Design of Remote Control System for Household Appliances based on Single Chip Microcomputer

Haibo Huo*
Sanmenxia Polytechnic, Henan, China, 472000

*Corresponding author e-mail: drmichal@outlook.com

Abstract. With the development of society, people have higher and higher requirements for the convenience of life. Therefore, it is of great practical significance to study the remote control system of household appliances based on single chip microcomputer. This paper first introduces the common scheme of remote control technology of home appliances, then analyses the module of remote control system of home appliances based on single chip microcomputer, and finally gives the design scheme of remote control system of home appliances based on single chip microcomputer.

Keywords: Remote Control System, SCM, Household Appliances

1. Introduction
With the rapid development of remote control technology, the traditional home appliance control system has been unable to meet people's requirements for the convenience of life, so the requirements for the home appliance remote control system are increasingly high. The design of the remote control system of home appliances based on single-chip microcomputer can be designed reasonably based on the actual needs of people for home equipment, give play to the advantages of remote control technology of single-chip microcomputer, so as to further improve the convenience of people's life[1]. With the development of information technology, Internet information technology is more and more used in the remote control of smart home appliances, which has become the development trend of smart home appliances. Therefore, it is of great practical significance to study the remote control of MCU based on mobile Internet.

2. Common scheme of remote control technology for home appliances
At present, the more common remote control system of household appliances mainly has three ways as shown in Figure 1. Among them, infrared remote control is to send the corresponding information through a specific encoding by the transmitter, while the receiver analyses the received information through a specific decoding strategy, and finally completes the identification and control of the encoded information[2].

With the development of society, people have higher and higher requirements for the convenience of life. Therefore, it is of great practical significance to study the remote control system of household appliances based on single chip microcomputer. This paper first introduces the common scheme of remote control technology of home appliances, then analyses the module of remote control system of home appliances based on single chip microcomputer, and finally gives the design scheme of remote control system of home appliances based on single chip microcomputer.

Keywords: Remote Control System, SCM, Household Appliances

1. Introduction
With the rapid development of remote control technology, the traditional home appliance control system has been unable to meet people's requirements for the convenience of life, so the requirements for the home appliance remote control system are increasingly high. The design of the remote control system of home appliances based on single-chip microcomputer can be designed reasonably based on the actual needs of people for home equipment, give play to the advantages of remote control technology of single-chip microcomputer, so as to further improve the convenience of people's life[1]. With the development of information technology, Internet information technology is more and more used in the remote control of smart home appliances, which has become the development trend of smart home appliances. Therefore, it is of great practical significance to study the remote control of MCU based on mobile Internet.

2. Common scheme of remote control technology for home appliances
At present, the more common remote control system of household appliances mainly has three ways as shown in Figure 1. Among them, infrared remote control is to send the corresponding information through a specific encoding by the transmitter, while the receiver analyses the received information through a specific decoding strategy, and finally completes the identification and control of the encoded information[2].
Infrared control system

Telephone control system

PC remote control system

**Figure 1.** The specific control method of remote control technology

As a non-contact control method, infrared remote control method is different from other wireless control methods, it will not produce interference phenomenon, and the method is simple and convenient. But the distance of infrared remote control is relatively short, which is not suitable for long-distance communication. The PC remote control is to realize the remote control of home appliances through the Internet. It uses Java language or C language to design the remote control interface, establishes the connection between the PC terminal system and the network, and then sends the control instruction to the receiving terminal such as the gateway through the Internet[3]. After receiving the instruction, the receiving terminal controls each household appliance according to the specific route. The specific control method is shown in Figure 2 below. As a more popular control method recently, the telephone network control is to realize the remote control of home appliances through the telephone. The telephone network control is relatively simple in wiring and easy to popularize[4].

**Figure 2.** The specific control method of PC remote control

3. The module of remote control system of home appliances based on single chip microcomputer

3.1. Ring detection and simulation off hook module

With the development of single-chip technology, its application in the remote control system of household appliances can significantly improve the efficiency of remote control of household appliances. The two important parts of the remote control system of home appliances based on single
chip microcomputer are ring detection and analog off hook module[5]. Base adopts resistance to realize voltage reduction, input to optocoupler through isolation conversion, output waveform signal from optocoupler, input to terminal counter of single chip microcomputer, so as to realize counting and detection of ringing tone. The design of the circuit of the electric pick-up machine should be based on the actual use demand to ensure the effectiveness of the signal transmission and realize the effective remote control.

3.2. Decoding module
As an important module in the design of the remote control system of home appliances based on single chip microcomputer, the decoding module often uses complex frequency code selection IC to form a complete DTMF receiver, so as to play the role of the decoding module. When the decoding module is applied to the remote control system of household appliances, the received information will be transmitted to the decoder inside the system and finally output to the external shared bus to realize the remote control of household appliances.

3.3. Electrical system module
The design of electrical system module in the remote control system of home appliances based on single chip microcomputer is relatively simple. Its circuit is mainly composed of triode, diode, relay and other components. In the operation of remote control system, the reliability level of data transmission is high, and the data information sent omits the confirmation link, so it has the advantages of high data transmission rate, but its reliability is not good, and it is easy to lose data information. Receive relevant instructions sent from the control side between the client and the server. The user operates according to the instruction interaction prompt, and the specific instruction information is sent from the control end to the controlled end, and the information is parsed to perform the corresponding control operation.

4. Design scheme of remote control system for household appliances based on SCM
Through the GSM short message module to send instructions to the single-chip microcomputer, the single-chip microcomputer receives the instructions to control the home appliances on and off. Through DHT11 module and mq2 module, relevant data can be collected and displayed on the LCD, and the key can change the control value of home appliance data. When the data is sent and received, SMS will be sent to the mobile phone through the GSM module to feed back the current status value of home appliances.

4.1. Hardware design of remote control system for household appliances
The hardware system consists of nRF2401, independent key input, LED display, relay control, power supply, SCM minimum system and other hardware circuits. The hardware system principle of this part is shown in Figure 3. With the popularization of home appliances intelligence and the increasing diversity and complexity of equipment and instrument functions, it is very important to design a simple and easy to operate user interface. Therefore, a visual user interface is designed in this project, and through the LCD screen, real-time display of the data status of electrical appliances, to achieve the control and operation of home intelligent equipment, to ensure good interaction with electrical appliances.
### 4.2. Software design of remote control system for household appliances

In order to ensure the normal upgrade of the software system in the future, the system adopts modular software design, so as to realize the decomposition of complex tasks into many small tasks. Then, the decomposed task is realized by subprogram. Finally, assemble all the programs, debug all the tasks and then carry out the final assembly test. Modular software design can realize the reusable subroutines.

### 4.3. System final assembly test

Power on the whole system and run it from the main program. First, initialize the hardware peripherals, such as wireless module, temperature sensor, independent key and LCD. Secondly, the transmitter then enters the main cycle, then carries out independent key scanning, presses the key to send data to the receiver, enters the receiving mode, judges the status data of the sender, reads and controls the switch status of the home appliances according to the data, and displays the required data and the status data of the home appliances on the LCD screen. In addition, wait for receiving data at the receiving end, read data information, and send data information and status data of home appliances to the sending end. After the comprehensive debugging of hardware and software, the remote control system of home appliances designed in this scheme can meet the needs and effects of intelligent remote control of home appliances.

### 5. Conclusions

At present, with the popularization of smart home appliances, remote control of home appliances has become a development trend. The remote control system designed in this paper can operate the function of the controlled object, which is not only convenient for users to obtain the corresponding data information of home appliances, but also can realize the control of remote home appliances. The design of the remote control system of home appliances based on single-chip microcomputer can not only give full play to the advantages of single-chip microcomputer, but also help to improve the operation efficiency of the remote control system of home appliances and meet the needs of people for the convenience of life.

### References

[1] Song Yuchao. Research and design of intelligent home monitoring system based on MCU [D]. Jilin University, 2018.

[2] Jiang Xiaozhe, Wang Yanxin, Julie. Design of a remote control system for household appliances based on single chip microcontroller technology [J]. Electrical materials, 2017 (1): 37-39.

[3] Hao Rong, Gao Guowei, He Gang, Ma Chao. Design of remote home appliance control system based on single chip microcomputer [J]. Sensor world, 2015, (6): 12-16.

[4] Tang min. research and implementation of key technologies of intelligent home infrared terminal controller [D]. Xinjiang University, 2013.
[5] Zhu Anlin. Practical application of computer network remote control system [J]. Information construction, 2016 (4): 81.