

Design of Intelligent Responder

Ronghui Xue

Xi'an Aeronautical University, Xi'an, Shaanxi 710077, China.

Abstract

In this paper, a 64 channel digital responder based on AT89C51 single chip microcomputer is designed. The design idea of digital display direct indication, automatic latch display results and automatic reset is adopted. It can generate different output signals corresponding to the input signals through the control and processing of the single chip microcomputer according to different input signals, and finally display the corresponding signals through LED digital tube. Even if the time difference between the two groups is a few microseconds, it can also distinguish which group of keys to press first, which makes full use of the characteristics of simple structure, powerful function, good reliability and strong practicability of the single-chip microcomputer system.

Keywords

Answer device; MCU; LED display digital tube.

1. Introduction

Responder is widely used in TV stations, commercial institutions, schools and other places. It adds stimulation and entertainment to various competitions and enriches people's spare time life to a certain extent. The traditional responder can only roughly judge the number of successful or fouled players, but can not show the time of each player. This paper develops and makes a kind of responder with simple structure, strong practicability and based on MCU, so as to judge the first responder fairly, quickly and accurately.

In this paper, 51 series single chip microcomputer AT89C51 is used as the control core. The system can realize the functions of operation control, signal recognition and display. The whole system has extremely flexible programmability, which can easily expand and change the system functions. Because the single chip microcomputer has superior high integrated circuit, and AT89C51 single-chip microcomputer can adopt 12MHz crystal oscillator, the measurement accuracy of signal is improved, and the function of the system can be expanded through software improvement. It is much simpler than using small and medium-sized integrated digital circuit and using mechanical switch button as control switch to complete the design of triggering the input signal.

2. Working Principle of Responder

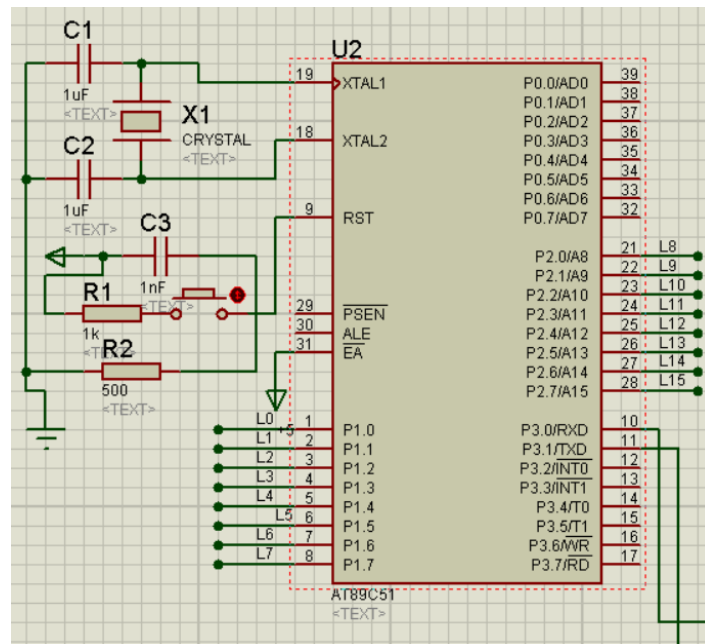
The working principle of the responder is to use the minimum system of single-chip microcomputer, and use inquiry type keyboard to rush to answer. Group number is displayed dynamically. The host can answer the question by pressing the start key. When the host presses the start button (P1.1), the buzzer will give a prompt, and the digital tube will display a 10 second countdown (10 seconds is valid). If someone answers the question within 10 seconds, the buzzer will prompt and display his group number. After answering the question, the host will press the reset switch to prepare for the next question. If there is no one to rush to answer after 5 seconds, the buzzer will prompt the time to rush to answer. Will be over, the end of the time has not been a rush to answer, this question by the host announced the answer after pressing the reset switch for the next question. According to the requirements of the design

function, the circuit should include control circuit, key circuit, and display circuit used to display the verdict results. In addition to using the digital tube to display the current action situation, but also need to use sound to remind or warn the operator, so the alarm circuit is added in the circuit design.

3. Hardware Circuit

3.1. Emergency Response Circuit

AT89C51 is an 8-bit microprocessor with 4k byte flash memory and 2k byte flash programmable erasable read-only memory. AT89C51 single chip microcomputer provides a high flexibility and low price scheme for many embedded control systems. The frequency of crystal oscillator is 12Mhz, and 89C51 clock pulse is provided to make 89C51 work. The reset work is the initialization of single chip microcomputer, which makes the MCU start to execute program again. When the reset switch is pressed, RST changes from low level to high level, then the program starts to execute again. In this circuit design, when a problem ends, the host presses the reset switch and then presses the next question.



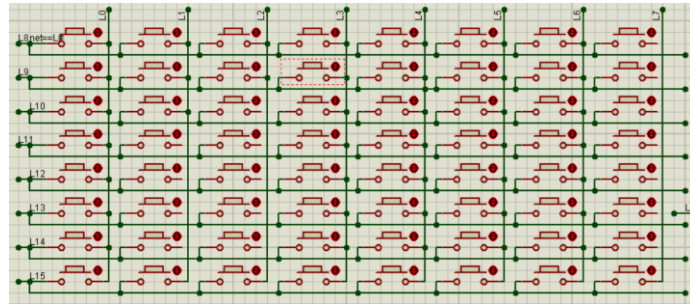


Fig 2. Competitor's answer circuit

3.3. Display and Display Driving Circuit

The nixie tube should display the number of the violator, the 10 second countdown, the number of the normal responder and the 20 second countdown of the answering time. The digital tube adopts dynamic display. The driving circuit PNP emitter is connected with + 5V voltage. When the base is low level and the collector is high level, it can drive the digital tube to display numbers. Because PNP is an analog device and a digital tube is a digital device, if the collector of PNP is not connected with a large resistance display, it will have problems. So a 10k ohm resistor is connected to the collector of PNP.

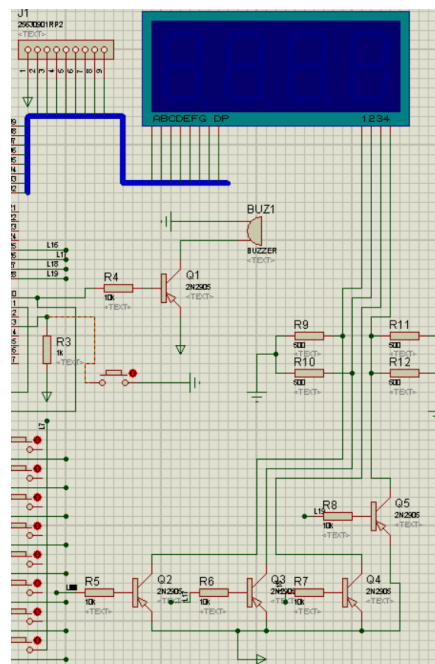


Fig 3. Display and display drive circuit

3.4. Buzzer Audio Output Circuit

The buzzer is a kind of commonly used generator in electronic circuit. The buzzer can be divided into active buzzer and passive buzzer. A triode is used to amplify the current to make the buzzer obtain enough driving current. The buzzer is connected to P1.0 port through 74LS04. When P1.0 output is low level "0", 74LS04 output is "1", transistor is on, both ends of the buzzer get about + 5V voltage to sound; when P1.0 output is high level "1", triode is cut off and buzzer stops singing.

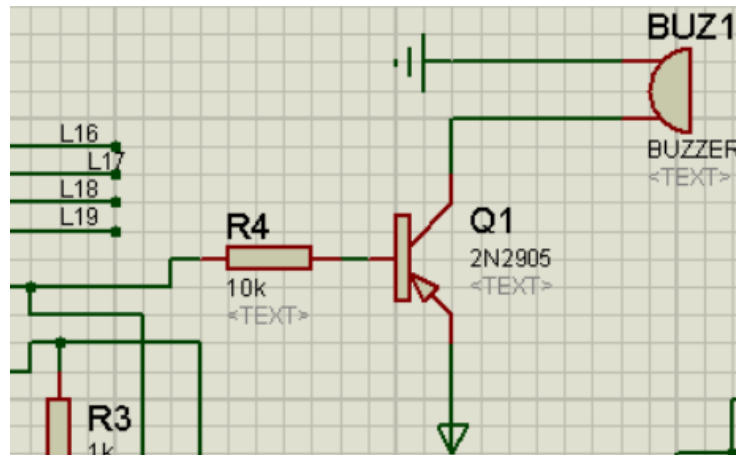


Fig 4. Buzzer alarm circuit

4. Software Design

It can be divided into two basic types: data processing and process control. Data processing includes: data acquisition, data filtering, scale transformation and so on. The process control program is mainly to make the single-chip microcomputer calculate according to a certain method, and then output.

There are three basic structures in process oriented structured programming: sequential structure, selection structure and loop structure. In order to complete this design, in the software design, the whole program is divided into several parts, each part is called a module. A program is divided into program modules with many specific tasks, which are compiled and debugged separately, and then connected together to form a complete program. This programming method is called modular programming. The so-called "module" refers to the process of dividing a software system into smaller, relatively independent and interrelated modules from top to bottom.

In order to achieve a fair, just and reasonable answer, it is necessary to set up the answer time before the host answers the order. Therefore, the program must be programmed before setting up the answer. When the time is set up, the host will issue the answer order according to the start button. When a competitor answers successfully, the program opens the timer interrupt and then calls the keyboard. Trace subroutine, write keyboard scanning program, other players after this key invalid. When someone has pressed the answer key in the scan, close t0 immediately, call the display program, and block the keyboard.

5. Simulation

The minimum system, display module, preemptive switch module and audio output module are designed by Proteus. Open the Isis editing environment of Proteus, select the components required by the circuit from Proteus, place the components, power supply and ground, and then click the electrical rule check in the menu bar tool drop-down. When "netlist generated OK no ERC error found" appears in the rule check, the circuit design is completed.

5.1. Start Simulation

After the host presses the start button, it enters the 10 second countdown. The simulation results are shown in Fig.5.

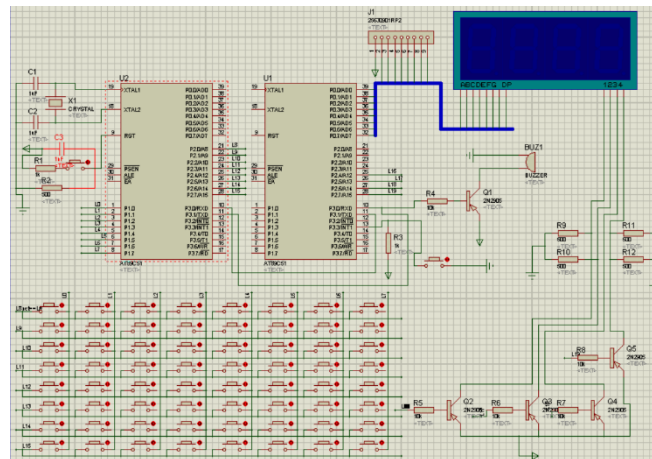


Fig 5. 10 second answer countdown starts

5.2. Analysis of Simulation Results

Through the simulation of the circuit, we can see the responder controlled by AT89S52. In Proteus Software can be very good to achieve a series of functions such as alarm, successful display and countdown. When the simulation starts to run, each module is in the initial state. The display shows 10 seconds. When the host presses the start button, it means that the preemptive answer officially begins, and the digital tube displays the 10 second countdown, and the buzzer sounds to remind the contestants that the preemptive answer has started. If someone presses the answer key within 10 seconds, the buzzer will sound to prompt and display his group number, and the player will be successful. If the countdown to 5 seconds, no one will rush to answer, the buzzer sound indicates that the answer time is about to end. From the simulation test results, this design can achieve the expected goal better.

6. Conclusion

Compared with the common responder, the 64 channel digital responder has the following advantages: It can be operated by the host to avoid invalid response in advance. It has the function of timing. If no one answers the question within the specified time, it means that all the competitors or teams abstain from this question. In addition, the function of the responder needs to be further enhanced, such as adding scoring function. The expansion of the function just reflects the advantages of using single chip microcomputer as the core controller in this design -- simple wiring, flexible programmability.

7. Author Profile

Xue Ronghui (1978 -), female, Han nationality, Hancheng, Shaanxi Province, lecturer, main research direction: power electronics and power transmission, new energy power generation.

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Project Name: Research on LCL control stability technology of grid connected inverter

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