Non-contact infrared temperature detection and RFID technology access control design

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Abstract. The non-contact infrared body temperature detection and RFID technology access control design uses 51 single-chip microcomputer as the core main control module, which combines infrared temperature measurement function (GY-MLX90614 sensor) and radio frequency (MFRC522) card swipe access control system, through swiping card and temperature measurement together control the door opening and closing. When it works in the high-risk zone mode, it detects the body temperature while swiping the card. If the body temperature is normal, the door opens, if the body temperature is abnormal, the door does not open and the buzzer sounds; when working in the low-risk mode, if the body temperature is normal, the door opens, if the body temperature is abnormal, the door opens and the buzzer sounds. Finally, it inputs the obtained card information and body temperature data to the WiFi circuit (ESP8266) through the serial port, and uses it as a hotspot to connect to the mobile device to realize data transmission, so as to realize more efficient unmanned management in different areas during the epidemic.

Keywords: Single chip microcomputer; Radio frequency card; Infrared temperature measurement; WiFi. Buzzer.

1. Introduction

Science and technology continue to race against the epidemic, and the fight against the epidemic has become a technological war for the whole world in 2020. COVID-19 is mainly manifested by fever, dry cough, fatigue, etc., and its transmission routes are mainly direct transmission, aerosol transmission and contact transmission. Contact transmission refers to the deposition of droplets on the surface of objects, contact with contaminated hands, etc. Contact with mucous membranes such as the mouth, nose, eyes, etc., may cause infection.

In the general environment, direct transmission and aerosol transmission can reduce the possibility of infection by wearing masks and goggles, but it is not easy to reduce direct contact. On the other hand, in daily life, there is a special person to perform body temperature detection when entering and leaving the house, which not only wastes manpower but also puts the examiner at a high risk of infection.

Non-contact infrared body temperature detection and RFID technology are proposed based on this. On the basis of the original radio frequency swipe card to open the door, we have added body
temperature detection. The 51 single-chip microcomputer is used as the core to realize high and low risk zone mode switching, and finally the status of the person who swiped the card is transmitted to the administrator through the WiFi module, which can effectively detect the person who starts to heat, so as to arrange the isolation and treatment work in time. This move is not only a kind of rescue for individuals, but also creates a safe area, which greatly improves the safety in the area, prevents person-to-person transmission in advance, and effectively suppresses the spread of the epidemic.

2. Design of system main module

2.1 Hardware design scheme

- **Single-chip microcomputer main control circuit**
  The main control circuit of this system uses STC89C52. The chip has the advantages of 8K bytes of program storage space, 512 bytes of data storage space, 4K bytes of EEPROM storage space, and direct download via serial port. It can complete design tasks at the lowest cost.

- **RFID swipe card module**
  This system uses wireless radio frequency to read and write the radio frequency card, find the data stored in the single-chip microcomputer, and then drive the single-chip microcomputer to open the electromagnetic lock. This design uses a contactless reader/writer card MFRC522 chip, which uses advanced modulation and demodulation technology, fully integrates all types of communication protocols under 13.56MHz, and supports a variety of working under 13.56MHz Radio frequency card read and write operations. The internal transmitter part can drive the reader/writer antenna to communicate with the radio frequency card and transponder without other circuits. This feature saves operation and is simple and practical.

- **Infrared temperature sensor module**
  The infrared sensor converts the collected infrared rays of the measured object into an electric signal, which is amplified and then converted into a digital signal by an A/D converter, and the digital signal is sent to the single-chip microcomputer, and the single-chip microcomputer sends the received signal to the display Circuit display. The GY-MLX90614 sensor has many advantages such as small size, low cost, and easy integration. The most important thing is that the TO-39 metal package integrates the infrared induction thermopile detector chip MLX81101 and the signal processing dedicated integrated chip MLX90302 (the chip is used to process the output signal of the infrared sensor). But in the end we chose this chip because of its integrated low-noise amplifier, 17-bit analog-to-digital converter and powerful digital signal processing components, which can achieve high precision and high resolution.

- **WiFi module**
  ESP8266 is an ultra-low power consumption UART-WiFi transparent transmission module. It is specially designed for mobile devices and Internet of Things applications. It can connect the user's physical device to a Wi-Fi wireless network for Internet or LAN communication to achieve networking Features. When making ESP8266 work in AP mode, it acts as a hotspot and connects the mobile phone or computer directly with the module to realize wireless control of the LAN.

- **Design of buzzer circuit**
  In addition, this design also adds an over-temperature alarm function. When the temperature of the measured object exceeds 37 degrees, the buzzer will alarm.

- **Hardware circuit diagram of the system**
2.2 Software design scheme

The running process of the main program: the system is normally powered on, the initialization starts, the function keys are scanned, and the working mode of the system is selected by the keys. When working in a high-risk area, if the access card is read, it will be judged whether the temperature is abnormal. If the temperature is normal, the door will open, and if it is abnormal, the buzzer will alarm the door not to open. When working in a low-risk area, if the access card is read, it is judged whether the temperature is abnormal, the door opens if it is normal, and the buzzer alarms the door to open if it is abnormal. Finally, the series of data obtained are sent to the WiFi module through the serial port, and the WiFi module is sent to the mobile terminal for checking.

Fig. 1. Hardware circuit diagram of the system

Fig. 2. Flow chart of software design
3. Conclusion
The access control system is an important part of the safety protection system. With the development of the times, the functions included in the access control system are gradually increasing, and its technology has also changed from immature to mature. In the future, there may be more natural disasters similar to the new crown sweeping the world. The future development trend of this access control management system is mainly in the following aspects:

- In the future, the access control system may pay more attention to the control of data. The processing of big data analyzes high-risk areas, saves a lot of manpower and material resources, and prevents data collectors from being infected when collecting data.
- The access control system not only guards the door, but also guards the security of an area. In densely populated areas such as train stations and airports, it can be directly determined as high-risk areas. When users check in and enter the station, their body temperature can be detected, which can effectively isolate people with abnormal body temperature and ensure the flow of people Safety in the process.
- At present, the mainstream basic functions of access control only include access control, offline operation, forced entry alarm and entry and exit record storage. With the development of science and technology, in the future, the access control system will not only understand the personal situation in real time through mobile phones, but also conduct real-time management of the flow of people, but also an analysis of data. In the future, on the basis of this access control system, technologies such as mobile secret key door opening, WiFi door opening control, and data classification storage analysis management can be added, which can further enhance the intrinsic value of the access control system.

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