Design of Car Alarm System

J. Zhu, X. Cheng*

Suzhou Institute of Industrial Technology, Suzhou 215104, China.

* xiaorongcheng@126.com

Abstract

This topic mainly takes the design and manufacture of automobile alarm system based on single-chip computer as the research subject, and designs an intelligent automobile alarm system using STC89C51 single-chip computer as the internal core controller. This topic realizes many ways of anti-theft alarm function for this single-chip computer control system. Firstly, automobile alarm is detected by a high-sensitivity vibration sensor. Whether the alarm produces the vibration of the vehicle engine or the vibration action of the door during the opening and closing process when the alarm is deployed, once the vibration is detected in the deployment state, the system will think that the burglar has stolen into the vehicle and immediately cause the alarm function. At the same time, the alarm can also detect whether there is the infrared signal of the human body produced by the burglar in the carriage. Once the vibration is detected in the deployment state, the system Detection of human infrared signals will also be considered as vehicle theft, the system will achieve the purpose of alarming and intimidating thieves through high-performance sound and light alarm mechanism, in addition, the system can also display some important data generated by the car alarm system in the process of work to users. The overall performance of this intelligent automobile alarm control system is very stable and flexible after multi-angle testing. It can respond quickly according to the user's control, and achieves all the expected functional design targets.

Keywords

Intelligent vehicle alarm; Thieves detection; Engine vibration detection; Acousto-optic alarm.

1. Introduction

The intelligent car alarm control system mentioned in this topic is mainly based on the microcontroller and other microprocessors as its internal control core. After embedding the high-performance CPU, the CPU is used to external high-performance sensors. After the module group and other functional chips are driven in an orderly manner, the external input signal of the system is received, and then the high-performance arithmetic module of the CPU realizes processing of the signal and produces an output result, and the user can drive the output module [1]. The result of the processing is obtained. This paper designed a smart car alarm control system that can realize high-definition display of parameters, send alarms, human body signal capture, relay control, remote control and vibration detection. The development routine of this system is very clear. Its appearance is accompanied by the development of electronic technology and microprocessor production technology. In this development process, its maximum performance is greatly restricted by large-scale integration technology and CPU processing speed. The structure of the original intelligent car alarm control system was very simple, and it was far from the intelligent system of the current microprocessor core architecture. This initial system can only perform simple signal reception or low-speed signal comparison [2]. Operation, it is difficult to implement some complex logic operations, and thus it is impossible to realize some intelligent functions that require high computing power as a precondition. At this time, most of the internal circuits of the intelligent car alarm control system consist of some basic components such as transistors. To build, because of the space gap between these scattered devices in the circuit layout, when there are many components, the external volume of the whole intelligent car alarm control system is very large, so the external temperature environment factor is

very It is easy to interfere with the normal operation of the internal circuits of the system. Nowadays, the intelligent car alarm control system has been developed to the stage of high-speed data processing, intelligent function performance and integrated circuit density. The entire internal circuit architecture uses high-speed digital processing chips as the internal core, and has a micro-processing capability with 32-bit data. The processor chip realizes the control of the whole system, and adopts digital processing for all received signals. Since the digital signal has higher anti-interference advantages than the analog signal, the intelligent automobile alarm control system can maintain low error rate and high throughout the processing. Through the observation and data review of most intelligent car alarm control systems on the market, it can be found that the intelligent car alarm control system has developed to this stage, the performance of the internal microprocessor chip itself, the performance of the sensor and the internal program code. Three factors of high efficiency determine the key core functions of the intelligent car alarm control system. To achieve higher performance systems, these conditions must be met at the same time.

Nowadays, the intelligent car alarm control system has realized large-scale digitization. Few designers will adopt the traditional analog circuit architecture. The advantages of the all-digital architecture are very significant. For the system itself, the performance is stable and rarely It may be affected by external environmental factors; the function optimization of the system is very easy to implement, and only the program code inside the microprocessor chip needs to be re-burned to quickly realize the product replacement or defect repair, and the subject will This digital intelligent car alarm control system is designed as a research object to design a system that meets the requirements of the subject.

2. Design scheme

The intelligent car alarm control system will use the STC89C51 microcontroller chip as the main control part of the software and hardware system [3]. It will serve as the core controller part of the whole system, realize the LCD1602 display circuit, active buzzer circuit, HC-SR501 heat release. The control of sub-circuits such as electric sensor circuit, relay drive circuit, infrared remote control circuit and vibration detection circuit, its Flash size is 4k bytes, with 256 bytes of RAM, and the external interface of STC89C51 MCU is rich, not only 32 Each GPIO pin can be provided to the user, and has a stable UART serial port interface. The user can control the RXD and TXD pins of the chip through the program code to realize the serial communication function [4,5].

Figure 1. Picture of STC89C51 MCU

The design of the reset circuit is mainly the matching of the two parameter values of the resistor and capacitor. According to the data obtained, the time parameter generated by the combination of the 10k resistor and the 10uF capacitor is most suitable for the reset circuit of the STC89C51 microcontroller, as shown in the following figure. The appearance structure of the reset circuit is that the button is connected in parallel at both ends of the capacitor, and the output signal of the circuit is directly input to the RST pin of the STC89C51 single chip microcomputer.

The clock circuit will be built by capacitor and crystal oscillator. Connecting the capacitor to the crystal oscillator will make the crystal oscillator generate a 12MHz stable clock signal and send it to the two clock input pins of the MCU. The role of the clock signal in the STC89C51 MCU is mainly Provide a time base for the work of the internal CPU to make it work step by step.

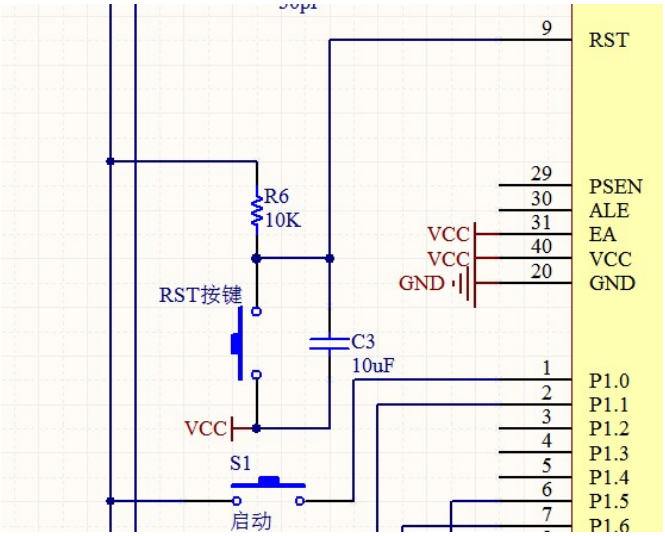

Figure 2. Reset circuit

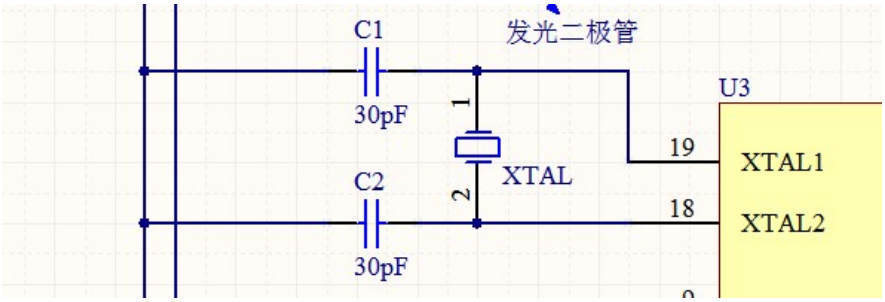

Figure 3. Crystal oscillator circuit

In order to detect whether the car alarm generates vibration caused by the engine of the vehicle or the vibration action generated during the door opening and closing process, the subject will use the vibration sensor module in the following figure, which integrates the vibration monitoring head, comparator. The conversion circuit, the threshold adjustment circuit, and the LED lamp, etc., so that the user only needs to perform simple command drive control when using it to perform a high-performance detection vibration signal function.

Figure 4. Picture of vibration sensor module

In the expected design goal of this subject, the function of detecting the vibration signal is included. Therefore, the vibration sensor is used for the function realization. The vibration sensor device is connected to the external data input and output pin according to the connection relationship in the following figure. On the P1.6 pin of the STC89C51 single-chip microcomputer, the detection of the vibration sensor output is collected through the pin. When the vibration sensor outputs a high level,

it indicates that the vehicle has detected vibration, and the output low level indicates that no vibration is detected.

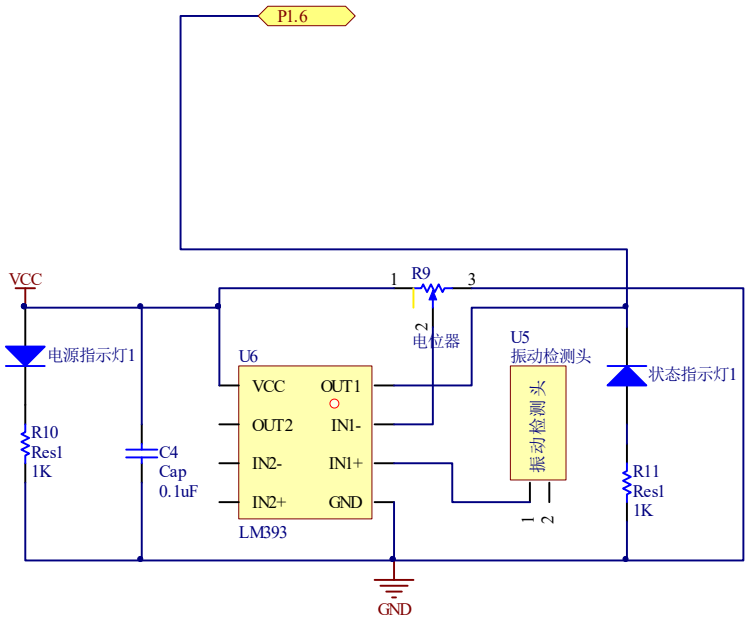

Figure 5. Vehicle body vibration detection circuit

In order to realize the human body detection in the car to judge whether there is a thief entering, the intelligent car alarm control system selects a pyroelectric sensor, which can output a high level signal to indicate the surrounding space, and through its internal delay circuit Function, you can lock the output signal. The device diagram in the figure below is a pyroelectric infrared sensor with an induction angle of 360 degrees.

Figure 6. Picture of pyroelectric infrared sensor

The pin of the pyroelectric sensor is divided into three. The STC89C51 single-chip microcomputer uses the P1.7 pin to realize the output signal acquisition of its OUT pin. This topic uses the P1.7 pin of the STC89C51 single-chip microcomputer to output the pyroelectric sensor. The level signal is detected. When the sensor outputs a high level, it means that someone in the car is detected. If it is in the armed state, it will be considered that the thief is in the car, and P1.7 is low to indicate the normal state.

In order to realize the control of turning off the main power of the vehicle when the thief enters the car, this topic will use the relay module, using the relay in the figure below, its maximum withstand current and power can meet the working requirements of the vehicle power supply.

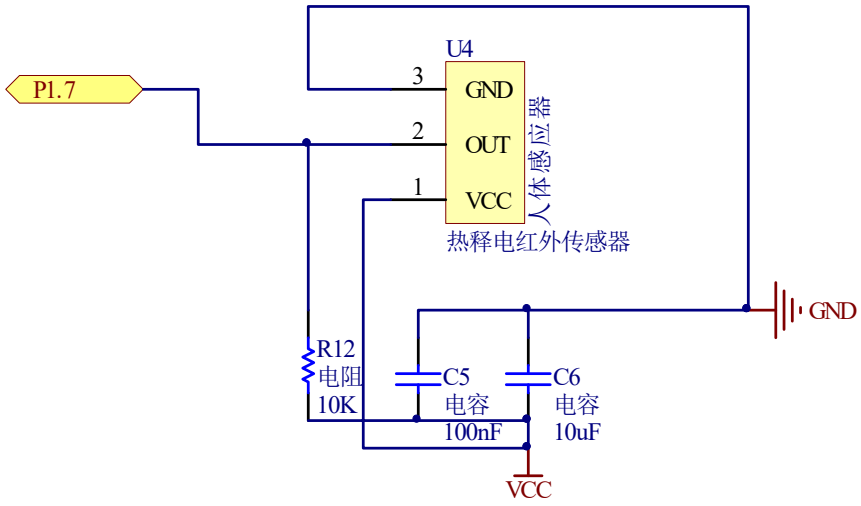

Figure 7. Design of thief detection circuit

Figure 8. Picture of relay component

The main function of the relay drive circuit is to cut off the vehicle power supply. This system needs to use the P1.5GPIO pin of the single-chip microcomputer to control this circuit, and connect according to the schematic diagram in the figure below. In the module power supply of the relay, use the +5V voltage of the system, connect according to the power supply method in the figure below, and ground the 2nd pin. When the P1.5 pin of the MCU outputs a high level, the main power supply of the vehicle is normally supplied. The output low level indicates that the system automatically cuts off the main power of the vehicle when the thief enters the vehicle.

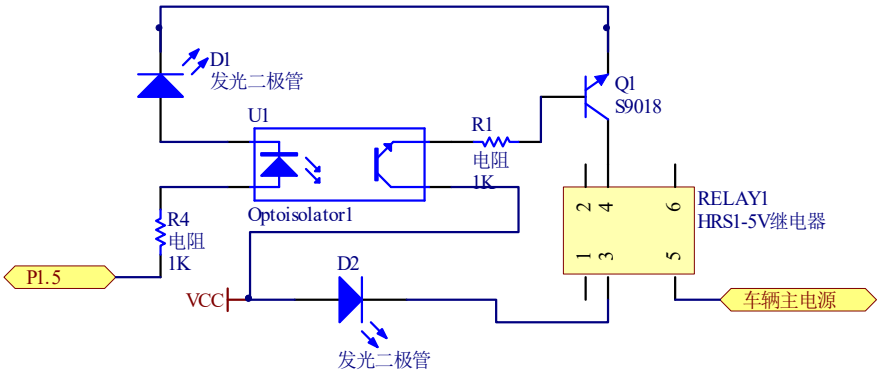

Figure 9. Vehicle main power cut-off circuit

In order to display some important data generated by the car alarm system during the work process, the LCD1602 liquid crystal display will be used to construct the display circuit. The ordinary GPIO pin of the MCU can realize the flexible driving of this LCD screen. It can realize the high-definition liquid crystal display function of the intelligent car alarm control system at a lower cost. After applying the correct voltage, the controller inside the LCD1602 can continuously receive the commands and data sent by the external main control device, through the internal retrieval of the font data, the characters are displayed on the screen in a dot matrix form.

Figure 10. Picture of LCD

As shown in the figure below, in order to realize the input and output of data and commands between the MCU and the LCD1602 LCD screen, the following connection relationship is adopted, and the 4~14 pins of the LCD1602 LCD screen are respectively connected to the corresponding P2 of the MCU. 5~P2.7 and the eight pins of P0 port. The LCD1602 display is powered by a positive 5V DC-DC voltage. Its No. 2 pin is used for power supply. In addition, the contrast adjustment circuit needs to be designed. Two resistors, R1 and R2, are used to output a DC voltage of about 1V and applied to the V0 pin. Get the best contrast display of LCD1602.

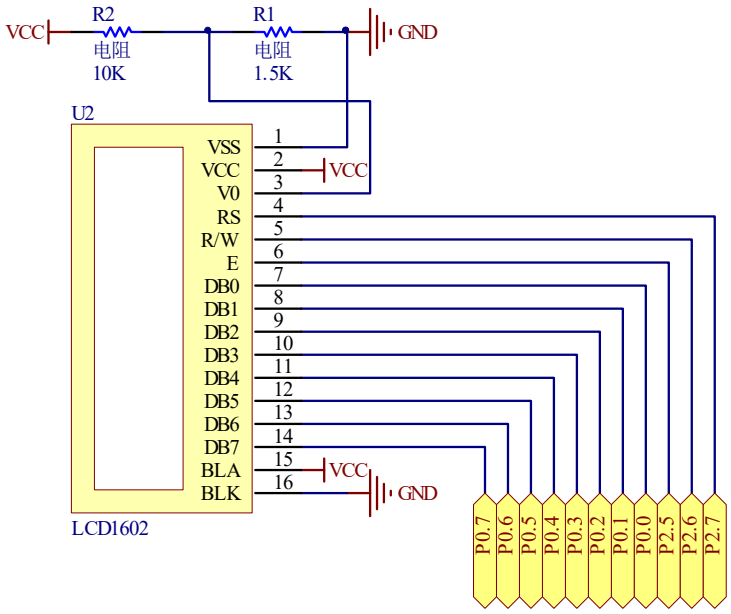

Figure 11. Display circuit design of car alarm system

In order to realize the function of sound and light alarm, the intelligent car alarm control system will construct an alarm circuit through the active buzzer. The design of the alarm circuit is relatively simple. Since the active buzzer integrates the oscillator internally, the microcontroller does not need to output. The pulse signal only needs to pass the high and low level to realize the output of its buzzer sound. The high and low level signals output by the P2.0 pin of the STC89C51 single chip need to be driven by the SI2302 switch tube in the figure to start or pause the buzzer.

In order to realize the non-contact remote control of the alarm system through the infrared remote control, this subject uses the infrared remote control receiver. Its main function is to send the received infrared remote control signal to the STC89C51 single-chip microcomputer. The HX1838 infrared integrated receiver has the right The advantages of infrared remote control command for stable reception and conversion, and the fly in the ointment is that the HX1838 receiver has a large external shape. In terms of operating parameters, this infrared remote control transceiver module can exhibit performance up to 0.1s receiving conversion time.

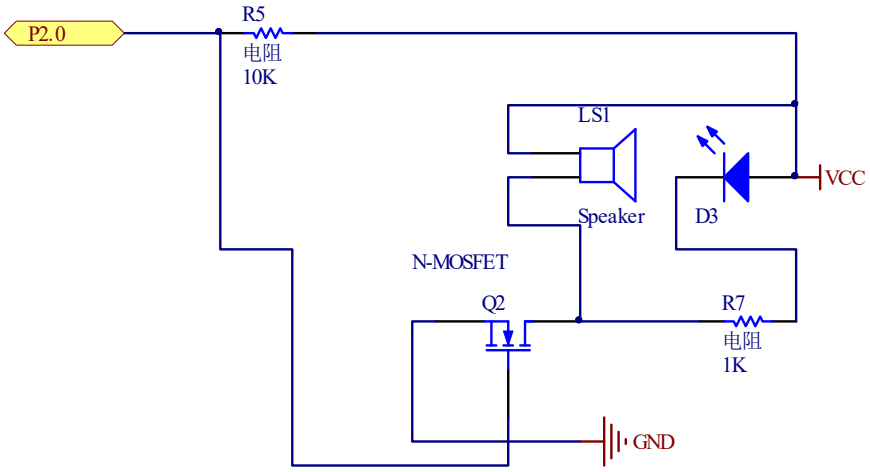

Figure 12. Sound and light alarm circuit design of automobile

Figure 13. Picture of infrared integrated receiver module

The driving circuit of the HX1838 infrared integrated receiving head is designed according to the circuit schematic diagram in the following figure. The P3.2 pin of the STC89C51 single-chip microcomputer is connected to the OUT pin of the HX1838 infrared integrated receiving head, and then directly passed through the +5V DC voltage. The HX1838 receiver can be powered. The names of the pins of this infrared integrated receiver device are VCC, GND and OUT. It can realize the main function of sending the received infrared remote control signal into the STC89C51 microcontroller through the core part of the internal infrared receiving tube.

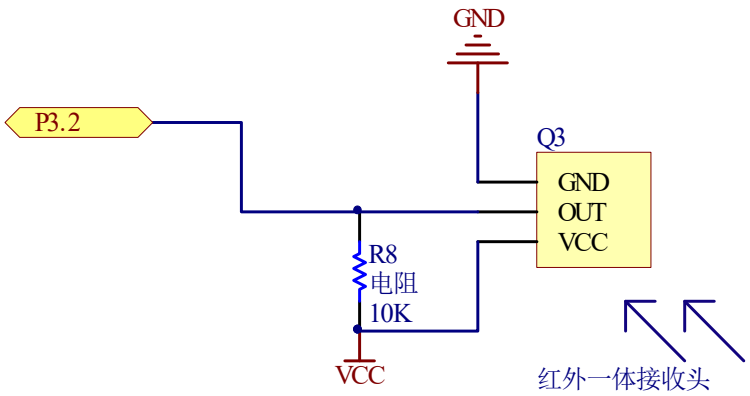

Figure 14. Infrared remote control circuit design of alarm

3. Conclusion

This paper implemented a smart car alarm control system that will implement multiple ways of anti-theft alarm function. It can detect whether the car alarm generates vibration or the door is closed by the high-sensitivity vibration sensor. The vibration action generated during the process, once the

vibration is detected in the deployment state, the system will consider the thief to steal the car and immediately cause an alarm function. At the same time, the alarm can also detect whether there is a thief in the compartment. The human body infrared signal, once the human body infrared signal is detected, will also think that vehicle theft has occurred. The system will use the high-performance sound and light alarm mechanism to achieve the purpose of alarming and threatening the thief. In addition, this system can also use this car. Some important data generated by the alarm system during the work process are displayed to the user. The following are the realization goals of the system: 1. It can realize fast data communication with STC89C51 single-chip microcomputer, and clearly display the characters to be displayed; 2, through the simple and effective configuration of the active buzzer circuit, combined with the C language program to achieve the alarm function; 3. High-sensitivity capture of human infrared signals around the intelligent car alarm control system through pyroelectric sensors; 4. Design the relay control circuit, realize the closing and opening of the internal contacts of the relay through the pin control of the STC89C51 single-chip microcomputer, thus flexibly driving the successor module; 5, can realize the infrared remote control function, when the user automatically presses the remote control command after pressing the remote control button, the intelligent car alarm control system can capture and restore the electrical signal through the HX1838 infrared receiving head, then decode and execute the corresponding subroutine according to the NEX protocol. ; 6. Through the configuration of the vibration sensor drive circuit, the output signal of the vibration sensor can be detected by the ordinary GPIO pin of the STC89C51 single-chip microcomputer to achieve high-sensitivity detection of vibration around.

Acknowledgements

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