Chapter 23
A Simple Fire Extinguishing Demonstration System Based on Single-Chip Micyoco

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Abstract The system uses STC89C52 microcontroller as the main control chip, with infrared transmission and infrared reception as the transmission device, in order to achieve the powder and flame of the fire extinguisher sprayed to simulate, reproduce the fire extinguishing step. The system makes full use of the principle of "sound, light, and electricity", greatly restores the real fire drill scene, through the use of fire extinguishers, the real reproduction of the fire extinguishing process, to achieve the purpose of fire extinguishing drills. This not only reduces energy consumption but also improves presentation efficiency. If it can be widely used, it will be an indispensable tool in fire propaganda departments, schools, enterprises and institutions, government agencies, social organizations, the research and development of this project will bring people a lot of conveniences, if the whole society generally uses this product, it can improve the efficiency of personnel and social safety.

23.1 Introduction

Fire Protection Law of the People's Republic of China, as amended by the Fifth Meeting of the Standing Committee of the Eleventh National People's Congress, The society has set off a round of learning the new fire law upsurge, various forms of fire law publicity and implementation activities have been carried out in various places. The construction of legal system of fire control is an important link to carry out fire control work in an all-round way. In order to cooperate in full swing now hereby stable cross activities, the Ministry of Education jointly the Ministry of Public Security issued a 28 ministries file Fire safety management regulations of colleges and universities, May 1, 2009 and clearly requires colleges and universities should carry out fire control safety education and training, to strengthen the fire drill and

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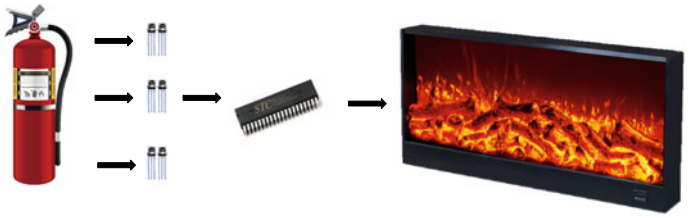

Fig. 23.1 Flow chart of the system

improve the fire safety of staff and students consciousness and save your survival skills. Because of the limitation of funds and foreign exchange, fire training in most colleges and universities is mainly confined to a variety of simple fire extinguishing drills based on fire equipment and familiar with the campus consumption equipment for all kinds of fire extinguishers, namely the basis of commonly used, which include dry powder fire extinguishers, CO_2 fire extinguisher and foam fire extinguisher, fire demonstration mainly is to use some open flame or smoke simulation, using different fire extinguishers to put out the fire. In this process, although the teachers and students can learn some basic fire common sense, to be familiar with a number of fire equipment, but as a result of the training itself is set spraying and fire extinguisher itself out of the dust to the campus and the whole social environment more than heavy pollution of the premise, developed a set of simulated fire demo system idea was born.

The concept of fire extinguishing the demo system is introduced; the system makes full use of the principle of sound and light, greatly reducing the real fire drill scenario, through the use of fire extinguishers, recreating the extinguishing process, to achieve the purpose of fire drill. Such not only reduced the energy consumption and improve the efficiency of the demo system concept, which is shown in Fig. 23.1.

23.2 Product Design

The software part of the system consists of the transmitter and the receiving control. Transmitter is mainly used to continuously send infrared signals and LED white light to the receiver. The receiving control terminal is mainly used to receive infrared and white light signals sent by the transmitter. The signal is analyzed and processed by the single-chip microcomputer to judge the fire extinguisher scanning flame. After the fire extinguishing is completed, the system enters the standby state and broadcasts the voice “the fire extinguishing has been completed”.

The hardware part of the system consists of the transmitter and the receiving control. The transmitting end is mainly composed of infrared transmitting tube and strong light LED lamp. The receiving control end is mainly composed of infrared receiving module, photosensitive resistor sensor module, audio module, flame control module, and so on. At the same time, the STC89C52 single-chip microcomputer is used as the main control chip.

23.3 System Composition

At present, SCM is a powerful assistant for developers and an indispensable tool in practical application. It is widely used in various fields [1]. As an important representative of embedded systems, it plays an important role in the development of electronic technology [2].

The maximum operating clock frequency of the STC89C52 single-chip microcomputer is 80 MHz, the sheet contains 4 K Bytes of ROM, the device is compatible with the standard MCS-51 instruction system and 80 C51 pin structure. A universal 8-bit CPU and an ISP Flash memory unit are integrated into the chip, Cooperate with PC end control program can download program into the single-chip computer, So you don't have to buy a universal programmer, And faster than the editor [3]. STC89C52 MCU pin diagram is shown in Fig. 23.2.

Because the system needs to simulate the sound of the flame, we use the MP3 decoding chip to store the audio file and select the corresponding audio file directly from the single-chip computer instruction [4].

MY2480-16P is a small micro-integrated voice module developed by Shenzhen Maiyou Technology Co. Ltd. Using MY2480-24TS MP3 main control chip, support MP3, WAV format double decoding, module maximum support 16 MB FLASH can also be connected to the U disk or USB data line computer to replace FLASH audio files. This module built-in 3 W power amplifier can directly drive 3 W horns, which is more convenient to use.

Simulated flame box: black oak box with 75 * 20 * 45 CM, Internal emptying, A groove of 75 CM * 5 CM on the front. Two threads with a distance difference of 70 CM are drilled from the groove 3 CM, and then the two sides are left with a gap of

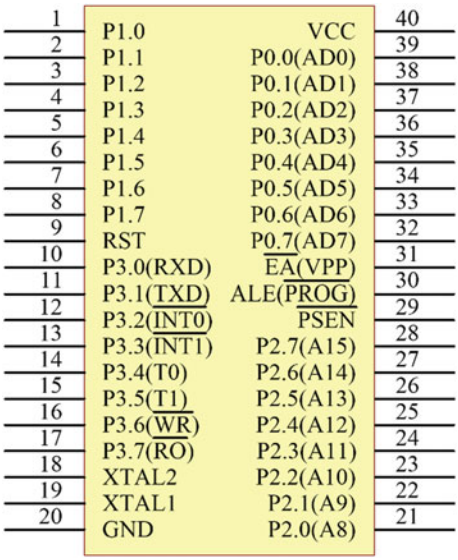

Fig. 23.2 STC89C52 single-chip microcomputer pin diagram

5–5 and a platform with a width of 4 CM is placed at a height of 6 CM above the gap. The specific components of the simulated flame box are: (1) rotating motor, rotating motion when electrified; (2) electronic carbon strips, made up of wooden blocks, and light transmission; (3) fire system, from the silver-plated reflector projection to the reflective screen formed; (4) LED light, XML-T6L2U2; model (5) infrared receiver, type VS1838B bandwidth 2–5 kHz; (6) flat glass, GB4871-3 mm; model; (7) wooden boxes, the model is 75/20/45.

The infrared receiver is one of the most commonly used electronic components in electronic equipment. According to its transmission function, it can be divided into pulse type and level type. The level infrared receiver outputs a continuous low (or high) level when receiving a millisecond infrared pulse signal, which is easy to receive and process, but its transmission distance is limited. The pulse infrared receiver only responds to the arrival of the carrier signal in milliseconds. Therefore, the use of pulse infrared receiving control as a long-distance, output continuous pulse signal module is a lot of electronic system design scene needs [5].

The external receiving circuit is usually composed of infrared receiving diode and amplifier circuit. The amplifier circuit is usually composed of an integrated block and several resistors and capacitors and needs to be encapsulated in a metal shield box, so the circuit is more complex. The volume is small. The receiver head is a special infrared receiving circuit, which integrates the infrared receiver tube with the amplifier circuit. It is small (the size is equivalent to a medium power transistor) and has good sealing, high sensitivity, and low price. The market price is only a few Yuan and it has only three pins, which are the positive pole of the power supply, the negative pole of the power supply and the output end of the signal, and its working voltage is about 5 V. As long as it is connected to the power is a complete infrared receiving amplifier, very convenient to use.

Its main functions include amplification, frequency selection, and demodulation. After its receiving amplification and modulation, the original signal will be output directly at the output. So that the circuit to achieve the most simplified! Sensitivity and anti-interference are very good and can be said to be an ideal device to receive infrared signals. IRM-3638T infrared receiver tube product parameters are shown in Table 23.1. IRM-3638T infrared receiver tube appearance size diagram is shown in Fig. 23.3.

An optical sensor is a sensor that uses Guang Min element to convert the optical signal into an electrical signal. Its sensitive wavelength is a near-visible wavelength, including infrared wavelength and ultraviolet wavelength. Optical sensors are not only limited to the detection of light but also can be used as detection elements

Table 23.1 IRM-3638T IR receiver product parameters

Name of name	Parameters
Supply voltage	0–6 V
Working temperature	−25 to 80 °C
Storage temperature	−40 to 80 °C
Welding temperature	260 °C

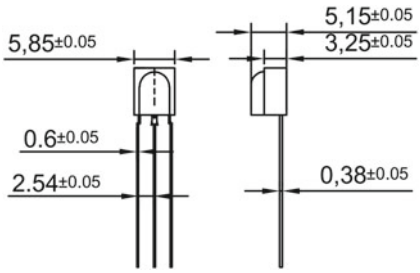

Fig. 23.3 IRM-3638 T external dimensions of infrared receiver

to form other sensors to detect many non-electric quantities, as long as these non-electric quantities can be converted into changes in optical signals. The optical sensor is one of the most widely used sensors, which plays an important role in automatic control and non-electric measurement.

23.4 Physical Debugging

According to the hardware design, use Altium Designer software to complete the schematic drawing, the following is the control end. The physical schematic diagram is shown in Fig. 23.4.

According to the hardware design, the Altium Designer software is used to complete the drawing of the PCB diagram, and the receiving control end can be drawn, which can save the cost. Some of the PCB components are encapsulated by patch, pursuing small volume and portable; as shown in Fig. 23.5.

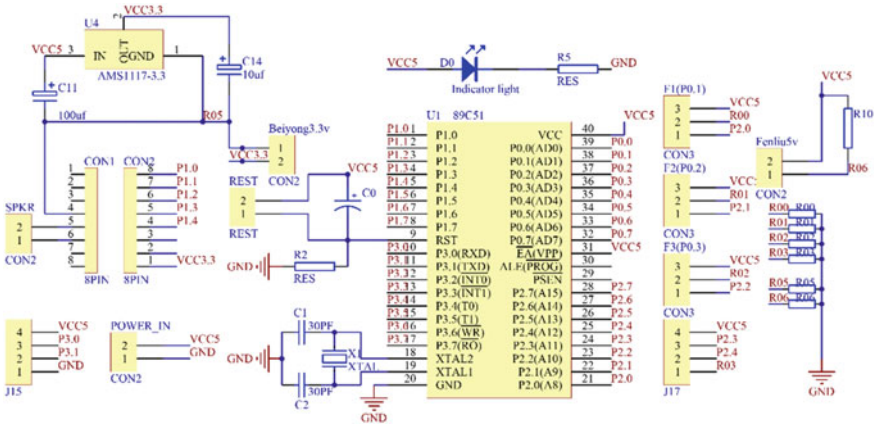

Fig. 23.4 Physical schematic diagram

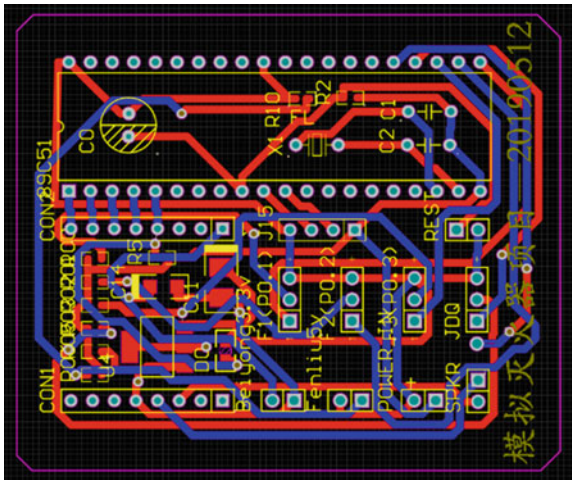

Fig. 23.5 Physical PCB

Fig. 23.6 Physical diagram of the system

The software design of the system completes the programming, and the hardware design completes the hardware construction. The physical picture is shown in Fig. 23.6.

23.5 Conclusion

The existing firefighting demonstration is based on the real combustion environment and the use of fire extinguishers to achieve fire extinguishing, which has caused serious pollution to the environment and time consuming, waste of resources, and other shortcomings so that fire awareness has not been popularized. At the same time, per capita participation is very low.

The system has a simple structure, stable and reliable operation, and strong anti-interference ability. The successful development of the system improves the efficiency of fire demonstration. For the first time, the system combines "LED lamp

flame" with "infrared induction lamp fire extinguisher" to design a realistic fire scene and the product is efficient, reliable, and running for a long time, which can reduce energy consumption and achieve the effect of energy saving and emission reduction. To sum up, it has the following advantages:

(1) Environmental protection: no wood-burning, zero air pollution, and reusable;
(2) Safety: without open fire, children and adolescents can use it safely;
(3) High stability: using an infrared sensor, the anti-interference ability is improved significantly and the reliability is high, and it can run for a long time;
(4) Low power consumption: the circuit is composed of basic combinational circuits, which can reduce energy consumption and achieve the effect of energy saving and emission reduction;
(5) Low installation cost: the original circuit is simple, the equipment is exquisite, the installation is convenient, can improve the personnel installation work efficiency.

The system is cheap, easy to operate, can significantly improve working efficiency and reduce costs. If it can be widely used, it will be an indispensable tool in fire control propaganda departments, schools, enterprises and institutions, government agencies, and social organizations. If the whole society uses this product generally, it can improve the work efficiency and social safety of the personnel. Therefore, it has a wide market prospect and great social significance.

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