An attendance system design based on RFID technology

Lijuan Shi and Qing Li

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Lijuan Shi
School of electronic engineering
Changzhou, China
Changzhou College of Information Technology
shilijuan@ccit.js.cn

Qing Li
School of electronic engineering
Changzhou College of Information Technology
Changzhou, China
lqmzrq@qq.com

Abstrac—**This paper presented a design scheme of attendance system based on RFID technology. The system used Arduino, MRFC522 and WIFI to design the network card reader. The system stored data through Access database, and designed the upper computer program by the LabVIEW 2016. The system realized the record, query and background management of staff attendance data.Through the attendance system, the enterprise can timely understand the attendance of employees, facilitate the management and assessment of employees. The system had the advantages of low cost, simple operation, simple interface and easy maintenance.**

Keywords-attendance management system; RFID; Arduino; LabVIEW

I. INTRODUCTION

In the daily management of the enterprise, the importance of attendance is self-evident. It is related to whether the attendance of employees can get effective statistics and supervision. For employees, the attendance system can help them establish a sense of time and avoid unexcused lateness and early departure. With the development of science and technology, the early manual attendance has been eliminated by most modern enterprises. Now the paperless office has realized the exchange of internal management information, reducing the pressure on management, so the penetration rate in enterprises is gradually increasing [1].

Radio Frequency Identification (RFID) is a kind of automatic Identification technology, which carries out non-contact two-way data communication through Radio Frequency. RFID uses radio frequency to read and write electronic tags or radio frequency cards, so as to achieve the purpose of identifying targets and data exchange.RFID technology is considered as one of the most promising information technologies in the 21st century.

This paper uesd RFID technology to develop a network attendance management system. After the employee swiped the card, the punching record was displayed on the LabVIEW operation interface in real time. The daily clocking records were saved to the Access database, and the statistics could be inquired at any time, which was convenient for the assessment of employees and the calculation of salary. It not only improved the efficiency of attendance, but also ensured the accuracy of attendance data.

II. ATTENDANCE SYSTEM SCHEME DESIGN

A. System solution

This paper designed the attendance system using mobile interconnection technology, RFID technology, WIFI technology and liquid crystal display technology. Attendance system was mainly composed of network card reader, router and upper computer. The network card reader did not need independent wiring. After swiping the card, it could use the existing computer network to transmit information such as machine number and card number to the remote computer in time. After the computer operated the swipe card information, it could send different prompt information to the card reader immediately. This paper mainly introduced the design of wireless card reader and its application software.The network structure of the attendance system was shown in Fig. 1.
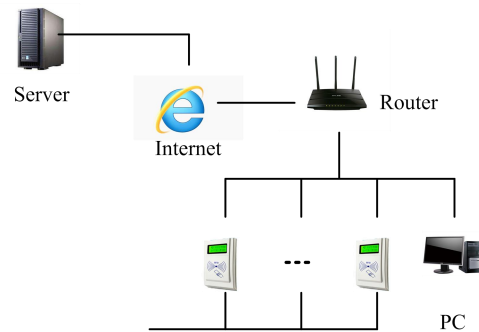

Figure 1. Network structure of attendance system

B. System Function Description

The goal of the system was to establish a attendance system which could be applied to employees of enterprises through RFID technology. The attendance system could check and count the attendance status of employees at any time, avoid mistakes and omissions, and lighten the burden of personnel by swiping cards, checking attendance data and saving them to the database. The system needed to have the following functions [2]:

a) able to quickly read the card, obtain the employee's card number and other information, record the punching time and generate the attendance record;

b) able to query and modify staff information in the background;

c) the cancellation and activation of employee CARDS can be realized.

III. Hardware design of attendance system

A. Network card reader design

The hardware of wireless card reader of attendance management system was mainly divided into single chip control module, RFID radio frequency module, WIFI module, LCD display screen and buzzer. MCU module mainly realized the control of each module, which was the core of card reader. The card reader transmited the read card information to the network by wireless means. The radio frequency module of RFID mainly realized the wireless communication with employee card. It communicated with Aquino UNO through SPI mode. LCD mainly displayed employee card information. It communicated with Arduino UNO through I2C bus. The buzzer alarmed when the card number was read successfully, prompting the card to be swiped successfully.

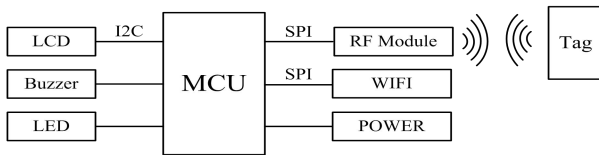The hardware design block diagram of the card reader was shown in Fig. 2 [3].

Figure 2.   Structure diagram of card reader

B. System hardware selection

1) MCU control module

The system used Arduino open source hardware as its control module, which had developed rapidly in recent years. Arduino is an open source electronic prototype platform that is convenient, flexible and convenient to use. It desalinizes the knowledge of the underlying hardware of single chip microcomputer. Arduino greatly simplifies the design of hardware and software of single chip microcomputer, so that many technology enthusiasts who do not understand the basic hardware of single chip microcomputer can also make electronic products [4].
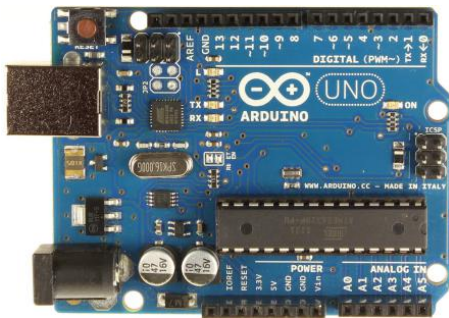

Figure 3.   Arduino UNO R3

This paper chooses the latest version of Arduino UNO R3 development board as the core control module. The control chip of Arduino Uno R3 circuit board is ATmega328P-PU. ATmega328P-PU is an 8-bit CMOS microcontroller with high performance and low power consumption based on AVR enhanced RISC architecture. Arduino UNO R3 was shown in Fig. 3.

2) RF module

According to the working frequency, the RFID system can be divided into four frequency bands: low frequency, high frequency, ultra-high frequency and microwave. The higher the working frequency of the card reader, the farther the range. Considering the requirement and cost of card reading distance of the attendance system, this paper selected the high-frequency RFID technology to read the employee card information.The RF- module was made of MF RC522 chip of NXP company. MF RC522 chip is a low-voltage, low-cost and small-size read-write card chip, which is applied in 13.56 MHz contactless communication.
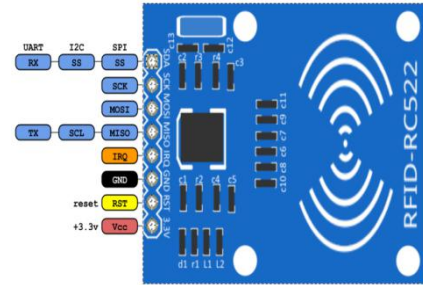

Figure 4.   MF RC522 RF module

3) WIFI communication module

This paper selected the wireless communication module made by Wi-Fi chip ESP8266 with low power consumption and high integration. ESP8266 can maintain stable performance and adapt to various operating environments. ESP8266 wireless communication module communicated with Arduino via SPI mode [5].

Figure 5.   ESP8266 wireless communication module

4) Display module

This paper selected LCD1602 to display user information. LCD1602 and MCU were mainly connected in three ways:

a) 11 ports: The control interfaces are RS, R/W, E, and the data interfaces are DB7--DB0, occupying 11 ports of the single chip microcomputer.

b) 7 ports: The control interfaces are RS, R/W, E, and the data interfaces are DB7--DB0, occupying 11 ports of the single chip microcomputer

c) 4 ports: Using I2C protocol, GND, VCC, SDA and SCL, only 4 ports are needed.

In order to avoid occupying too many I/O ports of Arduino UNO, LCD1602 with I2C module was used to display card information. The control chip of I2C module was chip PCF8574T. It could make most MCUs realize remote I/O expansion by two bidirectional buses. That was to   say, the serial data of MCU is converted into parallel data and sent to LCD display.
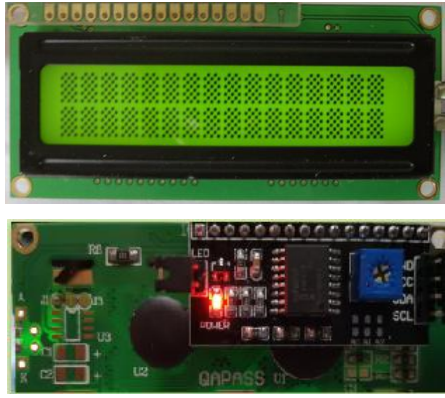
Figure 6.   I2C LCD1602 Front and Back

5) Electronic Tags

The electronic label was the staff attendance card. In this paper, Mifare one S50 (MF1S50) was chosen as the data carrier of staff information. MF1S50 was a passive and contactless smart card conforming to ISO/IEC 14443A. When the card approached the reader antenna, the high-speed RF communication interface would transmit data at a rate of 106 kBit/s.

6) System hardware connection mode

The pin connections between Arduino UNO R3, MFRC522, LCD1602, WIFI module and buzzer were shown in the following table :

TABLE I.   PIN CONNECTIONS BETWEEN MODULES

Arduino UNO	MFRC 522	Arduino UNO	LCD	Arduino UNO	WIFI
D9	RST	GND	GND	D0	TX
D10	SDA	5V	VCC	D1	RX
D11	MOSI	A4	SDA	GND	GND
D12	MISO	A5	SCL	3.3V	VCC CH_PD
D13	SCK	D2	Buzzer	D3、D4	LED

IV.   SOFTWARE DESIGN OF ATTENDANCE SYSTEM

A.   Card reader flow design

The system used Arduino's open source integrated development environment Arduino IDE to develop the lower machine reader program. The corresponding MFRC522, ESP8266, I2C library files needed to be loaded in Arduino IDE.

The main function of the reader was to realize card reading function and data uploading. When the employee card entered the working area of the card reader, the card was activated, and the RF module readED the card number and sended it to the microcomputer. At the same time, the buzzer gave an alarm, and the LCD screen displayed the employee information, indicating that the card was successfully swipped. The MCU transmited the read card number to the host computer by wireless. The upper computer recorded and counted attendance data.

After the card reader was powered on, firstly initialize WIFI module, serial communication, SPI bus, MF RC522 reader and display screen. After initialization, the card reader was in the loop reading state. The card reader software flow chart was shown in Fig. 7:
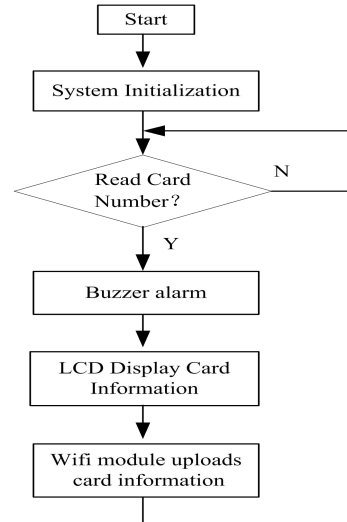

Figure 7.   Card reader software flow chart

B.   Software design of attendance system upper computer

Software design was divided into two parts: staff system and administrator system. The employee system could query the attendance information and modify the user password. The administrator system was consisted by two parts, one was the card management system, including the activation and cancellation of the employee card. The other was the attendance information management, which could record and count the staff's punching data. The design framework of the upper computer was shown in Fig. 8.
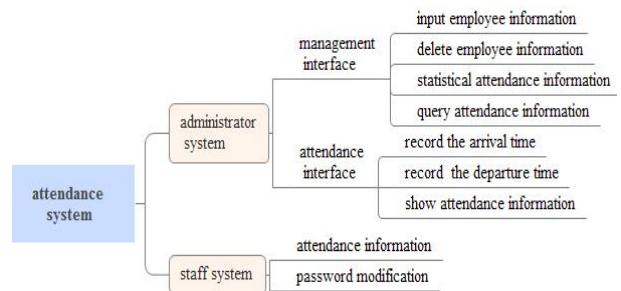

Figure 8.   Block diagram of computer programming for attendance system

This system useed the graphical programming environment LabVIEW to develop the upper computer program. LabVIEW has a highly modular graphics programming language and a library of mathematical. This paper used Microsoft Access 2016 to store data. There are many ways to connect Access database and LabVIEW. This paper connected Access database and LabVIEW software by the ODBC way[6].

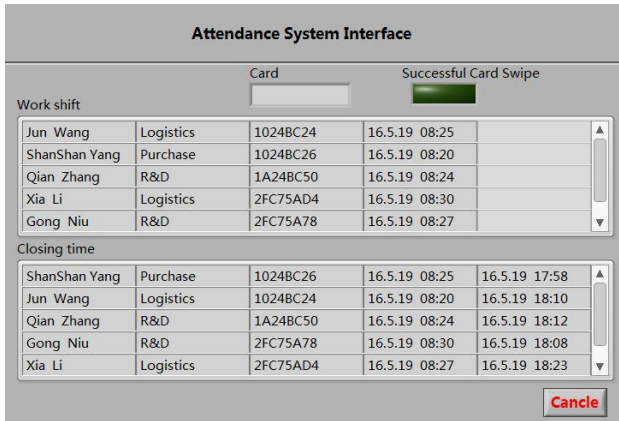The layout of the attendance interface was shown in Fig. 9:

Figure 9. interface of attendance system

V. ATTENDANCE SYSTEM TEST RESULTS

Through the analysis of the results of the system running test, we could draw a conclusion that the attendance management system designed by this project had realized the basic functions. It could record and count the attendance of staff, add and delete staff information, modify passwords and so on. record and count the attendance of staff, add and delete the staff information, modify the password and so on.

For example, in the attendance query, we input Wang Auxin, and clicked to the confirm key, the system would automatically called out Jun Wang's recent normal attendance times, lateness times, early retirement times. The attendance query results were shown in Fig.10.

Figure 10. data query result display of administrator system

VI. CONCLUSION

This paper used RFID technology, WIFI technology, Arduous, RF module, LCD display module, Access database and Lab View development environment to build an employee attendance system. At present, simulation tested were mainly carried out on studio staff. Considering the practicability of the system, the stability and robustness of the system should also be tested, which is the main content of future research.

VII. ACKNOWLEDGMENTS

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