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Design of Infrared Temperature Measuring Access Control System Based on Internet

Yingru Li
School of Electric Information and
Electrical Engineering
Yangtze University
Jingzhou, China

Abstract: This electronic document is a “live” template. The various components of your paper [title, text, heads, etc.] are already defined on the style sheet, as illustrated by the portions given in this document. Do not use special characters, symbols, or math in your title or abstract. The authors must follow the instructions given in the document for the papers to be published. You can use this document as both an instruction set and as a template into which you can type your own text.

Keywords: SM32 MCU; LU90614 infrared temperature measurement module; DHT11 temperature and humidity sensor ; Internet of Things; intelligent access control

1. INTRODUCTION

H1N1 is typically characterized by a body temperature of more than 38 degrees Celsius, while the first sign of COVID-19 is if the body temperature reaches 37.3 degrees Celsius and above [1]. Although traditional body temperature measurement methods are simple and feasible, there are certain limitations in how to detect body temperature quickly and accurately in a dense crowd [2]. Now, there are some high-precision temperature detection instruments on the market, these devices can quickly measure body temperature in a short period of time, is a very effective temperature detection method [3]. However, when using infrared temperature measuring instruments, they are easily affected by emissivity, ambient temperature and measurement distance [4], and attention should be paid to the accuracy, reliability and standard operation of the instruments. Therefore, for body temperature detection in densely populated areas, it is recommended to use high-precision, non-contact body temperature detection equipment to ensure rapid and accurate detection of temperature anomalies, so as to do a good job in disease prevention and control [5].Internet of Things infrared temperature measurement access control system is a combination of Internet of things technology, infrared temperature measurement technology and access control technology intelligent access control system. The system adopts non-contact high-speed infrared temperature measurement technology, which can quickly and accurately measure human body temperature, and also integrates the Internet of Things and access control technology, which can authenticate the identity of people in and out, record the information of people in and out, and improve the efficiency and accuracy of access control management.

2. OVERALL DESIGN OF THE SYSTEM

This system is composed of stm32f103c8t6 minimum core system as the main control chip, external WiFi module, infrared temperature measurement module, temperature and humidity module, card module, key control module, storage module, display alarm module and steering gear drive module. First connect the power supply and wait for the display to display the temperature, humidity, body temperature, body temperature threshold and initial value; The T/H module measures the ambient temperature and humidity and adjusts the temperature measurement error. When someone swipes the card, the infrared temperature measuring module will collect the temperature of the human body. If the card number is correct and the body temperature is lower than the set threshold, the steering engine will simulate opening the door and close the door five seconds after opening the door; If the card number is not accurate, the alarm light will be lit when the card is swiped; If the card number is correct but the temperature is above the body temperature threshold or the body temperature is below 32 degrees Celsius, the buzzer will alarm. Connect the host computer with WiFi module, open TCP connection destination IP address, and send instructions to control the system. The key module input and delete the card, adjust the temperature threshold, and control the rotation of the steering gear to simulate the door opening. The memory module is used to store the card number, and there is no need to re-record the card after power failure. The temperature measuring access control system is shown in figure1.

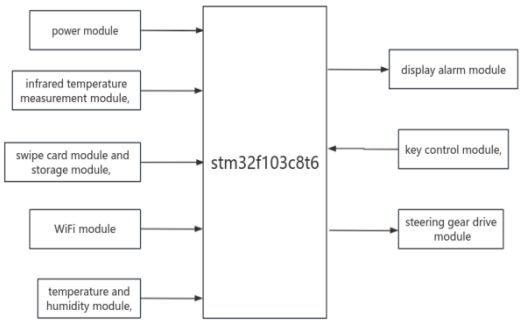

Figure 1. Block diagram of temperature measurement and access control system

3. PROJECT DESIGN

3.1 Stm32f103c8t6 Pin Description

In this paper, STM32F103C8T6 single chip is used as the main control chip for control and processing, equipped with a number of analog and digital peripherals, timer and interrupt

controller and other important functions, support high-speed peripheral bus and multimedia interface [6].

3.2 Human Body Infrared Temperature Measurement Module

The infrared temperature measuring module uses LU90614 infrared temperature measuring sensor, which is a flat GY906 series infrared temperature measuring sensor, but LU90614 only has a temperature measuring distance of 2 cm, the specific parameters are introduced in Table 1.

Table 1 LU90614 infrared temperature sensor

Digital interface Type	Serial port communication
Temperature measurement range	-70C~382.2° C
Temperature measurement error	±0.5℃(at room temperature) resolution 002℃
Operating voltage	3.3V~5V(module operating voltage)
The ambient temperature is	-40~125℃
Size	25*15*20mm, probe diameter 7.9mm

Infrared temperature measurement is through the measurement of the object's own infrared radiation to determine its surface temperature, the object in the temperature above absolute zero, will emit different wavelengths of radiation energy, including infrared radiation, these infrared radiation can be found on the surface of various objects. In this paper, LU90614 infrared temperature sensor is used, the temperature measurement distance is only 2 cm, the temperature measurement module needs to connect the single chip microcomputer with the serial port function of the pin.The actual picture is shown in Figure 2.

3.3 Swipe card storage module

Rd-rc522 module product features: reading card distance up to 10 cm, operating voltage: 2.5-3.3V, SPI, IIC, UART three communication modes can be selected, excellent reading performance, high speed 847kbit/s; The default interface is SPI. The actual picture is shown in Figure 3.

Figure 3 Physical picture of RFID-RC522 module

AT24C02 chip is a serial EEPROM, data read and write through the I2C bus, so AT24C02 write and read bytes need to first access to the specified address, so its performance depends on the bus rate and the address to be accessed. The rate supported by the I2C bus is usually 100kHz, 400kHz, etc., so the access speed of AT24C02 is relatively slow.

3.4 WiFi Module

ESP8266 WiFi is a low-cost system-level chip with a WiFi module that is faster than single-chip computers or traditional WiFi modules. ESP8266 module needs a pin with serial port function, the upper computer sends A # is the entry card, b# delete, c# open the door, d-36.7# set temperature threshold instructions to the MCU, the MCU receives serial data after parsing, in the control display and steering. The WiFi module is shown in Figure 4.

Figure 4 Actual picture of ESP-01s

3.5 Steering gear module

MG90S steering gear adopts three-wire control, of which one is the power line, one is the ground line, and the third is the control signal line, which is usually controlled by PWM signal. The frequency of the PWM wave cannot be too high, about 50HZ, that is, the period is about 20ms. The steering engine needs a pin with PWM function for multiplexing, and adopts high-precision PWM wave to control the sampling frequency [7].

4. SOFTWARE SYSTEM DESIGN

The software part of the intelligent access control system designed in this paper uses the programming software Keil5 to write the control program, and the programming language is the basic C language [9]. When the access control system is powered by the power supply, the code burned by the access control system will automatically run and wait for the next command. The initialization process includes RFID initialization using an analog SPI method; Serial port communication is used to initialize the temperature measuring module, and serial port interrupt function receives data. LED light initialization; Key initialization, key scanning mode for key reading; Temperature and humidity initialization; Buzzer initialization; PWM control the rotation initialization of the steering machine with timer 4 mode; The IIC communication protocol is used for OLED initialization, and the simulated IIC is configured with GPIO. ESP8266 initialization, the use of serial port 3 mode, the collected information uploaded to the host computer, data transparent transmission in the LAN, connect the hotspot AP mode, create a wireless hotspot, set the multi-client mode, the use of TCP protocol for data transmission, ESP8266 as a server, the host computer connected to the server for communication process; AT24C02 memory card account, using IIC communication mode, only

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one data line needs to answer the process to carry out the next transmission.

The WiFi module is used as a hotspot so that the upper computer device can connect to the ESP8266 WIFI module. First, send the AT command to set it to AP mode, then send a statement to configure the WiFi module to AP mode, and then send a statement to restart it, create the name of the ESP8266 WIFI hotspot: esp8266, password: 12345678, set the multi-client link, and establish the TCP Server port as 8080. Computer, mobile phone connect to ESP826 WIFI, open the network debugging assistant in serial debugging, ESP8266IP address is 192.168.4.1, and finally click Connect. When the connection is successful, the network Assistant will show that the TCP connection was successful, and the data can be sent. The network debugging assistant is shown in Figure 5.

Figure 5 Computer network debugging assistant diagram

5. SYSTEM PRODUCTION AND DEBUGGING

The program is burned into the single chip microcomputer, and the interface of the single chip microcomputer, the temperature and humidity module, the OLED display pin, the card storage module is connected. In the debugging process, the body temperature induced by the infrared temperature sensor corresponds to the temperature on the OLED display, and the temperature and humidity sensor corresponds to the temperature and humidity on the OLED display, and then you can see the display from the initial to the fixed display (temperature, humidity, body temperature 36.5 ° C, temperature threshold 37.5). The ambient temperature and humidity are measured every 300ms and the results are displayed on the screen. When the system restarts after a power failure, the storage module records the entered card number. After a power failure, you do not need to enter the card number again. Swipe the card once, the measurement data of the temperature measurement module is sent to the display through the MCU. Then compare whether the card number is stored in the storage module and whether the card number in the storage module is the correct card number identified by the access control system.

After the MCU is powered on, the card is entered through the key module or the WiFi upper computer, and the card is placed on the RFID522 module to measure the temperature and observe whether the temperature value on the display is higher than the temperature threshold. When the temperature is lower than the temperature threshold, the steering gear rotates to simulate the door. When the temperature is higher than the temperature threshold, the steering gear does not rotate and the buzzer alarms. Then delete the card number through the key module or WiFi upper computer, and measure the card again. The temperature will be displayed on the display screen to determine whether the alarm is generated. At the same time, the alarm light will light, indicating that the card number has not been stored and is not the user of the access control system. Multiple measurements can be made to verify the results by adjusting the temperature threshold and card number processing. The results of the access control system are shown in Figure 6.

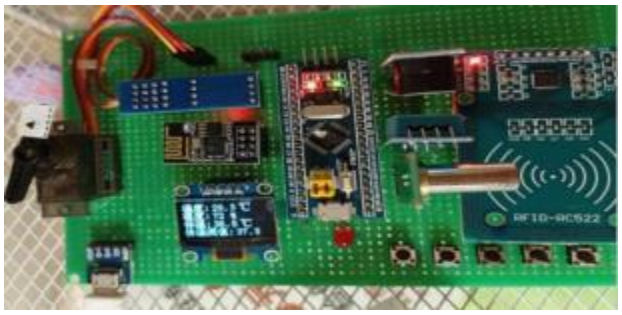

Figure 6 Results of access control system 5 Epilogue

6. CONCLUDING REMARKS

The core of the access control system is STM32 MCU, When working, in addition to checking the RFID card carried by the user, the system will also use an infrared sensor to monitor the body temperature, and will issue an audible alarm if the temperature threshold is exceeded. The T/H sensor corrects the result of the temperature measurement module based on the external temperature and humidity to avoid misjudgment. The administrator can use the WiFi module to connect to the upper computer, adjust various parameters, alarm threshold. The LCD displays the temperature, temperature and humidity of the sampled person. The software part starts from key scanning mode, PWM pulse width debugging, card processing, temperature measurement instruction, serial communication and so on. The program is based on C language, the required parameters are imported into the single chip computer, burning the program, by comparing the real object with the ideal function, judging the accuracy and perfection of the program, summarizing and modifying the difference.

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