RESEARCH AND DESIGN OF WARD CALLING DEVICE

Li Yang-jun, Peng Qiao ,Yang Jie and Huang Hai-shen

Physics and Mechanical and Electrical Engineering, Zunyi Normal University, Zunyi, China.

Email: 470397592@qq.com

ABSTRACT

The ward calling device has been designed based on the principle of digital circuit and MCU. We have selected the best design scheme from the different schemes, which is more simple and more easily. It is studied based on MCU structure. And the scheme is mainly composed of MCU, ward call button switch, LED lamp, display device, voice chip, according to the priority level of the definition of a good unit, which can response to high priority ward automatically.

Keywords: MCU, Ward calling device, Voice chip.

1. INTRODUCTION

With the rapid development of electronic information technology, electronic products have become a part of people's daily life. Patients and medical staff can communication timely and effectively, and they can effectively ensure the patient or the high-risk patient in safety especially. So that the hospital should no longer use the traditional direct call system, the more convenient and rapid ward calling device should been used. Now there are more types of devices in the hospital, but the function is too simple, sometimes callings are issued at the same time, it is difficult to ensure the high risk patients first treated [1-3] in the staff shortage. A ward calling circuit has been designed in the paper. When a patient calls, the system can signal priority high priority at the same time automatically, it will alarm to nurse promptly to treat the corresponding unit according to the priority of the incoming signal.

2. THE CIRCUIT DESIGN PRINCIPLE OF THE WARD CALLING DEVICE

Assuming there are No. 1, No.2, No.3, No. 4 wards in a hospital, the priority of No. 1 ward is higher than No. 2 ward, the priority of No. 2 is higher than No. 3, and the priority of No. 3 is higher than No. 4. There is a call button in each ward and there are buzzer and 4 indicator lights labeled as No. 1, No. 2, No. 3, No. 4 in the nurse duty room. As the call button is pressed down and the priority level is reached, the sound alarm and the light of corresponding ward is activated, which indicate that the ward needs help.

When the call button of No. 1 ward is pressed down, no matter the call buttons of other wards are pressed down or not, only the indicator light of No. 1 ward is lighted and the alarm sounds to remind nurse. When the call button of No. 1 ward isn't pressed down and the call button of No. 2 ward is

pressed down, whether the call buttons of No. 3 and No. 4 are pressed down or not, only the indicator light of No. 2 ward is lighted and the alarm sound 2, then if the call button of No. 1 ward is pressed down in this time, the indicator light of No. 1 ward is lighted and the alarm sound 1. When the call button of No.1 and No.2 wards aren't pressed down and the call button of No. 3 ward is pressed down, the indicator light of No. 3 ward is lighted and the alarm sound 3, if the call button of No. 1 ward is pressed down in the same time, the indicator light of No. 1 ward is lighted and the alarm sound 1, then if the call button of No. 1 ward isn't pressed down and the call button of No. 2 ward is pressed down, the indicator light of No. 2 ward is lighted and the alarm sound 2. When the call buttons of No.1, No.2, No.3 wards aren't pressed down and the call button of No. 4 ward is pressed down, the indicator light of No. 4 ward is lighted and the alarm sound 4, if the call buttons of other wards is pressed down in the same time, according to the priority of these wards, the indicator light of the first priority ward is lighted and the alarm sound the corresponding number.

3. THE LOGIC FUNCTION EXPRESSION OF THE WARD CALLING DEVICE

According to the design principle of the ward calling device, the priority of No. 1 ward is higher than No. 2 ward, the priority of No. 2 is higher than No. 3, and the priority of No. 3 is higher than No. 4. We represent the call button been pressed and not pressed with 1 and 0 respectively. We represent the indicator lighting and alarm sounding with 1. We represent the indicator not lighting and alarm not sounding with 0. A, B, C, D are used to represent each ward call button; Y0, Y1, Y2, Y3 are used to represent the state of indicator and alarm. From the above introduction, the logic function expression of the ward calling device is obtained as shown in Table 1.

Table 1. The logic function expression of the ward calling device

Input				Output			
D	C	B	A	Y3	Y2	Y1	Y0
0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	1
0	0	1	1	0	0	0	1
0	1	0	1	0	0	0	1
1	0	0	1	0	0	0	1
0	1	1	1	0	0	0	1
1	1	0	1	0	0	0	1
1	0	1	1	0	0	0	1
1	1	1	1	0	0	0	1
0	0	1	0	0	0	1	0
0	1	1	0	0	0	1	0
1	0	1	0	0	0	1	0
1	1	1	0	0	0	1	0
0	1	0	0	0	1	0	0
1	1	0	0	0	1	0	0
1	0	0	0	1	0	0	0

According to the logic function expression, the logic expression of Y0, Y1, Y2 and Y3 was obtained respectively:

$$Y_0 = AB'C'D' + ABC'D' + AB'CD' + AB'C'D$$
$$+ AB'CD + ABC'D + ABCD' + ABCD \qquad (1)$$

$$Y_1 = A'BCD + A'BC'D + A'BCD' + A'BC'D' \qquad (2)$$

$$Y_2 = A'B'CD + A'B'CD' \qquad (3)$$

$$Y_3 = A'B'C'D \qquad (4)$$

Through the method of Kano map, we simplify Y0, Y1, Y2 and Y3 to get the output Y of the ward calling device.

$$Y = Y_0 + Y_1 + Y_2 + Y_3 = A + A'B + A'B'C + A'B'C'D \qquad (5)$$

4. CIRCUIT DESIGN OF WARD PAGER CIRCUIT DESIGN

4.1 Solution 1: circuit design with 74 LS00, 74 LS01 and 74LS04

74LS00 is an integrated chip with two input nand gate, 74LS01 is an integrated chip with three input nand gate, and 74LS04 is an integrated chip with six reverser [4]. The circuit design as shown in figure 1.
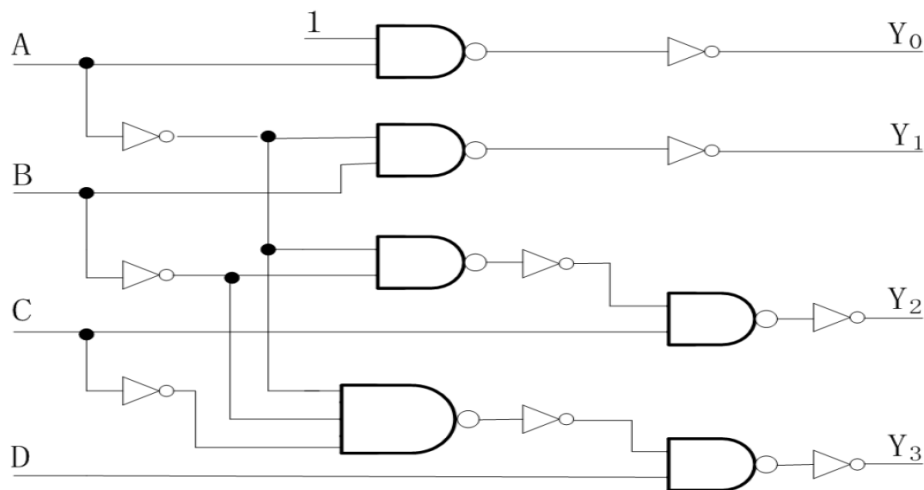

Figure 1. The electric schematic diagram

4.2 Solution 2: circuit design with 74HC148 and 74LS01 circuit design.

If 74HC148 is a priority encoder chip, in a priority encoder circuit, allowed to input more than two coded signal at the same time. But when designing priority encoder has all input signals according to the priorities of the team, when several input signal at the same time, only to encode one of the highest priority. 74LS01 is three input nand gate integrated chip. Circuit design as shown in figure 2.
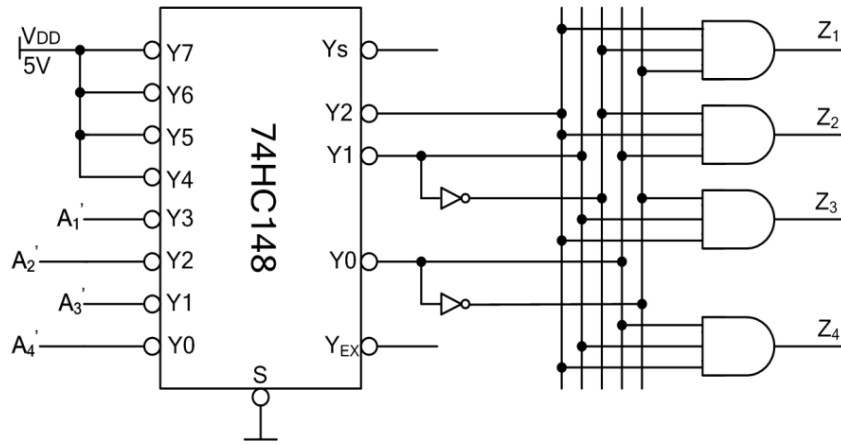
Figure 2. The electric schematic diagram of Solution 2

4.3 Solution 3: design with AT89C52 design.

MCU is one of the main chip of the circuit of control, AT89C52 is a small volume, low power consumption, programmable microcontroller [5], and storing large amount of information. The scheme of hardware is mainly composed of AT89C52, triode, 1602 display, alarm, resistance, etc. Circuit design as shown in figure 3: call button switch K1 control a

number of the hospital, and at the same time the alarm for the FM0 voice chip, similarly, K2, K3, K4, K5 corresponding FM1, FM2, FM3 and FM4 chips. Ward pager priority by AT89C52 software implementation. 1602 display by judging K1, K2, K3, K4, K5 button is pressed, respectively, according to one ward, the No.2, No.3, No. 4, No. 5, so that each ward's priorities is obtained.
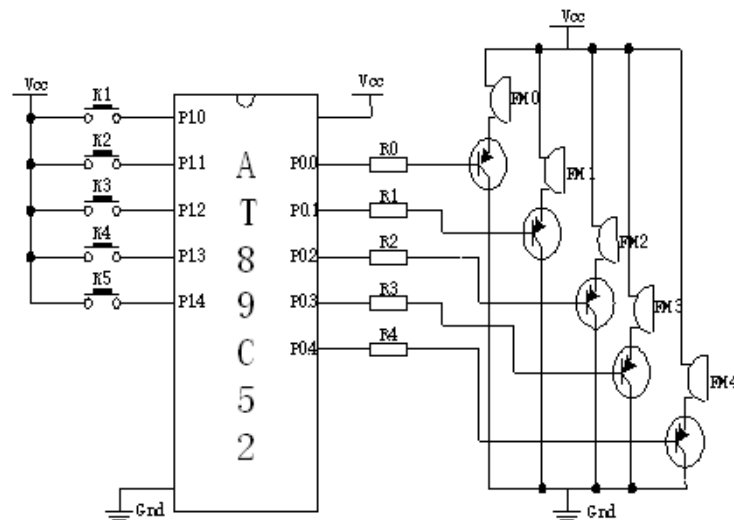

Figure 3. The electric schematic diagram of Solution 3

4.4 Brief Summary of Ward Calling Schemes

In comparison with the three ward calling schemes presented before, the first one is based on an elementary design scheme, which is easily implemented. However, it is not an idea circuit due to not expediently controlled and sustained energy consuming. The second one is simple, good-looking and realized in a controllable way. The shortcoming is that the single unit cannot be independently controlled. The third one is the simplest and most easily, which is based on MCU structure. And the scheme is mainly composed of MCU, ward call button switch, LED lamp, display device, voice chip, according to the priority level of the definition of a good unit, which can response to high priority ward automatically.

5. CONCLUSIONS

The ward calling devices are essential for patient nursing in hospitals. The ward calling device timely and accurately convey the help information of patients to the medical staff and make medical staff to find the patients' room in a timely manner. Meanwhile, the ward calling devices also reduce the workload of medical staff. At present, there are many small hospitals without ward pager devices, or number of beds ward calling often fail and so on. So beds pagers with higher quality and good performance are very important, and the development of the ward call system has become an inevitable trend.

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