Design of Electronic Password Lock Based on Single Chip Microcomputer

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Abstract

This topic is based on the research status of most similar control systems on the market. It aims to improve the average performance level of the electronic password lock system by a large margin. After the STC89C51 microcontroller chip embedded and several high-performance module circuit construction, and through the C language program code. The system has the functions of password input, password judgment, password preservation, error alarm and infrared remote control. In the design of hardware system, the whole electronic password lock system is divided into the smallest system circuit part of STC89C51 single chip microcomputer and the display panel drive subroutine, alarm subroutine, relay control subroutine, EEPROM drive subroutine and remote control command receiving subroutine. In the software part, the main program and remote control command receiving subroutine are used. Each subroutine is constructed, and each program flow is optimized and upgraded, which makes the software system and hardware system collocate reasonably, making this electronic password lock system designed by this subject show excellent work effect. After many angles and repeated tests, the system can run stably for a long time in both normal and harsh working environment.

Keywords

Intelligent password lock; single chip microcomputer control system; password storage; infrared remote control.

1. Introduction

The reason why the electronic code lock system controlled by the single chip microcomputer can be popularized is that this system has its unique charm. First, all the intelligent functions realized by the electronic code lock control system are controlled and realized in a very small silicon chip. This high integrated chip not only works stably, but also can make the electronic The intelligent function of the password lock system can realize efficient conversion. The programmer can convert the function at the bottom through various kinds of statement codes; on the other hand, the contribution of the sensor technology with intelligent collection function to the single-chip microcomputer control system is discussed. Through the implantation of various sensors, the single-chip microcomputer control system can make various kinds of external system. The type of signal is collected at high speed and the collected signal is sent to the MCU chip in the most compatible way for use, so that the function of the SCM system can be more abundant[1-5].

With the development of 32-bit microprocessor technology and application technology, more and more R & D designers have mastered the control method of internal registers of this high-performance CPU, and embedding this high-end CPU into the electronic password lock system is an effective way to improve the performance of the system, so more and more electronic password lock products are being adopted on the market. The microprocessor with higher processing speed is used to realize the control. At present, there is a certain gap in the development level of electronic password lock system at home and abroad. A large proportion of the core R & D technology of high-performance products on the market is in the hands of some enterprises in Europe and the United States. Due to the high cost of domestic products to import this electronic password lock system, the price is high. In order

to catch up with the R & D technology of these high-performance products, the domestic R & D technology is relatively low. Many enterprises have invested a lot of money to develop the high-end performance of electronic password lock system.

2. Overall Design

In this paper, the electronic code lock system is modularized, and the whole system is divided into STC89C51 single chip microcomputer minimum system circuit, parameter display circuit, buzzer circuit, relay drive circuit, AT24C02 eeprom circuit design and hx1838 infrared integrated receiver circuit at the hardware and software system levels. The following hardware and software design will be detailed The software and hardware drivers of these modules are designed. The minimum system of STC89C51 is to control the whole system, to drive the LCD display circuit, alarm signal generating circuit, relay driving circuit, data storage circuit and infrared remote control receiving circuit. The keyboard module is used to input the password. The infrared integrated receiving head is used to Receive the infrared signal from the remote control; the infrared remote control is used to send the password; the EEPROM chip is used to save the password; the LCD screen is used to display the parameters; the relay is used to control the switch of the lock valve, which is the main function of each module.

3. Design and Implementation of Hardware System

This part will begin to introduce the selection of the master microprocessor scheme of this electronic password lock system. Combined with the knowledge of single-chip microcomputer learned in University and the learning experience of various mainstream single-chip microcomputer chips, STC89C51 single-chip microcomputer is a very suitable microprocessor for this electronic password lock system. In terms of circuit configuration, this STC89C51 single-chip microcomputer uses the one in Figure 1. Direct pin package can reduce the layout difficulty when drawing the circuit diagram through Protel. Because the spacing between pins is very large, the lines can be flexibly arranged. After applying + 5V DC voltage to STC89C51, it can execute the instructions according to the procedure downloaded in flash, and realize the execution of various functions of electronic password lock system.

Figure1 physical figure of STC89C51 single chip microcomputer

In order to save the password, this project selects the EEPROM chip as shown in Figure 2. In terms of cost, this AT24C02 EEPROM has a relatively low price. Most of the AT24C02 EEPROM launched by most manufacturers are about 1 yuan per chip. Combined with its high-performance data saving effect, embedding it into the electronic password lock system can greatly improve the cost performance of the system. Parameter, AT24C02 memory chip has the performance of maximum 2K bytes storage capacity. When EEPROM chip is driven by GPIO pin, AT24C02 memory chip can orderly save the data after power failure under the control of DC 5V level.

Figure 2 physical figure of AT24C02 memory chip module

Many excellent features of the infrared remote control receiver are mainly due to the high-density integration of the receiver, filter, amplifier, interface circuit and mechanical structure. Therefore, users only need to carry out simple command driving control to make it show high-performance photoelectric conversion and realize the infrared remote control command receiving function. In the initial design goal, because the electronic password lock system needs to have the photoelectric conversion to realize the infrared remote control command receiving function, so this topic must consider to configure a module circuit which can realize the infrared remote control data receiving function outside the STC89C51 single chip microcomputer. After consulting the data of many commonly used infrared remote control data receiving modules on the market at present, it is found that The infrared integrated receiver is a very good choice, as shown in Figure 3.

Figure3 physical figure of infrared remote control receiver module

In terms of the internal architecture design of the LCD1602 LCD as shown in Figure 4, the R & D personnel mainly divided the device into several key parts in terms of hardware circuit, such as LCD control chip, LCD dot matrix, voltage processor, parallel bus interface and word bank memory, among which the LCD control chip is the core part, and the performance of this functional module determines the whole LC. The performance parameters of d1602 LCD, and in order to facilitate the user to realize the internal circuit control of LCD1602 LCD through the single chip microcomputer, the R & D personnel will lead out 16 pins for the user to control, so as to realize the function of LCD. Through the common GPIO pin drive of single chip microcomputer, the following advantages can be realized: the function of high-definition liquid crystal display of electronic password lock system can be realized with the lowest cost.

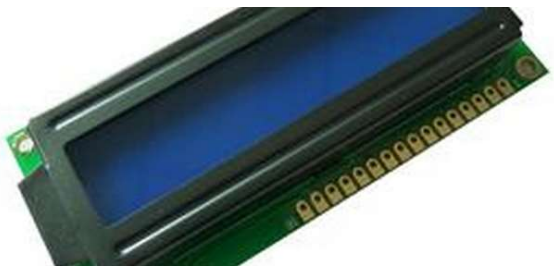

Figure 4 LCD1602 LCD screen

The main design points of the minimum system circuit are reset circuit and crystal oscillator circuit. Then, the minimum system can be constructed by connecting these two parts with STC89C51 single-chip microcomputer, so as to drive the surrounding circuit modules As shown in the circuit structure in Figure 5, after the crystal oscillator and capacitor are connected according to the structure in the figure, the circuit will be able to realize the output of 12Mhz stable clock signal, so that the single chip computer can stably execute instructions at 12Mhz clock frequency.

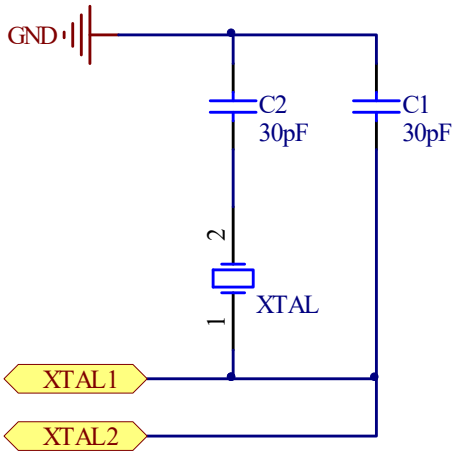

Figure5 crystal oscillator circuit design

as shown in the circuit structure in Figure 6. After connecting the key, resistance and capacitance according to the structure in the figure, the reset circuit can be constructed to realize the function of low-level output when pressing the key to reset the STC89C51 single chip microcomputer.

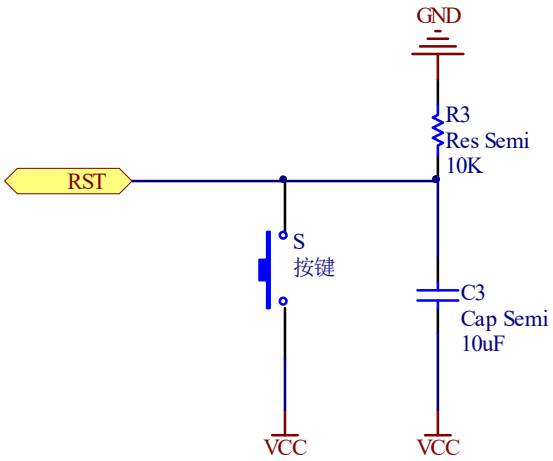

Figure6 reset circuit design

In order to realize the alarm function when the wrong password is input three times in succession, the alarm circuit of figure 7 is configured. In this electronic password lock system, the hardware circuit of the buzzer device will be driven according to the connection relationship of the schematic diagram in the figure below. The bottom drive between the STC89C51 single chip and the alarm circuit is relatively simple, which can be realized only through the GPIO pin of one STC89C51 single chip. According to the connection relationship in the figure, when p2.0 outputs high-level buzzer, it will alarm and output low-level buzzer will not alarm.

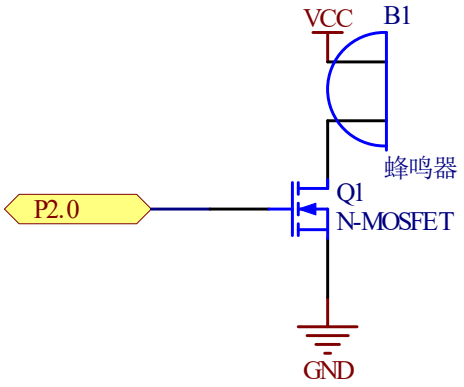

Figure7 circuit design of error alarm circuit

In order to realize the unlocking function when the password is input correctly, the relay driving circuit is configured to realize the driving of the lock valve by starting and closing the relay. The internal modules of the relay device, such as internal gasket, current limiting circuit, mechanical structure, electromagnetic coil and spring contact, have been designed before leaving the factory. In the design task of this subject, the STC89C51 single-chip microcomputer can be used. The common GPIO pin directly drives and controls the various functional modules inside the hk4100f relay. Through the mutual connection and interaction of these functional modules, the strong signal function of weak signal control is finally realized. As shown in Figure 9, the p2.1 pin of the single-chip microcomputer will drive the relay.

Figure 8 design of relay drive circuit

In order to save the password, EEPROM chip is selected to build the password memory circuit. Because the AT24C02 memory chip selected in this paper is from aitmel company, in order to realize the input and output needs of data and instructions between SCM and AT24C02 EEPROM, the connection relationship shown in Figure 9 is used to connect pins 5-7 of AT24C02 EEPROM to a single pin. The GPIO pin corresponding to the chip machine is enough. It can be seen from the connection between STC89C51 single chip and EEPROM chip and the circuit structure that the single chip will drive AT24C02 through p3.5-p3.7. The whole circuit structure and framework are relatively clear and concise, which is mainly due to the high integration characteristics of AT24C02 memory chip devices. Most peripheral circuits and required devices have been integrated and completed in the device.

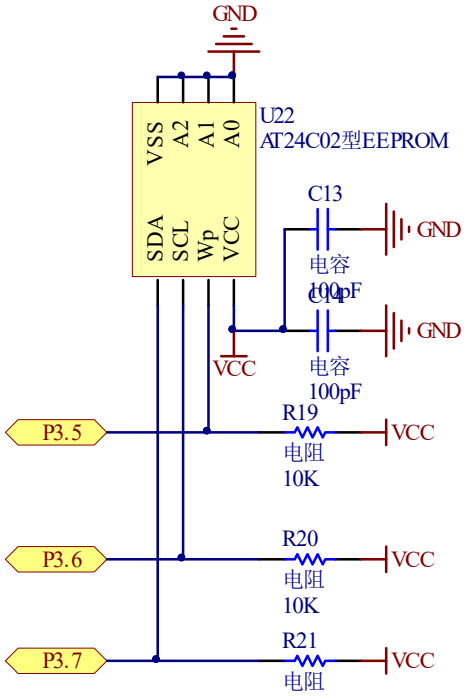

Figure 9 design diagram of password storage circuit

The infrared remote control transceiver module selected in this project is packaged externally, which is very suitable for the construction of circuit topology and the layout of PCB circuit board. Due to the large spacing between pins, the line routing is very convenient. STC89C51 single chip microcomputer can drive these three pins through common GPIO pins, and realize STC89C51 through specific bus interface. The data between the single chip microcomputer and the hx1838 infrared integrated receiver is received and sent to each other, as shown in the circuit schematic diagram shown in Figure 10. The output signal of the hx1838 infrared integrated receiver adopts NEC protocol, and the data form is serial. Its signal output is not controlled by the STC89C51 single chip microcomputer. As soon as the infrared signal from the infrared remote controller is received, it can be converted into electric pulse signal. According to the connection relationship in Figure 11, hx1838 sends the electric pulse signal to pin p3.2 to receive the wireless input password.

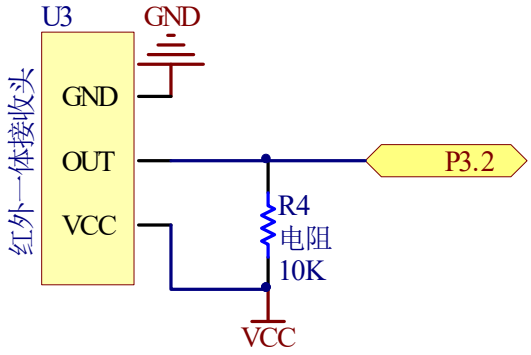

Figure 10 design schematic diagram of infrared remote control receiving circuit

The keyboard circuit is mainly used to realize the functions of password input and modification, as shown in the circuit structure of Figure 11. The P1 port of the single-chip microcomputer is used for dynamic scanning to detect the key value input by the user. The keyboard is composed of sixteen keys S1-S16 in the figure.

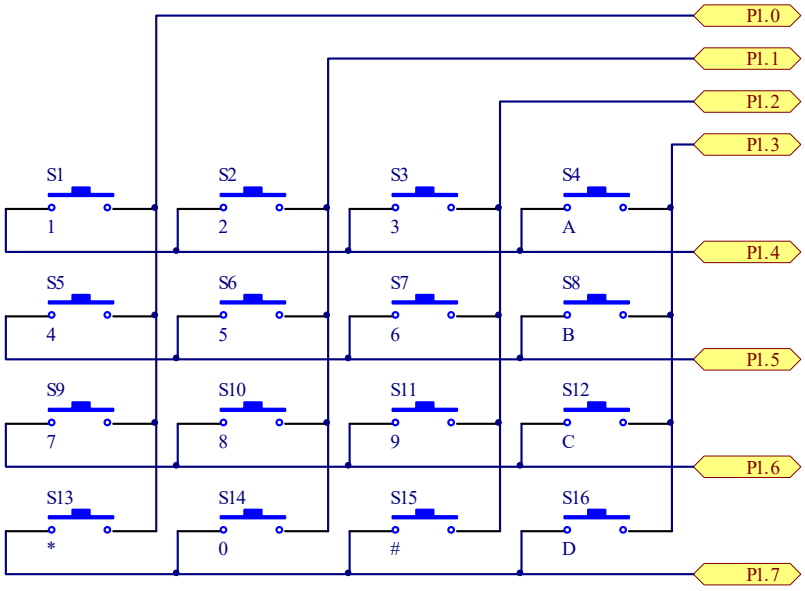

Figure11 keyboard circuit design

The main function of LCD display circuit is to realize password display and status data display. The circuit schematic diagram of LCD1602 display consists of two parts: DC 5V voltage supply circuit and parallel single chip microcomputer pin drive circuit. The system needs to allocate 11 different GPIO pins to connect with LCD1602 display device, and connect them according to the schematic diagram in Figure 12. After that, the drive can be completed. In the aspect of LCD1602 LCD module power supply, through consulting the information documents provided by the manufacturer of the device, it can be found that the device has the characteristics of wide voltage input, and can work

stably in the DC voltage range of 3.3 ~ 5V, which is mainly due to a high-performance internal voltage stabilizing module, which can reduce and stabilize the DC voltage input by external power supply and reduce the voltage. The components of AC interference carried in are effectively filtered out.

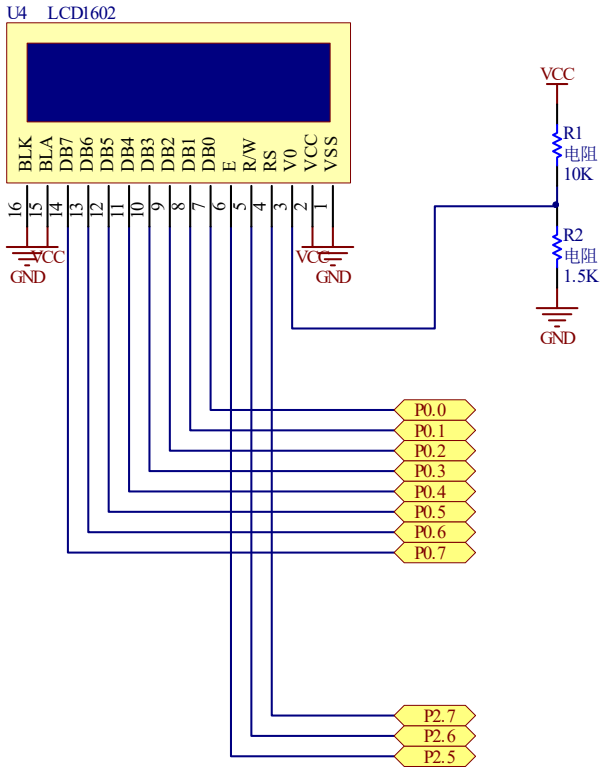

Figure12 LCD display circuit design

4. Conclusion

After the design of the whole system, hardware system circuit and software system subprogram, all the functional indexes of the electronic password lock system are realized, including password input, password judgment, password saving, error alarm and infrared remote control. The electronic code lock system designed in this project adopts the module design method, which divides the whole system into multiple functional modules according to the functions to be realized. Through this simplified design method, each functional module is designed and tested separately, and finally each functional module is connected through the external interface. This design idea is obtained in this project. Fully show, at the same time, in the design process, once the circuit running fault is encountered, the sub circuit module can be analyzed and troubleshooting independently, without the intervention of other functional circuits, which is very helpful for the design progress of the project. When all functional sub circuits are connected with the minimum system circuit of STC89C51, the system shows the expected work.

Acknowledgements

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