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DESIGN OF AUTOMATIC MONITORING SYSTEM FOR TRANSFUSION

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ABSTRACT

Infusion is a basic method in the treatment of the patient treatment of disease. Nowadays most of the main hospital to artificial monitoring transfusion process, when the liquid infusion. If the patient's bed unattended, or the medical staff can not arrive in time to take measures to rescue, the patient may face danger at any time, so in the face of this problem, put forward a kind of automatic monitoring system based on Bluetooth technology. This system mainly uses STC89C52 microcontroller as the core of the process of infusion set and monitoring, and the use of Bluetooth wireless communication technology to transmit monitoring data, it not only eliminates the cable connection, reduce the engineering, the monitoring system becomes more compact and portable, the infusion therapy becomes more intelligent and convenient and higher safety in the process of transfusion. Of course, to change and to its use, can also be used in other monitoring field, so the design and implementation of this system has practical significance cannot be ignored for the intelligent development.

KEYWORDS

Transfusion, Bluetooth, STC89C52, Controlling and monitoring.

1. INTRODUCTION

Drip infusion is an important method to treat diseases nowadays, but its safety hidden danger cannot be ignored. At present the hospital commonly monitors the drip device manually with poor efficiency. In order to improve safety and reduce labor force in infusion therapy, this paper presents a design of automatic infusion monitoring system [1-5].

This design adopts the single chip microcomputer as the core part, uses the Bluetooth module to realize the wireless transmission function in the infusion therapy process. The infrared tube is also used to collect liquid level information through reflection, because the infrared tube is not in contact with the liquid, so it can be detected simply, conveniently and safely no matter the liquid is toxic or corrosive with high usage value [6]. The system mainly includes infrared module, digital display module, acoustic-optic alarm module and Bluetooth transmission module, with which the height of liquid level to be controlled could be set according to requests, and functions of acoustic-optic alarm and display of liquid level information achieved [6-11].

2. SCHEME DESIGN

2.1 Detection module

The liquid level information is measured by infrared tube, that is to say, the principle of infrared refraction [12]. When the infrared tube faces to the water surface, the refractive intensity of infrared to the tube will differ due to the distance between the infrared tube and the liquid surface, specifically, the closer the distance between them, the greater the infrared intensity will be refracted to the infrared receiver, and greater the conductivity of the infrared receiver, which as signals can be obtained as voltage [13]. So, the liquid level information can be transformed into voltage amplitude, which then can be sent to the single-chip computer through the AD converter. When the signal is analyzed by the single-chip microcomputer, the voltage information can be transferred into the liquid level information and displayed in digital tube and then transmitted to the mobile phone through the Bluetooth module [14-19].

2.2 Display module

Select a four-in-one dynamic digital tube to display the liquid level due to cheap in price, the relatively simple procedure and little affected by outside environment, high accuracy, visual and reliable display, and, easy to maintain and operate [20].

2.3 AD conversion module

Select the ADC0832 analog-digital converter, an 8-bit serial A / D converter with high conversive speed, a relatively simple circuit, and is inexpensive.

3. DESIGN OF SYSTEM PRINCIPLE AND HARDWARE

3.1 System principles

This system detects liquid level information with infrared tube and the whole circuit is controlled by single chip microcomputer and short distance wireless control is carried out by Bluetooth module [21-25]. The system mainly includes infrared module, digital display module, automatic alarm module and Bluetooth module. Its main functions are:

(1) To judge the signal by collection of reflection intensity from infrared tube;

(2) Conveying liquid level information to the mobile phone through Bluetooth;

(3) To sound an alarm when the height of the liquid level is less than setting or when any abnormal cases occurs during infusion.

3.2 Introduction of STC89C52 single chip microcontroller

3.2.1 Structure and functions of STC89C52

Figure 1: STC89C52 physical diagram

STC89C52 single chip, as shown in figure 2, is an eight-bit micro-controller with low power consumption and ultra-high-performance CMOS produced by STC.

3.2.2 STC89C52 pin structure

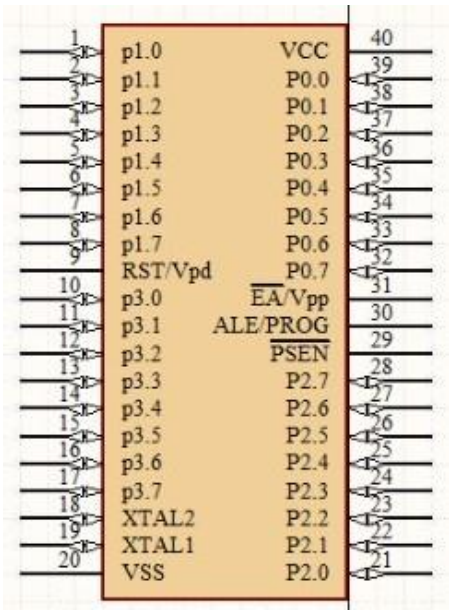

Figure 2: STC89C52 pin

3.3 Infrared module

3.3.1 Introduction to TCRT5000

(1) Main applications: Obstacle detection
Black and white line detection
Pulse data sampling of watt-hour meter
Paper detection of fax machine and shredder

(2) Basic parameters
Shape dimensions: The length 32mm-37mm; width7.5mm; thickness5 mm
Working voltage: DC 3V-5.5 V, recommended working voltage 5V
Detection distance:1mm-8mm, focus distance 2.5mm
The circuit diagram of the infrared module is shown in figure 3.

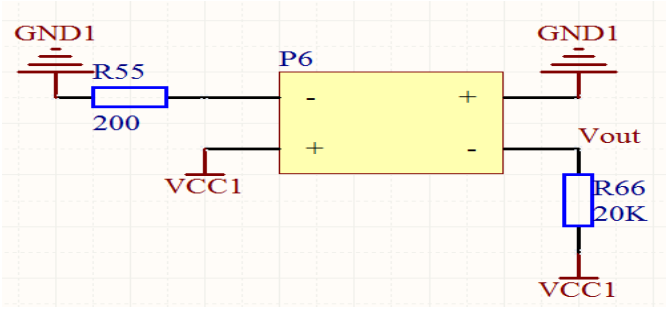

Figure 3: Infrared module circuit

3.4 A / D modulus conversion

3.4.1 ADC0832 overview

The ADC0832 signal acquisition chip is used in this design, its advantages as following:

(1) 8-Bit resolution;
(2) Generally, the power consumption is only 15mW;
(3) Dual channel A / D conversion;
(4) Input and output electric levels are compatible with TTL/CMOS;
(5) The input voltage of 5V power supply is between 0-5V;

3.4.2 ADC0832 pin structure

The ADC0832 pin diagram is illustrated as in figure 4.

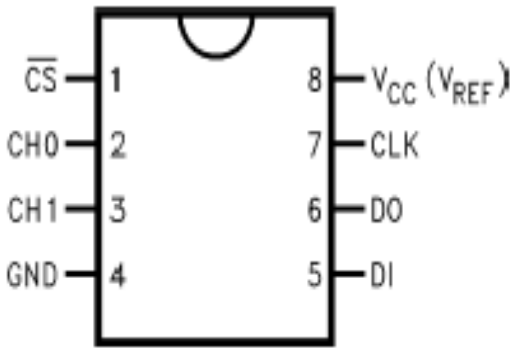

Figure 4: ADC0832 pin diagram

The pin functions are as follows:
(1) CS-chip selects low level effectively
(2) CH0 analog input channel 0 or used as IN + /-
(3) CH1 analog input channel 1 or used as IN + /-
(4) GND chip reference zero electric potential, grounded
(5) DI input data signal, select channel control
(6) DO output data signa, conversion data output
(7) CLK chip clock input
(8) VCC/REF Power supply input and reference voltage input(reuse)

3.5 BC-HC-06

Bluetooth module is specially designed for intelligent wireless data transmission. It adopts the BlueCore4-Ext chip made of British CSR Company and follows the Bluetooth specification of V2.1 + EDR, small in size, low power consumption, low cost and high transceiver sensitivity are several highlights of the module. The physical diagram is shown in figure 5.

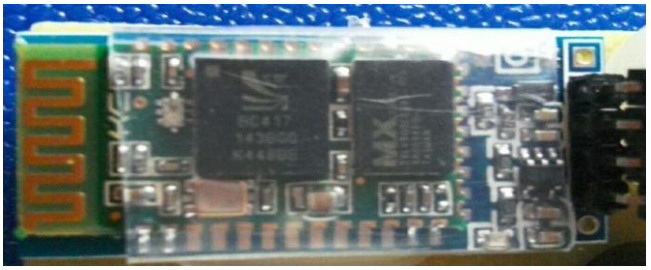

Figure 5: Physical diagram of BC-HC-06

3.6 Digital tube module

This design adopts dynamic display with eight segments and four parts in one common positive digital tube, consists of eight lights - emitting diodes, with each bit segment a light-emitting diode [26]. An 8 segment digital tube consists of a,b,c,d,e,f and g,plus a dp as radix point, which are connected with IO P00-P07 of the single chip.

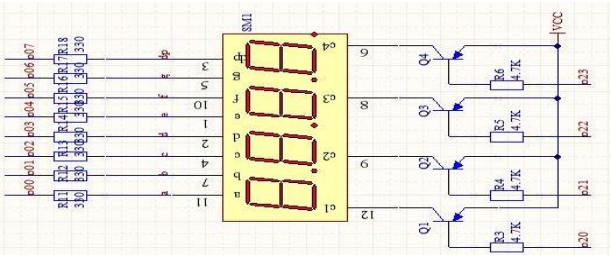

Figure 6: Digital tube display circuit

3.7 Alarm module

The key alarm form of this design is acoustic-optic alarm, which can control and drive the work of LED luminous tube and buzzer by single chip microcomputer to realize acoustic-optic alarm.

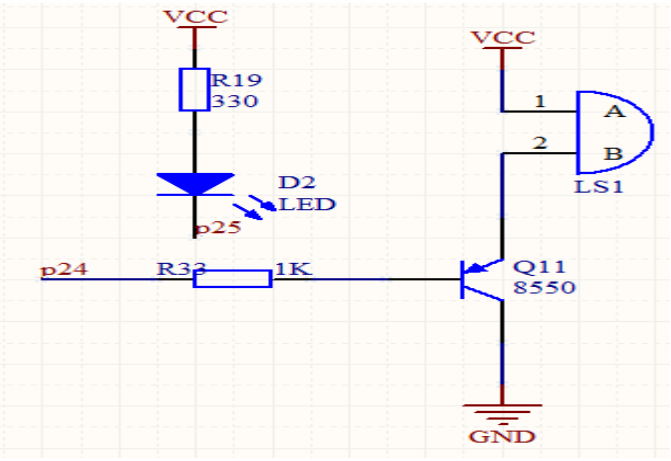

Figure 7: Alarm module circuit diagram

4. SYSTEM DEBUGGING

4.1 One piece of: Digital multimeter; Electric iron 1;5V power supply; Tin absorber

4.1.1 Pre-commissioning checks

After completion first go through the installation in sequence against the circuit diagram, points usually as following:

(1) Carefully check the specifications and models of each device, the parameter, as well as the accurate location of the installation and pin connection.

(2) Carefully check whether there is in-virtual welding, leakage welding and so on, whether there is any other unnecessary residue on the circuit board.

(3) Check if the debugging tools can be used normally, clean up the experimental site so as to debug.

4.1.2 Hardware debugging

When debugging the hardware, the first step is to detect the welding of the circuit with multimeter so as to prevent short circuit. After that turn, on the power to light the digital tube as normal.

4.1.3 Debugging results

During system hardware debugging, there are few difficulties and problems initially under the guidance of the teacher, but later when the hardware and software is synthesized debugged, a large digital tube display error, is found, finally after consulting the teacher, discussions with students and continuous testing, the program problem is found. And a bit of poor contact on the LED, which affected the entire circuit, after debugging and modification the desired results achieved [27-31]. It takes much time to debug the software-mainly the scan displays whose times of analysis and re-debugging needed. Finally, the overall requirements of the theme were achieved.

5. CONCLUSION

STC89C52 single chip micro-controller, infrared tube, ADC0832 and Bluetooth module are used in the automatic monitoring system of drip infusion based on Bluetooth technology, when the level of drip infusion is less than the setting height, the system sends out acoustic-optic alarm and sends the alarm information to the upper computer through Bluetooth (mobile phone Bluetooth software), the liquid level information is displayed.

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