Single Chip Microcomputer Multi-Channel Temperature Collector

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Abstract: Temperature collector is a universal instrument, involving home, industry, engineering and other industries, while most of the early temperature collectors are semi-automatic, and each collector is a single way acquisition, which is weak in application convenience. In this paper, a design scheme of temperature collector based on single-chip microcomputer, which can collect multi-channel temperature, is proposed. The data display of the collector can reach ten bits, and it has high accuracy performance. With the help of single-chip microcomputer, the intelligent full-automatic control mode is realized.

1. Introduction

In essence, the temperature collector is a kind of device based on the temperature sensor. After the temperature is set at the control end, the temperature data of the sensor is collected. When the temperature data reaches the set threshold, the alarm is activated. This device can help to monitor and control the ambient temperature manually. This function can be used in many fields. For example, in the industrial field, in order to avoid high temperature failure of production equipment, temperature collector can be used to automatically collect the ambient temperature. If the temperature reaches the threshold value, the alarm will be activated to inform the manual to deal with it. It can be seen that the temperature collector has a high application value, but with the development of society, the use of single channel temperature collector has not met the actual needs, and multi-channel temperature collector can make up for the defects of single channel temperature collector, making the collector application more convenient [1].

2. Design scheme of multi-channel temperature collector

In this paper, the design of multi-channel temperature collector is divided into three steps: hardware design, hardware module design, software design. The details of each step are analyzed below.

2.1 hardware design

The hardware design of multi-channel temperature collector includes the selection of single chip microcomputer, the circuit design of temperature collector, the power module design and the display module design.

(1) Singlechip selection

At present, there are many types of single-chip microcomputers that can realize multi-channel temperature collector, but considering the cost problem, this paper chooses STC89C51 single-chip microcomputer, which has low cost and can support the operation of multi-channel temperature collector. In the operation of the system, STC89C51 is mainly used as the control terminal. The operation logic is as follows: receiving the temperature sensor data for judgment; loading the data into the display module according to the judgment results; when the temperature data exceeds the threshold value, the alarm will be activated; during the operation of the alarm, when the temperature returns to the normal level, the alarm will be stopped [2-3].

(2) Circuit design of temperature collector

The circuit design of the temperature collector is mainly based on the temperature sensor. The temperature sensor selected in this paper is DS18B20 sensor, and the circuit design is mainly based

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on Figure 1.

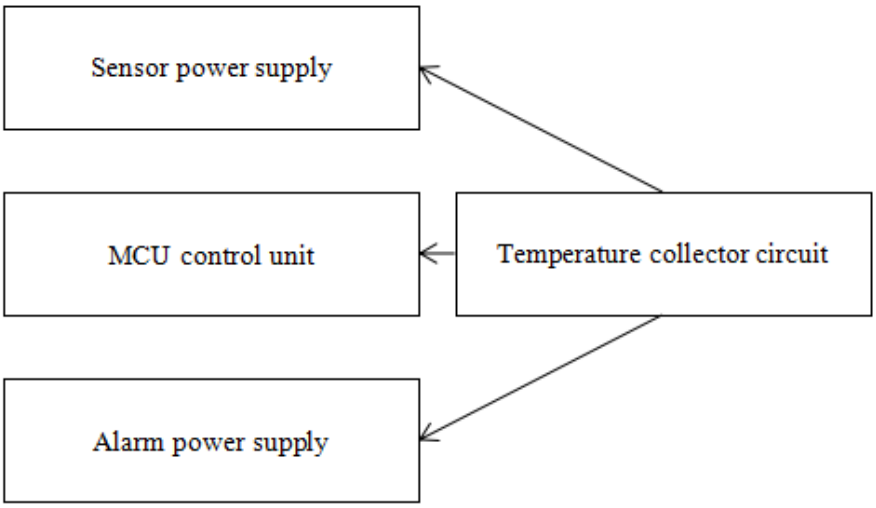

Figure 1 circuit design of temperature collector

(3) Power module design

The 4.5V dry battery is used as the power supply, which is installed at the temperature collector circuit for power supply. The use of dry battery can ensure the power supply stability of the whole circuit, and avoid the problem of abnormal shutdown of collector due to power failure and other reasons, but the disadvantage is that the battery needs to be replaced regularly. In this paper, the number of dry batteries and the capacity of a single section are adjusted, see Table 1 for details.

Table 1 4.5V Dry cell quantity and single capacity data

Name	Number	Single capacity
4.5V Dry cell	The Lord uses 1 quarters.	2100-2500mAH
	Spare 1 sections	

(4) Display module design

LCD1602 LCD is used as the display end, which has LCD drive structure, and can meet the access requirements of MCU control unit. At the same time, in order to ensure the normal operation of the display terminal, the display circuit is designed based on the circuit design of the temperature collector, as shown in Figure 2.

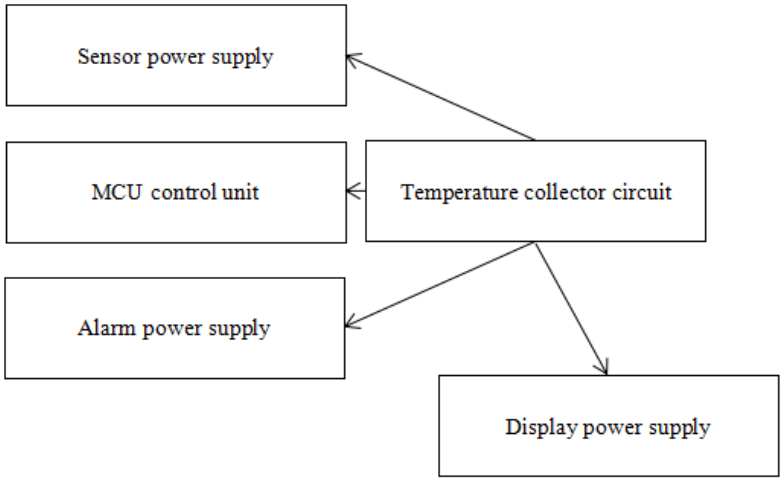

Figure 2 display circuit design

2.2 hardware unit module design

The design of hardware unit module is divided into three steps, which are the design of main

control module, display module and alarm circuit. See below for details of each step.

(1) Main control module design

Take the single chip microcomputer as the core, connect its circuit with other modules, and confirm that the single chip microcomputer can monitor each module through debugging. In addition, it should be noted that the main control module design of any multi-channel temperature collector must follow the "tail weight principle" to design, so as to ensure the stable operation of the system.

(2) Display module design

Based on LCD1602 LCD, the data port is connected with P1 interface of MCU, and the control key is connected with RS and RW of MCU. Thus, the interactive connection between the single-chip microcomputer and the display screen is realized, that is, the single-chip microcomputer can input the temperature data in the sensor into the display screen, while the display screen can save the temperature data, generate the temperature change curve, let the single-chip microcomputer judge whether the current temperature is normal according to the set threshold value, and if not, activate the alarm. In addition, on the individual function of the display screen, it can display four temperature values at the same time, the display data will be replaced after 3S, and the replaced temperature data will enter the temperature change curve according to the generation time for manual reference [4].

(3) Circuit design of alarm

Considering the alarm function of the alarm, the alarm used in the design of this paper is acousto-optic alarm, that is, after being excited, it will emit red light and alarm sound, which can maximize the effectiveness of the alarm, and in the case of not being excited, it will keep the state of green light and no sound. The circuit design of the alarm is relatively simple, and the alarm plug can be directly inserted into the power supply. The reason why the alarm circuit is not included in the temperature collector circuit is to ensure the independence of the circuit, so as to avoid the phenomenon of misoperation and misoperation [5].

2.3 software design

Software design is divided into main program design and subprogram design. First of all, in the main program design, the function planning is carried out according to the function modules in the system, that is, the temperature acquisition module and alarm module are planned in the main control module, and then in the subprogram design, the program development is carried out according to the function planning results, including the temperature curve generation process, database program, etc.

3. System test

3.1 Test ideas

Firstly, the simulation test is carried out to verify whether the system can judge the temperature independently and activate the alarm under the simulation environment. Secondly, the actual test is carried out to verify the working condition of the system in the actual environment. Finally, the simulation and actual test results are compared (the comparison items include the temperature of triggering alarm, response time of alarm and error rate). The error of the system in the actual environment and the simulation environment is judged by the data. If the error value is within the allowable range, the system has good feasibility.

3.2 Test plan

In the simulation and actual test environment, three temperature sensors are installed, all of which are connected with single-chip microcomputer to realize the arrangement of multi-channel temperature collectors. At the same time, the alarm temperature value, i.e. 55 ℃, is set on the single-chip microcomputer. Under this condition, three temperature sensors are tested by simulation software and artificial heating method at the same time, and the operation of single chip computer is

counted.

3.3 Test results

See Table 2 for simulation and actual test results.

Table 2 Simulation and actual test results

Simulation test			Practical testing		
Temperature at which the alarm is triggered	Alarm response time	Error rate	Temperature at which the alarm is triggered	Alarm response time	Error rate
They are all 55 degrees centigrade.	All are 1s	0%	53℃/56℃/51℃	2s/3s/1s	0%

According to the comparison of data in Table 2, firstly, the error of actual test and simulation test is ± 3 ℃ (mean value) in the temperature angle of triggering alarm, secondly in the response time angle of alarm, the error of actual test and simulation test is ± 1s (mean value), and finally in the error rate angle, the error of actual test and simulation test is ± 0. Under this condition, the maximum error value of the three comparison items is set as ± 5 ℃, ± 2S, ± 1%. It can be seen that the actual test performance of the system is good, and the data of each comparison item exceeds the maximum error value, which shows that the system is feasible.

4. Conclusion

To sum up, the design of the multi-channel temperature collector is realized through the research of this paper. The collector is based on the single-chip microcomputer, and can monitor the multi-channel temperature sensor by using the intelligent control logic of the single-chip microcomputer, so as to realize the purpose of multi-channel temperature collection. At the same time, through the display end of the system and the software function, the temperature collection result can be checked at any time by the human, so as to ensure the controllability of the system and alarm The design of the controller can inform the human to come for management in the absence of human, which improves the functionality of the system in a disguised way. Finally, the design scheme of multi-channel temperature collector in this paper is proved to be feasible by test for reference.

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