Wireless communication through antennas and electronic tags, as well as data storage and management functions. Compared with electronic tags, readers can provide more storage and processing power, and have better security and privacy. Antenna is mainly divided into electronic tag antenna and reader antenna. RFID uses electromagnetic wave for communication, and the transmission and reception of electromagnetic wave need to be carried out by the antenna.

The application system is mainly used to transmit application instructions, respond to and explain the information sent by the reader writer. The working process can be summarized as follows: (1) The reader sends a specific signal in the recognized area; (2) After the electronic tag in the identified area is energized, it will transmit the information and data it carries to the reader via the antenna; (3) The reader uses the antenna to receive the marked information, and then transmits it to the reader-writer through the RF interface, and then carries out demodulation and decoding, and then transmits the processed information to the main application program; (4) The main application software system operates on different instructions correspondingly, and stores the processed information [5].

2.2. Current problems of RFID

Conflict is an important factor affecting the efficiency and accuracy of RFID. At present, the identification conflict in RFID technology is mainly divided into tag conflict and reader conflict. When more than two readers read and write the same label, reader conflict often occurs. Tag conflicts occur when multiple tags simultaneously respond to the same reader. At present, there are two main anti-collision algorithms: ALOHA algorithm and binary tree algorithm. Among them, the ALOHA algorithm is widely used for its strong logic and low complexity. However, the algorithm still has some defects such as low channel utilization. Therefore, how to improve the existing algorithm or propose an efficient new algorithm will become the development trend in the field of RFID conflict prevention in the future. Secondly, as a practical technology, RFID is widely used in various fields and provides benefits as a commodity. Whether the production cost of RFID can be reduced determines whether the technology can be more widely used. The cost of RFID is mainly concentrated in the hardware component, including antennas and electronic tags. How to reduce the cost of hardware production and assembly has become the key to the wider application of RFID. Thirdly, RFID wireless communication and automatic identification mode make it a high requirement for accuracy. In some special environments, RFID tags are prone to pollution and corrosion. At the same time, some radio-based technologies will interfere with RFID system communication and affect data transmission. Therefore, in the process of RFID practical use, need to consider the relevant issues [6]. Finally, with the increasingly extensive application of RFID in the military, finance, security, and other important fields, its own security issues are also receiving more attention. At present, physical layer security technology such as RFID tag security technology and software technology such as RFID security cryptographic protocol are mainly used to protect against these security problems [7]. However, with the improvement of the attack level, it is necessary to update and improve RFID system security measures to ensure the security of data and information.

3. RFID application field analysis

As a practical technology, RFID has a wide range of applications. This paper will provide an overview and analysis of some major areas:

3.1. Medical field

In the field of medicine in the United States, for example, medical errors cause between 48,000 and 96,000 deaths each year. In the place of poor health conditions, which are more serious, the cause of this situation is the lack of medical knowledge, information collection, and identification errors, so there is a greater need for a scientific and reasonable health management system so as to greatly reduce the occurrence of such errors [8]. With RFID technology, we can quickly and accurately read, write and transmit medical equipment and patient information to the computer management system, and rely on

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the computer for analysis, processing, classification, storage, backup and other operations, so as to more accurately match the demand with the supply of medical resources. Compared with the traditional bar code, RFID technology has obvious advantages in the registration and update of medical devices. RFID technology can accurately and quickly read tag information, and does not need to be located in a specific area, so the application of RFID technology in the medical field will be very promising. The combination of RFID and medical information management system can make the registration and update of all kinds of medical supplies and personnel information more convenient and faster, so as to effectively reduce medical accidents caused by information errors.

3.2. Daily diet

In terms of daily diet, take fruits and vegetables as an example, which are indispensable food components in people's daily life. However, since fruits and vegetables need a long period of storage and transportation from the field to the table, all kinds of fruits are perishable and spoiled in the process, and there will be a large amount of loss in the circulation process, so the cost often accounts for about two thirds of the last, which has not only hindered the sustainable development of the industry, but also brought hidden dangers to the food safety of consumers. In order to ensure the quality and safety of fruit and vegetable products, domestic and foreign manufacturers have adopted RFID technology to trace the origin of fruits and vegetables. Taking Xinjiang melon as an example, the manufacturer created the Xinjiang melon traceability system. The system uses RFID technology, two-dimensional code technology and combines information base technology and network technology to collect detailed data on various links of cultivation, origin procurement, packaging, logistics and sales of Hami melon fields, which can help government departments to better supervise the quality of cantaloupe [9]. The quality of the melon can be improved by enabling consumers to better grasp the information they need, which also increases consumer confidence in the quality of the product. At the same time, RFID technology can be combined with other technologies to establish a traceability system of fruit and vegetable cold chain logistics. The system includes fruit and vegetable production, wholesale, logistics, sales, monitoring, tracing, inquiry and other subsystems, and carries on the classification and management [10]. Each subsystem can not only be planned as a whole, but also has the corresponding information base, which can be independently played.

4. Analysis of RFID development prospects

At present, the development of RFID technology is also facing a lot of difficulties, especially in China. Due to the late development, the most critical chip module of RFID technology has not yet reached scale, and there is a lack of relevant cutting-edge technology [11]. But in spite of many difficulties, the domestic market still does not give up on chip updates and research. Secondly, the degree of standardization is low, and the technical standards are difficult to unify. Although the United States, the European Union, and other economies have issued relevant standards, there are also gaps between the standards, which makes product development and application positioning confusing. Thirdly, different from the pattern of two-dimensional code and bar code, the information transmission between the reader and the label is easy to interfere with each other, which often causes problems such as not being able to identify the label or identifying the wrong label. Finally, compared with conventional identification methods, high cost makes RFID products less competitive, and it is still necessary to develop more inexpensive and improved methods [12]. Radio frequency identification technology has more than 70 years of development history. As a practical technology with strong application ability, it should be further developed. It not only requires a theoretical breakthrough, but also needs to form scale, industrial upgrading, so as to reduce production costs and improve the scope of application. All this requires policy support from the government and clear standards from the scientific community to improve the degree of standardization.

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5. Conclusion

This paper mainly introduces the general situation of radio frequency identification technology and analyzes the current technical pain points of RFID, such as that the problem of conflict prevention is difficult to completely solve, the production cost is high, and the security still needs to be further strengthened. The future development direction is also pointed out from the medical, diet, and three specific areas of analysis. However, limited by the current research level and scientific applications, the prediction of the development of this technology is inevitably not accurate enough. However, it is not difficult to find from the analysis that the application scenarios of RFID will be further expanded with the continuous addition of new technologies in the future. RFID-based electronic tags may replace the most commonly used paper tags, becoming a new trend in the field of unlimited identification. This article is currently an analysis based on existing literature and data, and future research will conduct empirical analysis in conjunction.

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