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Design of anti-theft alarm and fire detection system based on IoT cloud platform

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Abstract: This time for a STM 32 single chip computer as the core of the intelligent home system of anti-theft alarm system for a detailed design, It aims to provide a comprehensive understanding of the hardware composition, software design and implementation principles of the smart home system, And analyze its advantages and disadvantages, Thus better providing intelligent early warning for human beings, Prevent the emergence of emergencies, Saving the lives and property of the people, The security information of the user can be monitored remotely, It can also turn it off via a button, In the anti-theft mode, You can also use an infrared sensor module installed in the human body to detect whether there is anyone in the home, So as to achieve the purpose of fire and fire prevention and theft. On this basis, a residential intelligent management system based on wireless communication is designed. The OLED LCD screen can display the currently detected temperature and the density of the flue gas, and use the button to set an upper alarm limit. When the detected temperature or smoke content exceeds the upper limit, the LED indicator light will light up and issue an alarm. Also, there is an emergency button to send out a distress signal at any time.

Keywords: STM32F103; Campus security; Temperature monitoring; Smoke monitoring; Alarm.

1. Introduction

With the continuous development of the Internet of Things, WiFi cloud platform technology is becoming increasingly mature and playing a crucial role in daily life. The wireless data transmission on the WiFi cloud platform provides technical support for security alert systems. In daily life, whether it is hotels, cinemas, schools, office buildings, residential areas, etc. The so-called anti-theft technology uses infrared sensor modules inside the body to detect people. Currently, most fire extinguishing products use temperature and smoke sensors. When a fire occurs, the ambient temperature rises and some combustible materials release a large amount of smoke. When the smoke concentration is too high, the recorded temperature and smoke concentration will trigger an alarm and activate it. On this basis, further research was conducted on the working principle of the system, and the operation of the system was mastered.

This article mainly studies the STM32F103 chip and its home intelligence. This article introduces a custom control method based on STM32F103. The system consists of three modules: detection, display, and alarm. The testing includes: temperature and smoke concentration, detecting the current temperature with temperature sensors, monitoring smoke content with smoke sensors, transmitting relevant data to microcontrollers through ADC, processing these data with microcontrollers, and calculating a certain temperature and smoke density based on formulas. Some monitors use LCD monitor LCD1602 to display the current temperature and smoke concentration. This button can be rotated to display the upper temperature limit and smoke alarm. The alarm system includes a keyboard, alarm, and cloud wireless network configuration. Firstly, set the maximum temperature and smoke concentration through the settings button, and then check if they exceed normal values. After exceeding the standard, The LED will light up and display an alarm. At the same time, the temperature signal is sent to the GSM module through the microcontroller. When the smoke concentration exceeds the warning value, LED lights will emit a warning sound, allowing users to stay informed of the current situation no matter where they are on their computer or phone.

2. Design Plan

2.1. Design ideas

The design concept of a smart home system should first be considered from a functional perspective. Firstly, the main function of the safety alarm system is a safety alarm, which is used to monitor whether there is a fire inside the body and alarm through sensors and buzzers. For the combustion process, real-time monitoring of parameters such as temperature and smoke is required. In addition, compared to general security alarm systems, this solution also includes a data display. Therefore, we have chosen the commonly used OLED LCD display as the display. In addition, an alarm device should be installed to set the alarm signal through buttons. When the alarm signal reaches the upper limit, the infrared radiation inside the human body will automatically sound an alarm. When the infrared detector inside the human body detects people in the room, the automatic alarm function will be activated. After dividing the functions, hardware selection and circuit design were carried out. As the core of the microcontroller, it plays a crucial role. Through querying, screening, and comparison, this article selected STM32F103 with better performance and higher cost-effectiveness for the collaborative work of multiple sensors and peripherals. This system uses high-precision DS18B20 temperature sensors MQ-2 smoke detector The hardware components of the system include OLED LCD display screen, buzzer, wireless network, etc.

2.2. System composition

The entire system consists of two main components: hardware and software. The hardware design of the system uses microcontrollers, sensors, and components. After confirming all materials, install power cables to ensure that

each wire is correct and smooth. According to the design drawings, connect all components together to make a microcomputer. Once the hardware design is completed, the next step will be to use software to control the entire microcontroller. This is the software written on Kyle. After completion, it will be tested and if there are no issues, the generated hexadecimal file will be saved on the microcontroller. In this system, all applications are written in C language and supported by the integrated Kil5 development platform. The program is also divided into modular programming based on its core functions. This subroutine is supplemented by other modules, including temperature control subroutine, button setting subroutine, reminder subroutine, and WiFi wireless subroutine.

The system adopts STM32F103 as the core controller, which can be divided into detection, display, body infrared perception, alarm, etc. according to their respective functions. The monitoring part takes DS18B20 as the research object, uses MQ smoke sensor to detect smoke, converts the obtained simulation results internally, and sends the results to the microcontroller. Using OLED LCD as the display, smoke and temperature data obtained through microcontroller calculation are used as images. The alarm system consists of four main parts: alarm value setting, alarm alarm, and text description. This device mainly has two functions: buzzer warning and LED warning.

2.3. MQTT protocol

This project is based on MQTT (Message Queuing Telemetry Transport), MQTT is a lightweight information transmission protocol suitable for communication between IoT terminals. The benefits of doing this are:

Lightweight: MQTT is a very concise communication method, with a title of only 2 bytes, so its cost is very low, especially suitable for devices limited by network bandwidth and memory.

Published/Subscription: MQTT allows multiple subscribers to receive a message and can also dynamically add and exit users, making it very suitable for distributed event notifications.

Stability: MQTT has three different packet transmission qualities (Quality Quality, QoS) , It can ensure the transmission of messages and is suitable for situations with high requirements for communication reliability.

Continuous working phase: MQTT supports client-side working phase, and when the client interrupts, the messages of the working phase can still be received.

SSL: MQTT provides a dual password for TLS/SSL, ensuring communication security

The reason why EDP was not used is because it belongs to the dedicated communication protocol of the China Mobile network, which can only complete the upload and release of commands, so the protocol is relatively simple. However, MQTT is a relatively common protocol that can be used by most cloud platforms and can be uploaded and distributed. In addition, it also provides subscription and other services, which is slightly more complex in terms of protocol.

3. Three hardware circuit design

OLED liquid crystal displays provide real-time temperature and accumulated smoke concentration, as well as indications of smoke in the air. The next column displays warnings. This article uses STM32F103 as the microcontroller core, STM32F10 is a new type of microcontroller. Set the upper limit of fire and smoke concentration alarms through buttons, and convert the collected smoke data into digital signals through the AD system at the end of the microcontroller, which is then sent to the microcontroller for calculation. Wireless transmission through cloud platforms. The device is equipped with 4 buttons for installing smoke and temperature signals. Using mobile phones to alert and detect people through infrared radiation. Turn on/off anti-theft mode, the microsystem adopts a 5V DC power supply, and its hardware circuit diagram is shown in Figure 1:

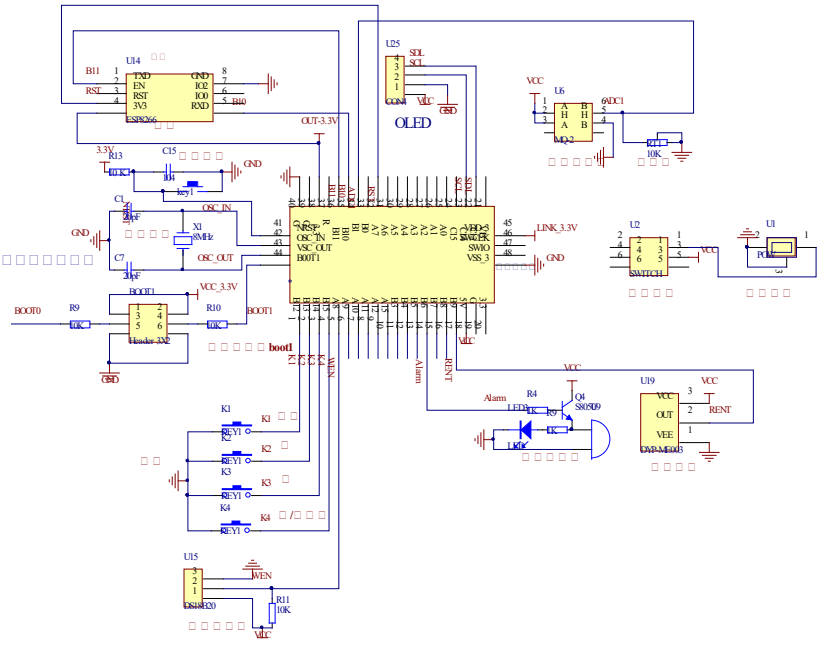

Figure 1. System Hardware Diagram

4. Software System Design

After designing and troubleshooting hardware and software, enter the programming phase of the controller and various peripheral sensors. When designing a system, the first step is to have a clear concept, first draw the process, and then

proceed with the entire project in the order of the sensors. Firstly, turn on and activate all devices to detect temperature, smoke, infrared OLED display screen, ringtone, wireless network, etc. At the same time, monitor the temperature and smoke in the vicinity and trigger an alarm. Its working method is to initialize the existing wireless network, use temperature sensors to detect the current environment, and apply it to smoke detection. Set the highest temperature and smoke concentration alarm. When the alarm or smoke alarm exceeds the threshold, it will sound an alarm and turn on the corresponding LED alarm.

5. System debugging

Prepare the required materials and welds, follow the design of the printed circuit board, solder the plug-in first, then solder the busbar, and reset the phase and least squares of the microcontroller. Find the location of the LCD 1602 display screen, solder the resistor and P0 interface together, then connect the leads to the display, and appropriately solder the various components together. Finally, wire each component separately according to the circuit to ensure there is no short circuit phenomenon. The microcontroller uses a recording device to edit the recording device, and finally embeds it into multiple modules. After routine inspection, first connect the fixed 5V power supply, press the button again to check if the circuit of the LCD 1602 monitor is normal, and then check the operation of other sensors to see if there is a signal displayed on the screen. If there is a problem, identify specific components and handle them separately.

After single chip microcomputer welding test, there is no problem, and the function cannot confirm the correctness of the program. After the initialization of LCD 1602, everything should be correct, and then the performance of each sensor should be checked. Open the homepage, which is divided into two parts. Here are the unit prices and all costs calculated in the main matrices. When an object is placed on a pressure sensor, its weight can be displayed on the LCD 1602. After pressing the matrix button, the LCD 1602 display will display the set price of the product, and use the matrix button to calculate and display the total amount of the product. The sound chip is responsible for transmitting the weight and value of the product to the speaker. At this point, all performance tests have been completed.

The third stage is comprehensive troubleshooting of the solder pad machine, mainly using methods such as clock, constant current power supply, and oscilloscope for comprehensive detection. Ensure that all devices are operating properly. Classified as dynamic maintenance and static maintenance

Whether the working status can meet domestic regulations and avoid affecting the operation of the system due to internal injuries.

In the industrial field, the original process is no longer used, but conventional welding processes have been adopted. However, currently, in general electronic component production, system maintenance, and testing, the original conventional welding methods are still used. The key is that if there are issues with its basic design, it will have a negative impact on the entire welding process. It can be said that due to the existence of a large number of welding problems, more use of this control system is needed.

Before starting the main power supply, special attention should be paid to obvious defects such as disconnection, positive and negative combination during the welding process, such as non-standard joints and welding. Next, the millimeter wave method is used to detect major power supply faults such as negative pole short circuits.

Summary

This solution uses the OneNET IoT cloud platform to build an anti-theft alarm and fire detection system. The system is driven by various functions such as temperature sensors, smoke sensors, and human infrared sensing to display the current detected temperature value and smoke concentration on an OLED LCD screen. The alarm limit is set by pressing buttons or using a mobile phone. Additionally, simply press a button to activate the infrared sensor.

Its working principle is to convert temperature, smoke, infrared, OLED display screens, buzzers, wireless networks, etc. are all activated, and nearby temperatures are detected based on parameters such as temperature and smoke, and corresponding alarm prompts are given. This method first completed the initialization of the indoor environment and installed a temperature sensor indoors. Based on this, smoke in the indoor environment was detected. Set maximum temperature alarm and maximum smoke concentration alarm. When the alarm value or smoke alarm limit is exceeded, the alarm will sound an alarm signal and the LED indicator light will light up. You can also press the button to activate the safety lock. If someone passes by, The LED indicator light will light up and sound a bell. Press the button again to turn off the anti-theft device, and it will not sound an alarm when someone passes by.

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