Design of Wireless Intelligent Ward Calling System

Maocai Yang¹, Xin Wang ^{1*}, Yuxin Wang², He Bing ¹

Abstract

The ward calling system based on STC89C51 single chip microcomputer takes STC89C51 as the core. Through the integrated wireless module and video circuit, the system can transfer information between patients and medical personnel, and encode and make the signal content of wireless notification. Start with the button, and then the radio transmitting module receives the signal, decodes and synthesizes it with the microcomputer. Finally, LCD1602 displays the caller's bed number with an alarm tone. The system has the advantages of high cost performance, convenient operation and maintenance.

Keywords

STC89C51; wireless transceiver; LCD1602; buzzer; call system

1. Introduction

Ward calling is a means to ensure the safety of patients and nurses. Using modern information and communication technology to provide medical services, improve hospital service quality and cost efficiency, and meet people's needs is an important aspect of the development of hospital informatization.[1] Ward call system is an indispensable tool for hospital monitoring and a symbol of hospital modernization. It plays an important role in information exchange and effectively ensures the timely care and treatment of patients.^[2]

This design is based on MCU and nRF24L01 wireless transmission module, which is implemented in the hospital call system. It is divided into two parts: wireless transmission and wireless reception, which are console, address change, display, alarm call, etc.^[3] In the control unit, the single-chip microcomputer coordinates the work of the whole system, and acts as the main body of remote transmission of wireless materials, making it easy to communicate with patients. The bold application of wireless network technology in medical beds is an innovation in the medical industry.

2. Overall Scheme Design of the System

The whole system is divided into two parts: the transmitting terminal installed in the ward and the receiving display terminal installed in the medical duty room. [5-8] The system is an effective call system for patients and medical staff to establish and maintain.

The ward call system uses the organic connection between wired module and wireless module, that is, the whole call system is developed from wireless technology by wired circuit and wireless communication module.^[10] The call terminal is sent through four call buttons and connected to the wireless module through wires. The alarm display terminal is connected to the wireless receiving module, MCU, LCD, buzzer and re button initialization. The wireless receiving module receives signals,

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and the single-chip microcomputer LCD control panel and alarm signals. The scheme is shown in Figure 1.

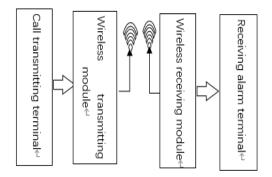


Figure 1: System block diagram of the scheme

The construction of this system is more in line with the needs of modern society and people. The project not only uses wireless modules to simplify circuits, but also facilitates installation and maintenance.

A total of 4 patients were registered in the same ward, including 1, 2, 3 and 4 beds respectively. The priority is determined according to the severity of the disease. The "critical patient" of the four beds presses the call button, the radiation module sends the corresponding signal, the wireless receiving module receives the signal, and displays the number of beds called by the patient on the monitor controlled by the chip device. Or multiple patients press the call button at the same time, and the call system displays the bed number according to their priority. If the priority is higher, the calling system displays the bed number first. If the priority is lower, the priority is lower. The design of the system is shown in Figure 2.

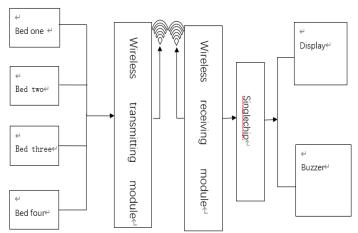


Figure 2: AD PCF8591 circuit schematic diagram

3. System design

3.1. Hardware system

3.1.1. Design of transmitting terminal and receiving terminal

The transmitter is installed in the ward and consists of coded PT2262 chip, transmitter head, help button, button and 12 V dry battery. Press the call button and press this key to specify the light flashing. After the coding information, the shipper sends a universal coding circuit with low energy and low price. Its pin diagram shown in Figure 3.

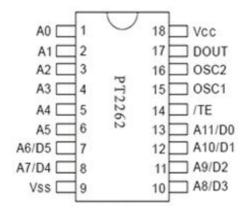


Figure 3: PT2262 pin diagram

The receiving and display terminal is composed of STC8951 single chip microcomputer, wireless receiving module, LCD1602 and buzzer. The wireless receiving module receives the wireless signal from the call transmitting terminal, and the STC89C51 single chip microcomputer controls the alarm display, that is, the LCD1602 displays the bed number of the calling hospital bed, accompanied by the alarm sound of the buzzer.

The wireless receiving module is composed of a receiver and a decoded PT2272 crystal. In addition to the PT2262 and PT2272 address codes, the frequency fluctuation impedance must also be connected. The decoder is usually 2.5-8 times larger, and the accepted distance is reduced. It is even impossible to be compatible with the technological progress of the chip market, but in fact, it just needs a simple resistance. When in use, the larger the external vibration resistance is, the slower the vibration frequency is. The larger the code width, the longer the transmission time. The pin diagram of PT2272 is shown in Figure 4.

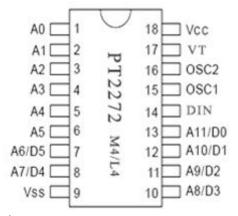


Figure 4: AD converter state machine

The receiver receives signal input PT2272 with 14 input keys (DIN). PT2272 decodes the received signal and releases it after decoding.

This is from the basic design. If you press this button, PT2262 will not light up and 17 pin is low. Therefore, if you press PT2262 to activate the 315MHz frequency transmission line, it will be invalid and there will be a 17 pin link. Provide the set serial data signal. If 17 low-level pins are used, vibrate the high-frequency channel 315 MHz and send the same high-frequency signal amplitude, the 315mh high-frequency channel stops high-frequency vibration, ensure that the high-frequency transmission phase receives and guides the digital signal output ric, and connect the amplitude from the PT2262 socket to the 100% modulated high-frequency circuit. The schematic diagram of connection mode is shown in Figure 5.

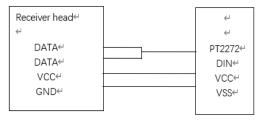


Figure 5: Schematic diagram of connection mode between receiving head and PT2272

3.1.2. Display and alarm circuit

Press the call button, the wireless transmission module sends relevant information, receives and decodes the wireless reception module, and LCD1602 and buzzer are integrated. Use LCD1602 to display mode alarms. LCD1602 can use 8-bit d0-d7 bus to display two 16 symbol lines, three Rs, r/w, 5V operating voltage and 2.0 Ma operating current modes. The module can also use d4-d7 as the four digit double data of the University of Canterbury. Therefore, i/o port resources can be saved in the following ways.

The function of the alarm channel is that the alarm signal displays the patient on the LCD when the patient presses the call button. LCD displays the number of beds of the caller, and starts the buzzer to sound and alarm to remind the medical staff. The circuit diagram is shown in 3.9. When the patient presses the call key, p3.4 is the low level. Connect PNP triplet through current limiting resistor, 2.2k resistor and signal.

3.1.3. Check and clear the circuit

Checking the reset mode is the key to checking the reset circuit. When the patient calls, the bed number appears on the screen. After receiving the call, press the reset button. When two or more patients press the call button at the same time, the LCD displays the priority number of the bed. When you press the reset button, the medical personnel will check that the number of priority position is removed, and the following priority order will be displayed at the same time.

3.2. Software system

The main program flow of the calling system is shown in Figure 6.

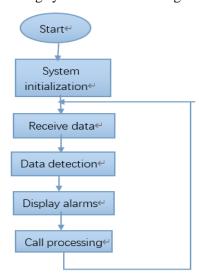


Figure 6: Main program flow chart

The reminder module is alarmed by buzzer and LCD of LCD1602 server. Run each message to ensure that the LCM flag BF is 0 and the dabf is equal to 1.0. It is impossible to send data or instructions before reading and writing data. The "busy flag" must be determined. The flow chart of alarm display procedure is shown in Figure 7.

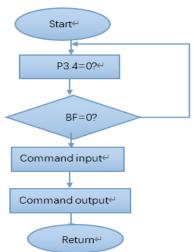


Figure 7: Shows the flow chart of alarm program

3.3. Software debugging and analysis

After the program is started and initialized, when a ward call is detected, the ward number will be displayed and the alarm will ring; If it is detected that there are multiple wards calling at the same time, judge the priority of the ward, select the ward number with the highest priority to display and ring the alarm. After the nurse has handled the patient's condition, disconnect the call switch of the corresponding ward, and the display will display the ward number with the next highest priority to remind the nurse to go to the hospital for treatment. After the nurse has handled all the conditions, the system will return to the initial state after resetting and wait for the ward to call again.

In Figure 8, the ward call switch is k1-k4 from the upper row from left to right, then to the lower row from right to left, and the corresponding call indicator is D1 ~ D4. Turn on the simulation start switch, first turn off all ward switches, you can see that the call indicator is not lit, at the same time, the nixie tube displays "happy every day", and the speaker does not sound an alarm. The circuit design requires that when multiple wards send a call request at the same time, the digital display tube in the nurse duty room displays the ward number with the highest priority according to the priority of the ward. If we press the call switches of channels 3 and 4 at the same time, the ward call indicator lights D3 and D4 will be on, and the loudspeaker will sound an alarm. Among them, the third channel has the highest priority. The digital display shows the ward number "3", as shown in Figure 9 above. When the nurse disconnects the K3 button after handling the patients in ward 3, the digital display will display the ward number of the next high priority "4".

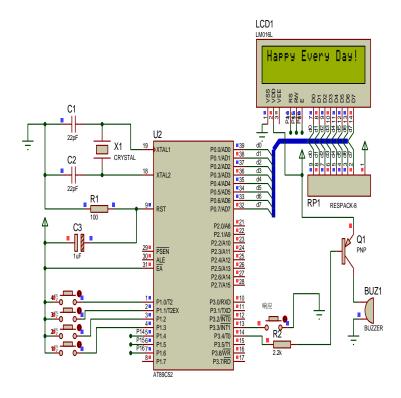


Figure8: Standby state diagram of the system

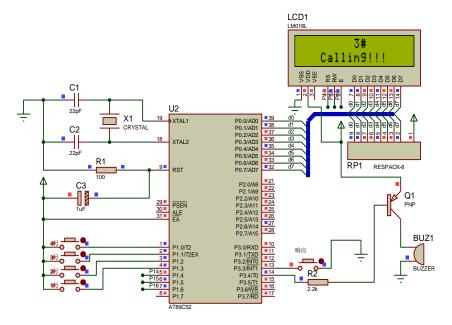


Figure 9:System debugging effect

4. Conclusion

This paper presents a wired ward call system based on STC89C51 single chip microcomputer and with priority selection function, and introduces the relevant technical points and design process of the system from two aspects of hardware and software. The sound and light alarm, priority selection and correct display of multi-channel call signals are realized. The design uses STC89C51 single chip microcomputer as the core control unit, which simplifies the circuit structure, breaks through the

shortcomings of the traditional wired call system, such as complex circuit structure and difficult maintenance, and has strong practicability.

5. References

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