The Design of Electronic Door Lock Based on RFID

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Abstract. To realize intelligent management of door locks in the people's workplace, we come up with a design of electronic door lock based on RFID. This design is divided into two parts: the inside machine and the outside machine. The STC89C58RD+ microcontroller is used as the core module of the outside machine, and connects the physical keyboard, LCD screen and RFID reader to form the human-computer interaction outside the door. The STC15F2K60S2 microcontroller is used as the core module of the inside machine, and peripheral circuits such as a FLASH memory module, an electronic lock control circuit and a communication port are connected. By writing the main control program, the password or card number transmitted from the outdoor machine is compared with the information in the FLASH memory to judge whether the password or card number is legal or not, thereby controlling the opening and closing of the door lock. It can also manage the RFID card number or password according to the instructions of the outdoor machine or the upper computer. At the same time, the upper computer program is written to implement systematic management of user information, RFID cards, and password information. Experimental results show that the system has easy operation and can realize the function of identify unlocking and access control management well.

Introduction

With the development of Internet of things technology, intelligent access control management is urgently needed in office. Because it can bring considerable convenience and security to people's lives. For example, if the laboratory, office and other areas have a certain flow of people, but also have certain permission requirements for the access personnel, the opening permission should be modified according to the information of the access personnel to achieve intelligent management. Therefore, this paper proposes the design of electronic door lock based on RFID, which uses RFID card and password as the digital key for identity recognition, and has relatively perfect authorization management function.

System Design

The overall design diagram of the RFID based electronic door lock system studied in this project is shown in Figure 1. The outdoor machine system mainly needs to realize the function of human-computer interaction and data transmission. Its hardware mainly includes the main control chip of the outdoor machine, RFID card reader, LCD screen, physical keyboard, etc. The system needs to realize the functions of information storage, card number and password comparison as well as door opening and closing. Its main hardware includes memory, main control chip, door lock switch circuit, communication port, etc.
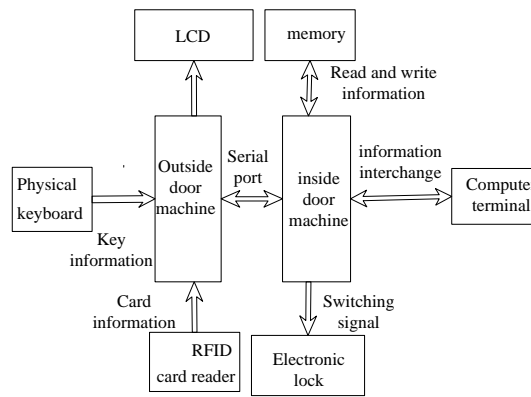
Fig.1. Overall Design Diagram of The System

Main Control Module of Outdoor Unit

STC89C58RD single chip microcomputer is used as the controller of the door's outside machine. The main controller is connected to LCD12864 as the display. Use 4x4 matrix keyboard as input device. Rc522 module is used as RFID card reader. The serial port is used as the communication channel between the indoor unit and the outdoor unit.

LCD12864 LCD Module

LCD12864 is a display module composed of 128X64 dot matrix, with built-in Chinese character display font code library, which can display 4 lines and 8 columns of Chinese characters, as well as special symbols.

4x4 Matrix Keyboard Module

Matrix keyboard is an important way of user authentication in access control system. It can be used for password verification, menu bar selection, password change, RFID card addition and deletion, etc. Using 8 I/O of single chip microcomputer, adopting 4 rows and 4 columns dynamic scanning mode, it can not only save hardware cost but also meet the needs.

RC522 Card Reader Module

Rc522 card reader is selected here, which is composed of a high integrated contactless (13.56MHz) read-write chip. The reader supports the communication of iso14443a protocol card and the SPI interface. Therefore, it uses SPI mode to interact with the single-chip microcomputer to read the physical card number of RFID card.

Main Control Module of Door Machine

Stc15f2k60s2 single chip is used as the main control chip in the door machine. Stc15f2k60s2 single chip microcomputer has two groups of ultra-high speed asynchronous serial communication ports, one group is used to communicate with the inside machine, the other group is used to communicate with the upper computer, which fully meets the control and communication requirements of access control management.

Flash Memory Module

The system needs to store the initial parameters of the device, password, RFID card number and other user information. Therefore, w25x16 is used as data storage chip, which has 2m bytes of storage space. It can fully meet the data storage requirements.

Electronic Door Lock Control Module

The door lock is realized by motor lock, which is mainly controlled by step motor. It can be controlled to open or close. It does not need external force to participate in unlocking and closing, so it is convenient to use. At the same time, it has a door closing sensing module, which can sense the opening and closing state of the door, and is convenient for programming to realize the perfect door lock control function. Its working voltage is 12V, and it is powered by 12V external power supply. As shown in Figure 2, this paper uses a composite circuit to convert the control signal of the door lock. Send out high level signal through port P0, convert and output 12V control signal to control the opening of electronic door lock.
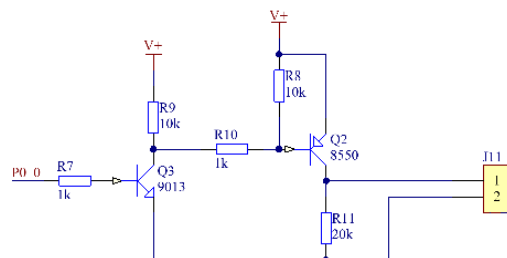

Fig.2. electronic lock control circuit

Communication Module

The door inner unit and the door outer unit use the serial port connection mode of TTL level to communicate, which is used to receive the command and data of the door outer unit, and report the door lock status at the same time. The connection between the door computer and the upper computer is realized by the way of serial port to USB. Through the USB communication line and the host computer to receive the information management of the host computer.

Management Software Design of Upper Computer

The upper computer management software is realized by VB and access database. The user login interface, system password modification interface and RFID user management interface are designed.

Fig.3. Control View of Login Interface of Access Control Management System

As shown in Figure 3, the main function of the login interface is to press two buttons: login and exit. After input, click the [login] button. After the upper computer successfully compares the user name in the database, send the password to the in door computer for comparison. If the password is correct, enter the management interface.
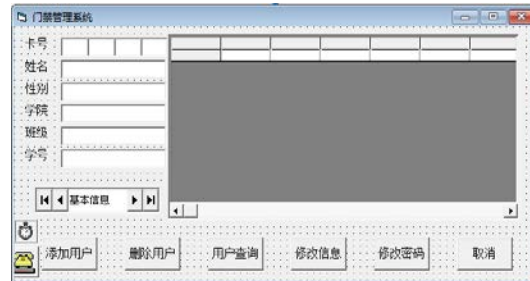

Fig.4. Control View of Management Interface

As shown in Figure 4, the management interface is mainly divided into user information display area and button control area. At the bottom of the management interface are six button controls, which realize the functions of RFID user information deletion and system password modification.

Conclusion

This paper introduces the system structure of electronic door lock based on RFID, which is divided into two parts: the door inside machine and the door outside machine. The outdoor unit is responsible for human-computer information interaction, including RFID physical card number reading. The door inside machine realizes the comparison of password and RFID physical card number and the door opening control. This scheme and design structure function are safe and reliable. At the same time, it can manage the password and RFID authorization information according to the instructions of the external computer and the upper computer. The device has comprehensive functions, low cost, stable performance and good application prospects.

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