
The Design of Temperature Control System for Vegetable Greenhouse

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Abstract

In the greenhouse system, environmental factors directly affects crop growth and development. Among them, the change in temperature is the most basic factor, the most significant impact on crops. Due to the different development stages of the vegetable crops and its different temperature and different requirements needed to stability in a certain temperature range, temperature control is not only depend on artificial management are timely, inaccurate, affect crop growth and waste of human resources. So to design a can of temperature detection has enough accuracy and real-time control of the temperature control system, it will have high use value. Based on single-chip computer, sensor, communication and computer technology, with temperature as testing object, the design has realized the temperature control system based on AT89S52 single chip microcomputer. Measurement accuracy, convenient debugging, the system can meet the requirements of as a greenhouse temperature monitoring and control system.

Keywords

Temperature control; Single chip microcomputer; The temperature sensor; Vegetable greenhouses.

1. The technical index of the control system and the design scheme

1.1 The technical indicators

Range of temperature control: $0^{\circ}\text{C} \sim +50^{\circ}\text{C}$;

Temperature measurement accuracy: $\pm 0.5^{\circ}\text{C}$;

Display resolution: 0.1°C ;

1.2 System design scheme

This temperature control system hardware circuit controlled by power supply module, main control module, clock module, temperature measurement module, keyboard interface module, data display module, alarm module, high-voltage electrical drive and control module of a total of eight modules, circuit diagram of the system is shown in figure 1.

This temperature control system consists of AT89S52 single chip microcomputer and its peripheral devices to complete together. Because all the voltage in the system for +5V, so the single chip microcomputer through LM78M05 regulated power supply. Independent keyboard as man-machine interface, through the MCU I/O port, so as to realize manual control and artificial adjustment function. DS18B20 will detect the temperature value into digital quantity input to the microcontroller, through single chip to achieve corresponding temperature control function. High voltage control and drive circuit is used to control hot fan and fan rev. Stop. When alarm circuit in the greenhouse temperature exceeds the scope of alarm. LCD module by HG1286401C liquid crystal display device, the LCD is mainly

display function, all the current information is very eye-catching display on the screen, can make people more intuitive to temperature Settings, check the temperature of the controlled greenhouse at present information.

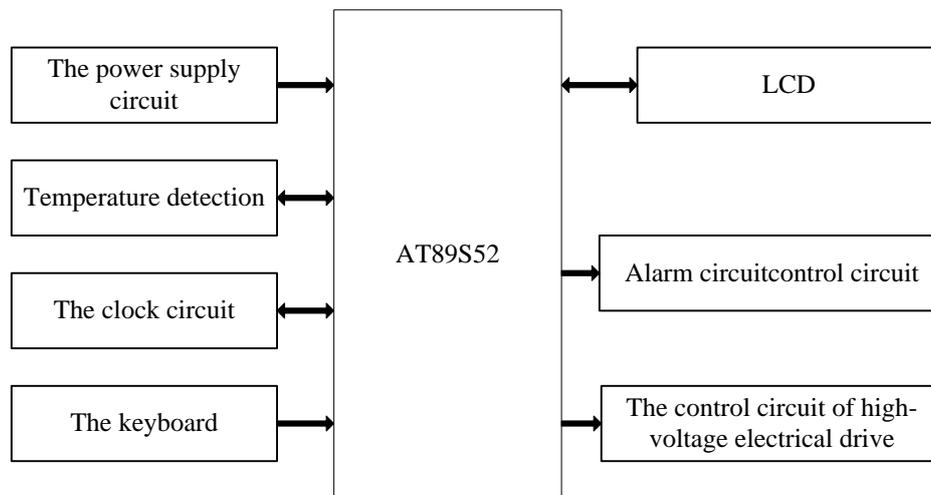


Figure 1 system composition block diagram

2. The system hardware design

This temperature control system hardware part is composed of AT89S52 single chip microcomputer and its peripheral devices, its composition block diagram is shown in figure 1. This part mainly discusses the MCU module, temperature acquisition module, data display module, alarm module, high-voltage electrical drive and control module.

2.1 MCU module

SCM application circuit module consists of chip AT89S52, clocking circuit and reset circuit. The function of this module is to make the single chip microcomputer to work properly, to deal with by DS18B20 read the temperature of the input data, and the temperature data through the P0 port to HG1286401C complete display.

2.2 The temperature acquisition module

For accurate temperature measurement, this system is chosen by DALLAS company launched the digital temperature sensor DS18B20. The sensor of temperature detection and digital data output fully integrated on a chip, thereby stronger interference resistance. Its a working cycle can be divided into two parts, namely the temperature testing and data processing.

2.3 Data display module

Data display module implementation by HG1286401C liquid crystal display device. The low voltage low power module, interface is simple and convenient operation, can form the man-machine interactive graphic interface in Chinese, can display 8 x4 line 16 x16 dot matrix Chinese characters.

The module connected to the MCU circuit is shown in figure 2.

2.4 Alarm module

Alarm module is shown in figure 3. Alarm module circuit is composed of transistor and small speakers, when the temperature exceeds the scope, the P2_3 output drive signal, drive the speaker sends out alarm. Alarm sound generated by the program, through the different lengths of time delay, continues to let P2_3 output high and low level, and audio signal, alarm is no longer "di di di" tone. If you need a loud alarm, power amplifier circuit design can be made of the LM386.

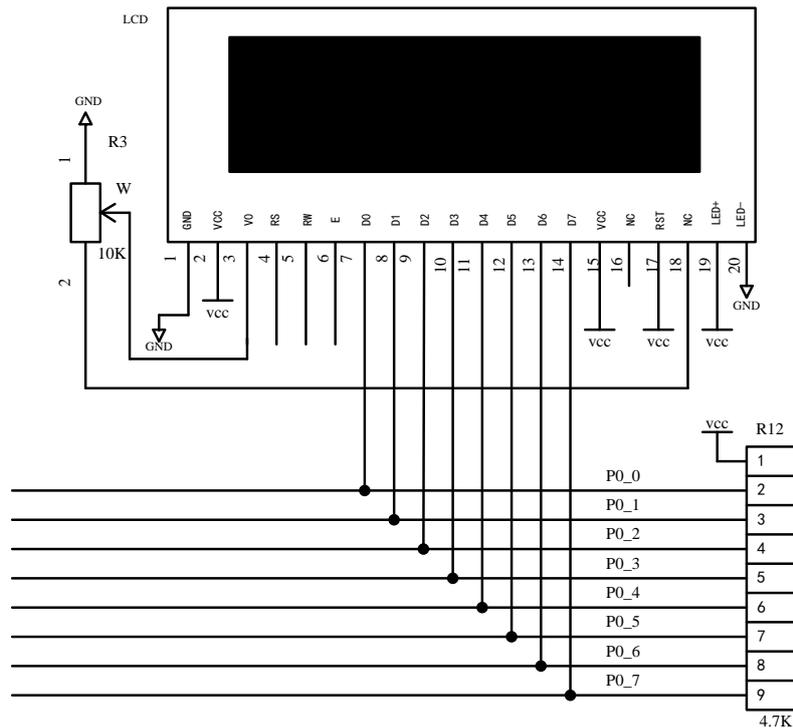


Figure 2 LCD module connected with MCU circuit

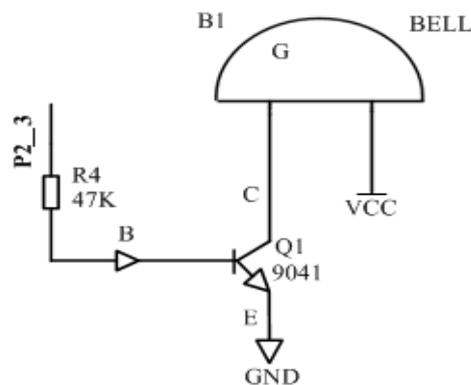


Figure 3 Alarm circuit

2.5 High voltage driver and control module

The module circuit adopts photoelectric coupler with zero passage trigger MOC3061, separate weak current and high voltage control, level before and after the electrical isolation of the circuit, as shown in figure 4. When temperature more than set the upper limit of temperature in greenhouse, microcontroller P3_3 feet output low level signals, the driver door 7407 driver optical coupling combiner MOC3061 internal photoelectric diode luminescence, between its output terminal 4 feet and 6 feet to get the output voltage, trigger bidirectional thyristor KS conduction, makes the control of electric heating heat fan or coal-fired hot fan, fan ac contactor to obtain the working voltage of 220V/380V. When direct control of hot air machine because of its power is larger, the bidirectional thyristor KS to choose large current device, can also be used in photoelectric coupler followed by solid state relay to realize the direct control of hot air blower.

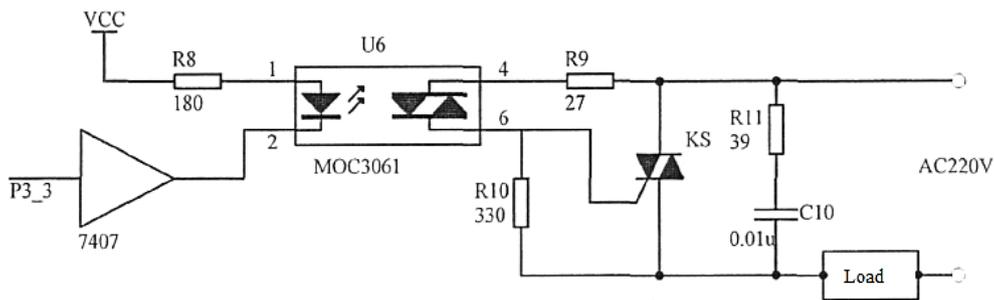


Figure 4 High voltage driving circuit

3. The system software design

The main program flow chart is shown in figure 5.

First initialized to the system, including the definition of port initialization, DS1302 initialization, LCD, and display the boot screen, and then enter the keyboard handler, the keyboard handler, calls to each subroutine to complete temperature detection and control. Keyboard handler execution constantly cycle, the system constantly refresh the temperature information.

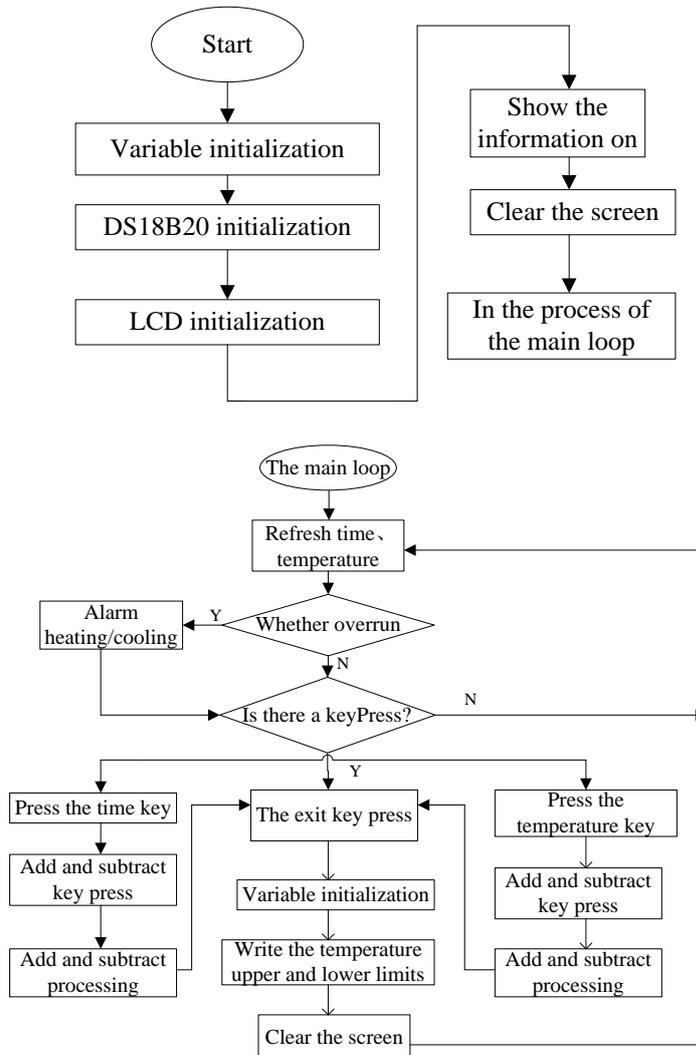


Figure 5 main program flow chart

4. Conclusion

This paper mainly introduces the temperature control system based on AT89S52 devices, realize the temperature automatic monitoring and control functions. According to different crops, can set the desired environmental factors crop parameters of the upper and lower limit, when the system detects the limit temperature, starts the alarm device, in order to control the corresponding actuator, to achieve real-time monitoring of vegetable greenhouse temperature. Compared with the traditional test system has a simple structure, small volume, low cost, high universality and easy to implement, etc.

Reference

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