# Research on the Application of RFID Technology in Modern Laboratory Management under the Background of Internet of Things

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**Abstract:** A laboratory equipment management platform based on the combination of ZigBee and RFID technology is designed. Through this platform, the management of experimental instruments and students can be realized. ZigBee sensor network is used to search devices and devices, RFID technology is used to identify users. The device can determine whether it can be used according to the result of user identity confirmation, and record the method used for inspection and tracking. RFID reader uses 13.56 MHz RFID chip RC 522 of NXP, ZigBee system uses ti's 2.4 GHz SOC chip CC 2530 for packaging. The experimental results show that the system design is stable, the device location is accurate, the RFID read speed and write speed are very fast, the recognition rate is high, the network stability is good, and the adaptability is strong.

## 1. Introduction

With the continuous expansion of the school, more and more research institutions have been established. The traditional experimental equipment, equipment, consumables, maintenance management and contribution management information system of these equipment and consumables have not been established. Through manual processing, error and equipment loss rate, the management process of equipment and equipment is easy to fill. It can easily manage the network development of continuous network technology, the combined solution of RFID and ZigBee technology and the experimental device. RFID is a non-contact automatic identification technology. In order to realize the automatic recognition of static or moving targets, space coupling transmission is used, and the characteristics of radar reflection or RF signal are used. ZigBee technology is a kind of wireless communication technology[1]. Bidirectional, low price, low power consumption, near range, low complexity, low speed and other significant features. This is suitable for monitoring, automation, remote control, sensors and other fields. Embedded in various devices and devices. Based on RFID and ZigBee technology, the management of experimental equipment and students is implemented. ZigBee sensor network is used to identify the location of the equipment, and the status information of the equipment is sent to the control center through ZigBee technology. The control center can also be an acceptable global control setting published by the host computer. RFID technology can identify the user's identity information[2]. The device can record the usage method and determine whether it can be used according to the result of user identity confirmation. The historical usage method of the device is to search the query of damaged device.

## 2. The Development of the World New Technology Revolution has Pushed the Internet to the Climax of the New Communication Technology

Specifically, it integrates other technologies such as "smart city" and "green tourism", so that it can penetrate into various industries and gradually apply Internet technology. The function of traditional university research room system is single. On the other hand, it can realize simple theft

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of equipment and appliances. On the other hand, it's just system management. Do not merge multiple functions. At the same time, most of the anti-theft equipment in the laboratory is limited to high-frequency RFID and cannot be monitored. In addition, in terms of laboratory management, although the previous manual management form has been adopted, even though some universities and colleges have formulated modern management laws, due to the situation of the laboratory, the current safety performance of the research institute is relatively weak. In addition, the anti-theft effect is not ideal. First, it is just to prevent employees from entering the laboratory for theft, but the laboratory equipment and instruments are not monitored, and the safety performance is poor. Second, the application is RFID Based High-Frequency anti-theft, with a general distance of about 0.5m, which has many limitations[3]. If universities continue to adopt the two methods, the loss will be greater and greater. When traditional employees enter the laboratory to use the equipment, they need to get the permission of the registration manager after they agree to use the equipment. This program is very troublesome, and it is difficult to record the use of the equipment under the corresponding conditions of the device. The maintenance performance of the equipment is poor. Through the registration method, it is impossible to know which device the manager is using, but after entering the research room, the manager can use the device more freely, so it is difficult for the manager to maintain and manage the device. The related consumables and modules of the research lab are basically not managed by people, lack of order, low efficiency, and prone to loss, which is the result of some degree of university laboratory resource waste. With the popularization of network technology in urbanization, it provides a correct direction and a powerful platform for the development of various university research rooms. Through the integration of single technology and Internet technology, the informatization of University and university research office management is realized. In view of this situation, a laboratory anti-theft management system based on uhf-rfid is developed, which can realize all-weather monitoring of laboratory environment and scientific management of intelligent information.

## 3. System Planning and Design

Based on RFID and ZigBee technology, the system platform has accumulated research experience of similar systems at home and abroad. The system RFID reader is designed to use the 13.56 MHz RFID chip RC 522 of NXP, and the ZigBee wireless sensor network uses the 2.4 GHz system level SOC chip of us ti. Balance.

Table 1 B group equipment identification rate

| | | | | | | |
|---|---|---|---|---|---|---|
| Number of devices in group A | 50 | 50 | 50 | 50 | 50 | 50 |
| Number of devices in group B | 1 | 10 | 20 | 30 | 40 | 50 |
| Number of group B equipment identification | 1 | 10 | 20 | 30 | 39 | 49 |
| Recognition rate | 1 | 1 | 1 | 1 | 0.497 | 0.98 |

### 3.1. Main Functions of the System

The main functions are as follows to protect the safety of the machine. When the equipment and device leave the safety range, the visual alarm will be activated within the time; the user only needs RFID identification before using the equipment, and then the equipment can be used after confirmation. When the device is forced to disintegrate, the visual alarm will start immediately when it can be heard.

### 3.2. System Framework Design

The system is mainly composed of control center, communication module of wireless sensor network based on ZigBee, equipment equipped with ZigBee and RFID, access control RFID and display part. The control center module is the Windows NT operating system. The control center environment is operated by VC software[4]. The system of X 86 is used as the platform, and the software development application framework based on MFC is used as the control center. Based on

the IEEE 802.15.4 standard of zstack-2530 CC protocol stack of Texas Instruments, according to the wireless sensor network communication component, in order to maintain the set wireless sensor network, the communication and node are being developed to complete the control function. Zu - ZigBee node and Ti - SOC single ZigBee chip are connected and use 2530cc, circuit diagram and peripheral devices. CC 2530 is an extended 8051 processor based on unified and real system level chip industry standard. The sensor is used to detect the information position and state of the experimental device including pressure, vibration, displacement and other sensors. RFID places the green on the pole, and the user can confirm using the instrument through authentication. RFID reader uses NXP's RC 522 chip to design the reader circuit. Because the original RC 522 chip with low price is easy to develop and use, it is very suitable to develop RF card terminal ahead of credit card. During use, the display section is used to display the status information of the system. In order to protect the safety of the equipment, this system can run on the musical instrument[5]. Only some simple LED status indicators and sound are needed to indicate the operation status of the system. LED status display is used for system debugging.

### 3.3. Design of System Communication Protocol and Data Frame Format

When ZigBee network structure and RFID technology are combined, the gateway is usually the communication module of ZigBee network node. ZigBee protocol is the use of RFID card to send data through concerned male public relations or control center. ZigBee communication is carried out through the serial port. The main chip reads out the information in the card and converts the information into data packets according to ZigBee communication protocol. The data packet is sent to the receiver via CC 2530 chip. The receiver then sends the data center to the control center for processing via the UART interface.double key circuit design

### 3.4. Circuit Design of ZigBee System

The basic circuit configuration scheme of the chip does not need RC 522, power control unit, and almost no external interface equipment, so the basic structure of CC 2530 can meet the needs of the system. 2.2 RC 522 RFID reader circuit design figure 5 is a typical application of RC 522 chip used to design the reader. Because the reader uses inquiry to identify RFID RF card, it does not need interrupt technology to read and write RFID RF card.

## 4. Design of Key Program

### 4.1. Terminal Programming

The system uses the protocol stack provided by Ti to develop the terminal program, and adds the functions needed by the system in the user script of the protocol stack.

### 4.2. Computer Programming of

The main computer program is developed by using MFC framework. The serial data processing unit uses Microsoft ActiveX to read and write to Microsoft's com communication control. The program is designed in the form of dialogue, and the main table generates the sub table for verification and display of debugging information. When the main computer program receives the data frame transmitted from the serial port, it determines which device transmits MAC address information from the header of the data frame[6]. Then, search from the device library maintained by the device. The MAC information of the device is recorded in the device library as an instrument device. Delete the device library and add the device information using the storage structure of linkrest. The host computer uses the device to update and manage the device library so that the information of the device library matches the actual device information. In order to make it easier for the system manager to control all devices and devices in batch, the upper level computer provides global time control arrangements such as global parameter setting, etc. By setting time control globally, all devices can control the length of time at once. Management also points out that the use of all devices can be prohibited by all devices, and that all schedules are controlled by the world.

## 5. Summary

The design of the system meets the expected requirements and realizes the laboratory management and anti-theft system based on UHF RFID. The anti-theft system of UHF RFID research institute not only improves the identification rate of electronic tags, but also increases the effective area of anti-theft in the laboratory and improves the real-time performance of the anti-theft system. The innovative design of the blackout device in this system can realize the "unmanned management" of the laboratory. When the user uses the credit card in the device, after rotation, information such as system startup and supervisor's supervision will be recorded automatically. Through the realization of remote access, users can master the situation of the laboratory from anywhere. Teachers can directly arrange the available time for the students who carry out the experimental teaching. Students can make an appointment in advance to use the experimental equipment, improve the use of experimental equipment, and improve students' initiative learning[7]. According to the management, the laboratory related equipment and modules can be used every month and every quarter through the use of Excel consumables. In order to reduce waste, the laboratory equipment can purchase modules and consumables according to the utilization rate of each equipment. Research management and anti-theft system based on UHF RFID can be widely used in universities and colleges, and can be extended to many important industrial fields. Therefore, it has broad market application prospect and social demand.

## 6. Conclusion

With the continuous development and improvement of RFID technology, the university has also begun the management of smart campus. The laboratory anti-theft management system based on UHF RFID technology designed in this paper achieves the expected goal, but with the development of the times, further research and analysis are needed to expand the field of use[8]. At present, the detection of the hardware part of the system can meet the detection requirements of the basic laboratory environment. However, in subsequent operations, the accuracy of current detection can be improved. If the circuit is further designed so that the detection current is less than 0.1 M, it can be integrated with the safety device and improve the safety of the experimental device. Now, the software of this system only contains the new function part of the design. If you want to add applications to the campus, you can integrate the database in the database[9]. The whole campus management function completes the system function. The system is designed as a management institute. In the future, with the deepening of technology, we want to expand in a wide range of areas such as offices and factories.

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