Design and Implementation of Fire and Burglar Alarm System

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Abstract

Most of the residential buildings in China are high-rise buildings, and many potential dangers exist around the residents. A fire and anti-theft alarm system needs to be built to give early warning for the safety problems around us in time and ensure the safety of people's lives and property. The fire prevention and anti-theft alarm system completed in this design can realize the detection of intruders at the same time, and can realize the fire detection and alarm through the fire detection module. In addition to meeting the basic requirements, the system has good stability. Later, the specific physical production is completed according to the hardware circuit, which can be used in home safety and production management, and can prevent possible theft, fire and other risks through the system, And the design has the advantages of small size, low cost and convenient maintenance.

Keywords

Fire and theft prevention; singlechip; Circuit design; Circuit simulation; sensor.

1. Introduction

In recent years, many cities have further put forward measures to attract talents in order to develop. Many people have entered the city for development, and the number of residential buildings in the city has also been further increased. Most of the residential buildings in China are high-rise buildings, with a large number of residents in a building. Therefore, the problem of personnel density has always existed. China is originally a city with a large population density, and if there is a safety accident, it will cause a relatively large number of casualties. So the problem of home safety has also been the focus of attention in recent years. Fire safety accidents, burglaries and other events that affect people's safety due to improper use of fire or illegal use of natural gas. Although China has been stepping up the construction of civilized residential areas, in the face of the current relatively complex public security environment and the continuous gathering of the population, it is inevitable that some people want to obtain financial services by doing nothing, resulting in burglary. People use natural gas and electric appliances more frequently in their home life. Few people often check whether the circuit is aging, whether the natural gas is a pipeline or whether there is gas leakage in the cooker. Because of the residents' cognition and professional knowledge, it is difficult to judge by human. Therefore, it is necessary to build a fire and anti-theft alarm system to give early warning for the safety problems around us and ensure the safety of people's lives and property[1-10].

Since modern times, with the rapid development of electronic sensor technology and communication technology, smart home products have appeared in people's lives. For example, intelligent switches based on the Internet of Things technology can be remotely controlled through wireless communication technology, which can solve the problem of finding that household appliances are not turned off after going out, It can not only avoid the power consumption problem of the electrical appliance for a long time and the fire problem caused by the heating of the electric wire for a long time. It is precisely because of the development of

smart home technology that has also promoted the development of fire and anti-theft intelligent alarm system, which has promoted the development of intelligent fire and anti-theft products. These fire and anti-theft alarm system products are also used in many life scenarios such as families, units, warehouses, and so on, to provide security for safe living and safe production. However, the common problem of the fire and anti-theft systems currently on the market is the high price The function is not perfect and the stability of the product is low, so it can not be used in a wide range. Therefore, this design designs a system that can not only have fire protection function, but also can achieve anti-theft. More accurate sensors are used to avoid false alarm and false alarm. At the same time, selecting appropriate components will reduce the development cost and meet the needs of the public in terms of economic applicability. Through this design, while mastering the knowledge learned in this specialty, we can reasonably apply the knowledge learned in the design of products. Fire prevention and anti-theft is also what people need to pay attention to at home. Once the product is deployed, it will have the effect of long-term use, without frequent replacement, so the fire prevention and anti-theft system has a broad application prospect[10-22].

2. Overall scheme design

This design is based on the single-chip microcomputer. It detects the burglar invasion and fire situation through the sensor, and realizes the alarm through the alarm circuit. After the system is deployed, the security monitoring of the environment is realized. According to the specific functions of the system, the design needs to complete the detection of personnel intrusion. According to the sensor data consulted, personnel detection can determine whether someone is approaching through the infrared ray released by the human body. The fire detection is to prevent the fire in advance, so it is necessary to detect some parameters before the fire, such as the detection temperature, smoke concentration, etc., through the sensor. Therefore, the sensor module includes the sensor for detecting the burglar and the detection module for detecting the fire smoke concentration Temperature sensor module. The system needs human-computer interaction, so it needs keyboard module and display module. The alarm module uses modules that can emit sound and light, and the control chip uses a single chip computer. The sensor data is processed by a single chip computer, and then calculated and compared to achieve the function of fire and anti-theft alarm.

The 51 single-chip microcomputer is not only a single chip, but also a 51 core chip. There are many models of 51 single-chip microcomputer, both domestic and imported, so they are collectively referred to as 51 single-chip microcomputer. Since its birth, 51 single-chip microcomputer has been used in different design scenarios. At the same time, its technology is mature, there are a lot of reference design data, and the price is very low. The IO port can be up to 32, and it can realize bit operation, It is a classic and practical single chip computer. The design is to read and calculate sensor data such as temperature and smoke concentration and take charge of the control of the system through the single chip computer. It does not need very strong performance. In order to make the product popular, it should be considered from the economic aspect. The 51 single chip computer can meet the requirements, and its circuit is simple, the cost is lower, and it can meet the needs of the design, Therefore, this design uses the AT89C51 model in the 51 single-chip microcomputer as the main control chip.

Pyroelectric is used to detect whether there is a person. The principle of its detection is that human tissues can emit a weak infrared ray, and whether there is a person can be determined by the perception of this infrared ray by the sauna. Pyroelectric is often used in the design of some automatic doors such as banks and enterprises. It can be determined that there is a person performing an action. Pyroelectric is the best choice for the detection of people. The infrared proximity sensor is limited by the detection conditions. The sensor can only be triggered when

the human body is facing the sensor. The pyroelectric sensor is used to detect the infrared signal sent by the human body. Therefore, the measurement in Scheme II is more accurate. Therefore, the pyroelectric sensor used in this design.

The fire detection includes the detection of smoke concentration and temperature information. According to the data of the sensor, MQ-2 can be selected as the smoke sensor, because the MQ series sensor mainly detects gas, while there are many temperature sensors.

DHT11 adopts integrated design, and can realize temperature and humidity measurement at the same time. It uses TTL level, with high cost performance, and can be directly connected with the IO of the shim machine to realize communication. Moreover, the data measured at one time contains two information of temperature and humidity, which is convenient to use.

This design is used for fire detection, so it only needs to detect temperature, and humidity information is not needed. Therefore, DS18B20 is selected as the temperature detection component in this design.

An independent key is a key detected by a single IO of the single chip computer, so a key will occupy an IO port. The key information can be obtained directly through the change of the level of the IO port. An independent key realizes a function, which is designed and implemented in the program. The independent key is mainly used in the situation where the human-computer interaction is not very complex. The key is used to realize the data fine-tuning or define an independent function. This design mainly realizes the threshold adjustment of smoke concentration and temperature through buttons, so this design adopts independent buttons.

LCD1602 is a liquid crystal display screen. The displayed information includes numbers, and it can also display English. LCD12864 can even display Chinese characters, graphics, and so on. And many LCD screens are equipped with backlight. The brightness can be adjusted, and there is no problem when used at night. In addition, there are many characters displayed. When displaying data, the name of the data can be added in front, which is more convenient for personnel to view. The design needs to display a lot of information about smoke concentration, temperature and personnel invasion status, but the design is to prevent accidents before they happen and needs long-term operation, so the design uses LCD1602 as the most display device.

3. Design of minimum system circuit of single chip computer

The singlechip used in this design is AT89C51. If the singlechip wants to work normally, it must have a minimum system circuit. Because the singlechip is a programmable digital chip, it needs a reset circuit and a clock circuit. The purpose of the reset circuit is to enable the program to be executed from the beginning after the singlechip is powered on. That is to say, the reset circuit is the starting position of mandatory program execution, and the reset can be automatically reset and manually reset, As a digital chip, the clock circuit is essential, and the work of digital chips requires the clock circuit. The AT89C51 provides two ways of internal clock and external clock. The external clock is used when the work of the single chip computer and the clock synchronization of the peripheral devices are required, while the internal clock is not required. This design does not need the clock synchronization of the external devices and the single chip computer, so the internal clock wiring method is adopted. The clock circuit of the single chip computer is realized through XTAL1 pin and XTAL2 pin plus crystal oscillator and filter capacitor; The reset circuit is to ensure that the program of the single chip computer can be executed from the beginning. Automatic reset is achieved by connecting a capacitor in series with the power supply and using the charge and discharge of the capacitor after power-on. Automatic reset is achieved by directly pressing the key to give a high level to the RST reset pin.

The pyroelectric infrared sensor consists of three parts: detector, filter window and field effect transistor impedance converter. The design adopts integrated pyroelectric sensor. The signal of the detector is output through switch variable. The signal is output from 2 pins after

processing. The single chip computer only needs to detect the level change of the information pin to detect whether there is any intrusion.

The measurement principle of MQ-2 smoke sensor is that the change of smoke concentration will change the resistance value. Therefore, a partial voltage circuit is designed to measure the voltage value of two fixed resistance segments, and the smoke concentration can be calculated according to the calculation formula corresponding to the smoke concentration. However, the output of the smoke concentration partial voltage circuit is analog variable, so the analog-digital conversion circuit is required to convert the signal. The model of ADC is ADC0832, which is actually an 8-bit ADC, The resolution can reach 256 levels, and there can be two inputs. Its CLK is a clock module, which is provided by the single chip computer, and D0 is the data output port, which outputs digital signals.

DS18B20 is a three-terminal component and a digital output temperature sensor. It uses a single bus data transmission, so there is only one data line and power supply line. In theory, the data line of DS18B20 can be directly connected with the IO port of the single-chip computer. But in practical applications, because of the change of the IO current of the single-chip computer, the data will be unstable, so this design connects a pull-up resistor to achieve data reading, Ensure the stability and accuracy of data reading.

This design uses independent keys, and the implementation method is relatively simple. Because the MCU can read the level change of the output through the IO port, the normally open reset key is used as the actual key. Each independent key is connected to a MCU IO port. This design uses four keys, low level trigger, and the function of the four keys respectively defines the switch setting position, data addition, setting, and data key buttons, The button can be used to adjust the time and ring time. The four keys are connected with P1.0-P1.3 of the single chip computer.

The design uses LCD1602 to display the time and system information. Through the display, you can view the system time and system status. LCD1602 is a character type display device, which can display 16 characters per line, and can display two lines at the same time. Its data transmission is a parallel serial port, and the power supply is 5V. LCD1602 is a LCD display, and the backlight can be adjusted. It also reserves a backlight adjustment port, A potentiometer is connected in the design to realize backlight adjustment. RS, RW and E are the control terminals of LCD1602, and D0-D7 is the data transmission port. Therefore, to control the display of LCD, it is necessary to control RS, RW, E and data ports to achieve display. RS, RW and E are the control terminals of the LCD, which are controlled through IO ports and connected with P2.6, P2.5 and P2.7 ports of the single chip computer. D0-D7 is the data port of LCD, which is connected with the P0 port of SCM.

This design is based on the alarm circuit design, which uses audible components to realize the sounder of the alarm system. The alarm circuit control is relatively simple, and the sound can be realized by powering on. In order to display the working status more intuitively, this design also adds LED indicator lights. When the bell rings, the LED lights up, and you can observe whether the system works normally through the indicator lights. Because the LED lamp and the sounder are controlled by the switch variable, the value can be controlled by the corresponding IO output signal of the single chip computer. The low level control adopted in this design is that the LED lamp is connected to the P2.0 port of the single chip computer, and the sounder is connected to the P1.5 port of the single chip computer.

The main program controls the overall operation of the fire and anti-theft alarm system. Because the SCM is connected to the power supply, the program is executed from the main function, that is, the main function. All the main programs are used as the main function programs to encapsulate and call other programs to realize the layering of the program. For this system, after power on, initialize the registers and other resources of the SCM through the

program, and then read the temperature values respectively, Read the smoke concentration value, read the pyroelectric value, compare the actual value read with the preset value and display it to determine whether there is a fire or whether there is a human invasion, if any, alarm. The system is executed in a cycle, and the detection and alarm procedures are always executed as long as the power is not turned off.

The value of the smoke sensor is mainly obtained by reading the data of ADC0832. First, the ADC is enabled, and then the signal is sent to the signal through the working time sequence of the ADC. Then the ADC works. Finally, the ADC converted value is read through the time sequence. This value is a hexadecimal number, which cannot be used directly. It also requires the microcontroller to analyze and calculate the smoke concentration value of the data.

Figure 1 Simulation schematic diagram

The reading of DS18B20 is completed through a data line. Therefore, the SCM is required to control the timing of DS18B20. First, the SCM sends the pulse reset signal to DS18B20. After receiving the pulse reset, the DS18B20 will send a corresponding signal to the SCM. When the SCM reads this signal, it means that the SCM and DS18B20 have established contact, and then the SCM sends the matching ROM command to start the temperature conversion, When the DS18B20 receives the command, it will send the temperature data through the single bus, and the SCM can read the data to complete the acquisition of the temperature data.

The display of LCD1602 is based on the UNCODE code. Each position corresponding to each line has its corresponding address. Before the display, the LCD1602 needs to be initialized and configured. The initial initialization includes the corresponding pin control definition, screen clearing and cursor reset. When LCD1602 displays a character, it sends the write command at the beginning, and needs to establish contact with LCD1602. After receiving the LCD response signal, the display is divided into two parts. One is to send the address command, which is the display position. After the position is sent, the LCD displays the display command and displays the relevant information according to the address and data.

This design is based on Proteus to simulate the fire and anti-theft alarm system. Proteus can carry out PCB design and circuit simulation. At present, Proteus has been updated to version

8.14, which supports many ARM SCM. The fire and anti-theft alarm system simulation of this design includes ADC module, SCM module, temperature sensor, LCD1602, button, buzzer and other modules. Because the smoke sensor cannot be directly simulated, its change is the change of resistance, so it is replaced by sliding rheostat, and pyroelectric can not be directly simulated. Because its output is digital switch variable, it can be replaced by keys, The true schematic diagram of the fire and anti-theft alarm system is shown in Figure 1.

Proteus simulation is the joint debugging of software and hardware. It is the same as the actual operation of the single chip computer. It needs to load the hex file generated by Keil into the single chip computer for execution. This is the compiled executable file of the single chip computer. The result of program loading is shown in Figure 2.
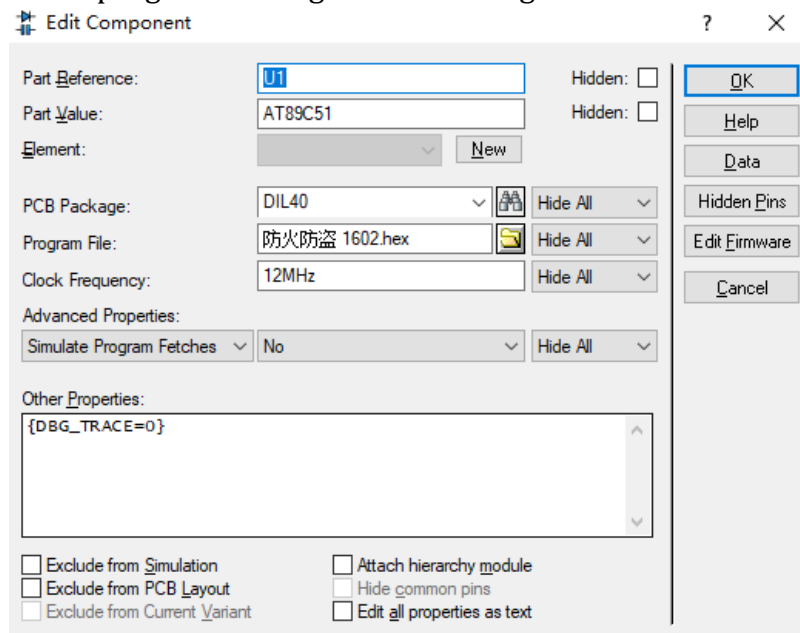

Figure 2 MCU program loading

4. Conclusion

This design introduces the development and application prospect of the fire and anti-theft alarm system, determines the scheme design of the fire and anti-theft alarm system by consulting the relevant literature, and conducts the scheme demonstration and selection of various components according to the scheme design. Then through the determination of the scheme, the appropriate components are selected. According to the application circuit of the components, the hardware circuit design of the fire prevention and anti-theft alarm is mainly based on the single chip computer, and then the measurement circuit is expanded, such as temperature measurement, smoke concentration measurement and display circuits, to achieve the overall hardware circuit design. According to the resource configuration of the single chip computer, the program design of the fire prevention and anti-theft alarm system is compiled, The software design is based on the program design specification of the single chip computer and the experience of other people. The modular design is mainly used to design the main program and functional program. Finally, the simulation and debugging of the system are completed in Proteus environment. Through debugging, the fire prevention and anti-theft alarm system completed by this design can realize the detection of intruders at the same time, and can realize the fire detection and alarm through the fire detection module. In addition to meeting the basic requirements, the system has good stability. Later, it is made according to the hardware circuit and can be used in home safety and production management, and can prevent

possible theft and fire risks through the system, And the design has the advantages of small size, low cost and convenient maintenance.

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