Design of a New LED Drive Circuit

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Abstract: This paper designs a new type of LED driving circuit. The circuit system is mainly composed of a main control unit and a driving unit. The main control unit is composed of a single-chip microcomputer to realize data acquisition and processing. The driving unit is constructed with a NPN transistor 8050. The circuit also has the functions of automatic dimming and fault self-diagnosis and alarm. The software part of the system is implemented in C language. In order to verify the correctness of the drive circuit design, the paper also carried out a test. The test results show that the circuit system not only has the advantages of fast response speed, simple operation, but also low cost of the drive circuit, can achieve high efficiency and energy saving of LED.

1. Introduction

With the rapid development of electronic information technology, the application of LED is more and more extensive. LED drive circuits are diverse, but LED drive circuits need to be energy efficient [1]. Therefore, when designing the LED driver circuit, it is necessary to make the LED's luminous efficiency perform better, and at the same time, it has the characteristics of high reliability and long service life. This paper designs a new type of LED driver circuit, which drives the LED to work with high efficiency and is energy saving. [2]

2. Basic Composition of the System

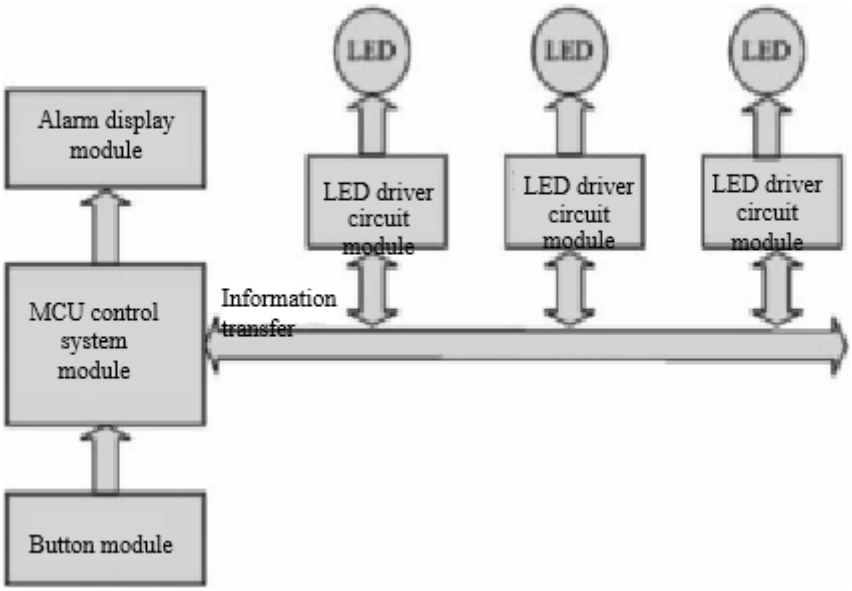

Figure 1. Basic Composition of the System

The block diagram of the system is shown in Figure 1.

The main drive circuit system is mainly composed of two parts, namely the main controller module and the drive module. [3] The MCU module is the core of the entire main controller module,

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responsible for the data processing of the entire system, and the result of the data processing is transmitted to the alarm display module. The driver module receives the execution data and is responsible for controlling the LED display. [4]

3. Hardware Circuit Design

The hardware circuit is shown in Figure 2.

In the hardware circuit design, the single-chip microcomputer control system is the STC89C52 single-chip microcomputer. This MCU has a 232 interface and SPI communication port. The software can be written in C language with low cost. [5]

The selected driver module is an 8050 triode with a driving voltage of 5V. The base input control signal of the triode drives the LED control signal from the emitter output of the triode. The advantage of the drive circuit is that the structure is simple, and the efficiency is high.

The open-loop control of the LED drive power is mainly realized by the single-chip microcomputer system. Through the PWM, the reference voltage of the driving circuit can be increased and decreased, and the current of the driving circuit can be adjusted to realize dimming. The adjustment of the brightness of the LED is realized by the button, and the switching of the state of the LED switch is also realized by the button.

The system also has automatic fault detection function, the circuit's reference voltage, LED loop circuit and status data are automatically fed back to the control system. The control system will detect and make judgments on these data, and finally get the working status of the system accurately. During the running of the system, if the output value is inconsistent with the reference voltage value of the drive circuit, the control light of the system will light, and an alarm will be issued. If the feedback street light is not lit, it indicates that the LED circuit is faulty. If the drive circuit reference voltage is 0, the street light is open. At the same time, it can also determine the exact location of the LED failure by the indication of the system control light.

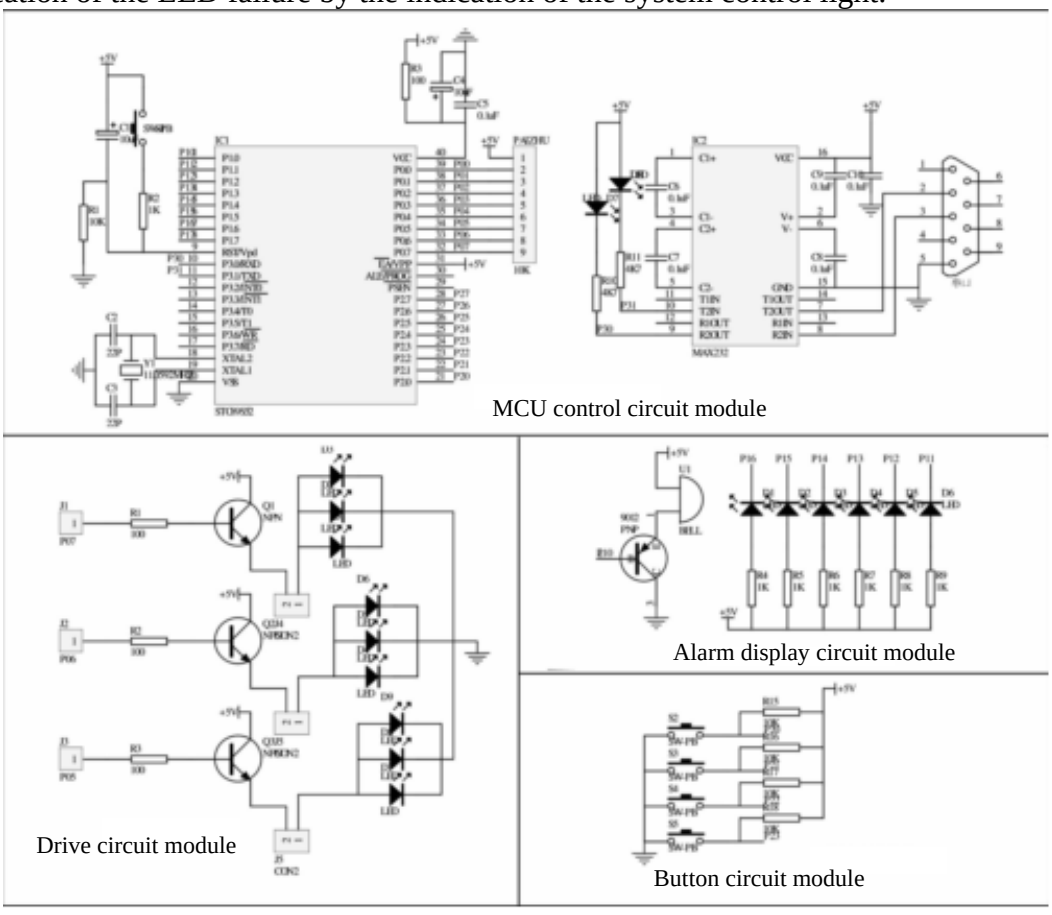

Figure 2. Design of LED Driver Circuit Hardware

4. Software Design

The software design of the entire system is implemented in C language. The software part is mainly composed of three parts: timing interrupt, response button, output PWM pulse signal. The specific software flow chart is shown in Figure 3. During the operation of the software system, the timer interrupt generates a clock tick, the main function is to poll the data of the drive controller. At the same time, it can also realize the refresh alarm unit display; According to this result, the corresponding button can enter the function interface according to the obtained data, thereby implementing which group of LED selection settings. At the same time, it is also possible to switch the switching state of the LED, and finally realize the PWM through the input signal of the button; the system can drive the LED through the PWM pulse signal. In addition, it is also possible to change the set value of the timer/counter, thereby realizing the adjustment of the brightness of the LED by adjusting the pulse width of the PEM. If the software system does not work, the hardware circuit is working properly, and the system is in a sleep state, which can better reduce the power consumption of the system.

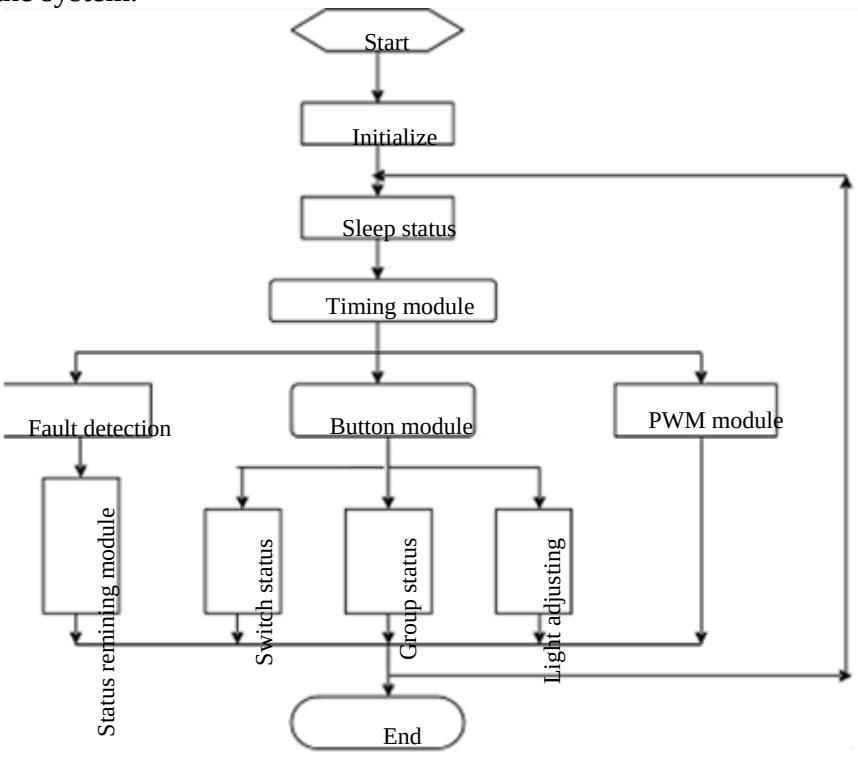

Figure 3. Flow Chart of the System Software

5. Test Results and Conclusion

5.1 Test Results

In order to verify the practicability of the circuit, the article conducted a hardware test. When testing, practical multimeters, DC regulated power supplies and digital oscilloscopes are used.

The test results are as shown in Table 1:

Table1 Test Results

Power setting /%	Test power /W	Proportion in the maximum power /%
95	0.9512	95.12%
75	0.7509	75.09%
45	0.4506	45.06%
15	0.1502	15.02%

It can be seen from Table 1 that after setting the power, the current of the circuit will change the

relevant data, and the power adjustment is completed quickly. The maximum power error is 1.44% with a minimum of 0.02%. Thus, energy efficiency can be achieved.

5.2 Conclusion

This paper designs a new type of LED driver circuit, discusses the overall block diagram of the circuit, and focuses on the hardware circuit design and software design. In order to verify the correctness of the paper, it has also been tested. The test results show that the LED driver is energy efficient and has a wide application space.

Acknowledgment

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