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Intelligent wheelchair positioning control system based on single chip microcomputer

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Abstract: *The design of an intelligent wheelchair positioning control system based on single chip microcomputer mainly solves the core problem that many people need to live with the help of wheelchairs because of the aging population and a variety of disease factors. in this case, it needs to be taken care of by the staff, but the family in this case is not rich, and it will cause embarrassment for the family and the family. Through the analysis, we can know that the most worried about the occurrence of wheelchair patients is that they are worried about their loss and are unable to grasp their geographical location. Make the children or relatives worried and unable to work, this design uses single-chip microcomputer as the core controller, combined with dipper module for positioning, and uses Hall module to detect its driving state. to achieve the purpose of learning the travel status of wheelchair patients in time. So that their children can work at ease.*

Keywords: *Microcontroller, Dipper module, Wheelchair, Hall module*

1. Introduction

1.1 Background and significance

According to incomplete statistics, the disability caused by major accidents and diseases is serious in China. With the continuous progress and development of science and technology, people gradually tend to develop in the direction of intelligence. Intelligent wheelchairs have become a favorite means of transportation for disabled people. Although there is many wheelchair equipment on the market at present, most of them cannot meet people's needs. Although the design is perfect enough, there are still many problems. According to the main defects of intelligent wheelchairs, this design explores and studies the design of this entry in terms of positioning and solves the main problems that families of disabled people are worried about after traveling. Although the positioning system currently used has invested a lot of money, most of the products designed are expensive, and have information transmission delay and high bit error rate; There are some problems such as low monitoring efficiency and poor monitoring accuracy when using medium and short distance wireless modules for transmission. It is necessary to improve the treatment and design a new product with high-cost performance.

An intelligent wheelchair positioning system is designed by using Dipper module, combined with MCU, sensors, buttons and display, which can not only detect the position of wheelchair, but also obtain the driving state of wheelchair users. It is beneficial for family members to grasp the location information and running status of the wheelchair in real time, which can effectively reduce the probability of accidents. Therefore, it is of great practical significance to study the intelligent wheelchair positioning system.

1.2 Research content

The design is mainly composed of MCU, Air801 module, GSM module, LCD12864 LCD screen, mechanical buttons and batteries, etc. The main functions of the design are as follows:

(1) The wheelchair position can be automatically reported and transmitted, so that the mobile phone can receive the position from time to time.

(2) It can detect the driving situation of wheelchairs in time.

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2. System assembly design

2.1 System scheme design

According to the design requirements of the control system, this system mainly needs to complete the following control functions, such as wheelchair position detection, mode setting function, display function, driving state detection, emergency call function, etc. Therefore, the control system is designed with six module functions, as shown in Figure 1.

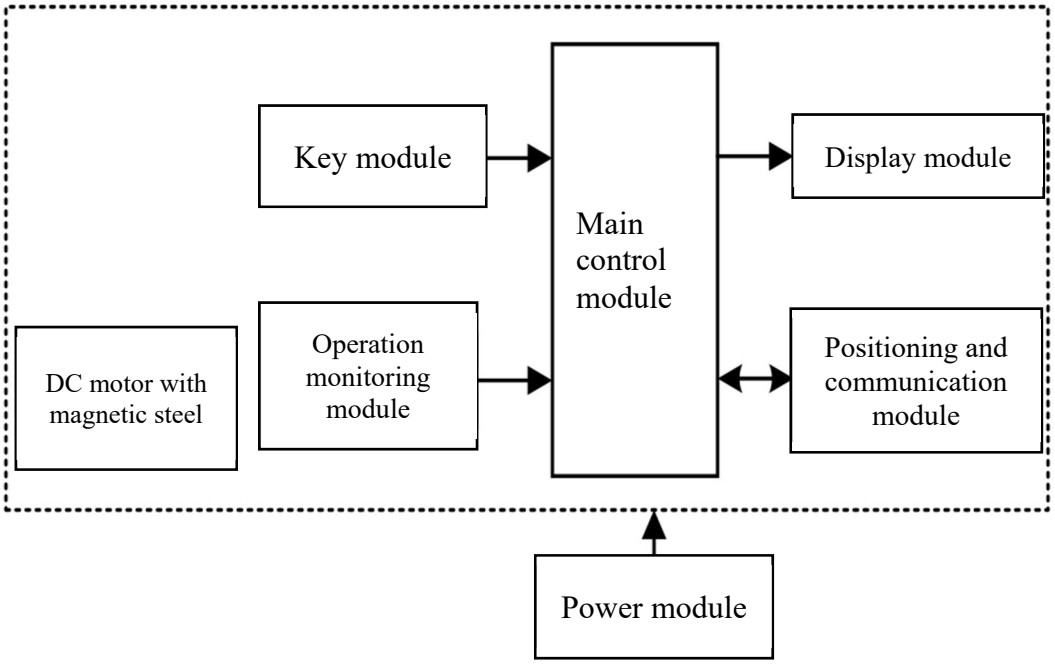

Figure 1 Overall system structure diagram

Press keys to realize operation mode setting and emergency call; Run detection to realize running detection function; Third, the positioning and communication module realizes the functions of sensing and information transmission; The display module outputs information; The main control module coordinates and controls each module; The power supply provides power for the system.

2.2 Core device

2.2.1 Main control module

The main control functions of the control system are analyzed. firstly, this chip can reduce the design cost; secondly, it can meet the operation requirements of the control system; finally, it can reduce the development cycle and make the design process convenient.

2.2.2 Positioning and communication module

The design is realized with AIR801 Beidou positioning and SMS sending and receiving integrated module. It can not only realize the location function, but also realize the transmission and acquisition of information. The development code is simple, and the programming is convenient, which can reduce the overall design cost of the system and ensure the reduction of the system development cycle

2.2.3 Display module

Compared with the analysis of the display module, the control system chooses LCD12864, which has a large display screen and can clearly display characters, which is beneficial for patients to observe. Secondly, the design and programming are simple and cost-effective, which can better adapt to the development and use of the system.

2.2.4 Operation and detection module

ES3144 hall detection module scheme. Hall switch has the advantages of low price, simple installation and strong working stability, which is very suitable for short-distance non-contact counting

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system. Simplifying the installation difficulty of the system is suitable for detecting the running state of wheels.

3. System hardware design

3.1 STC89C52 Master control circuit

The circuit diagram of the designed minimum system of MCU is shown in Figure 2, which is mainly composed of crystal oscillator circuit providing oscillation signal, reset circuit providing reset control for the system, and main control chip control.

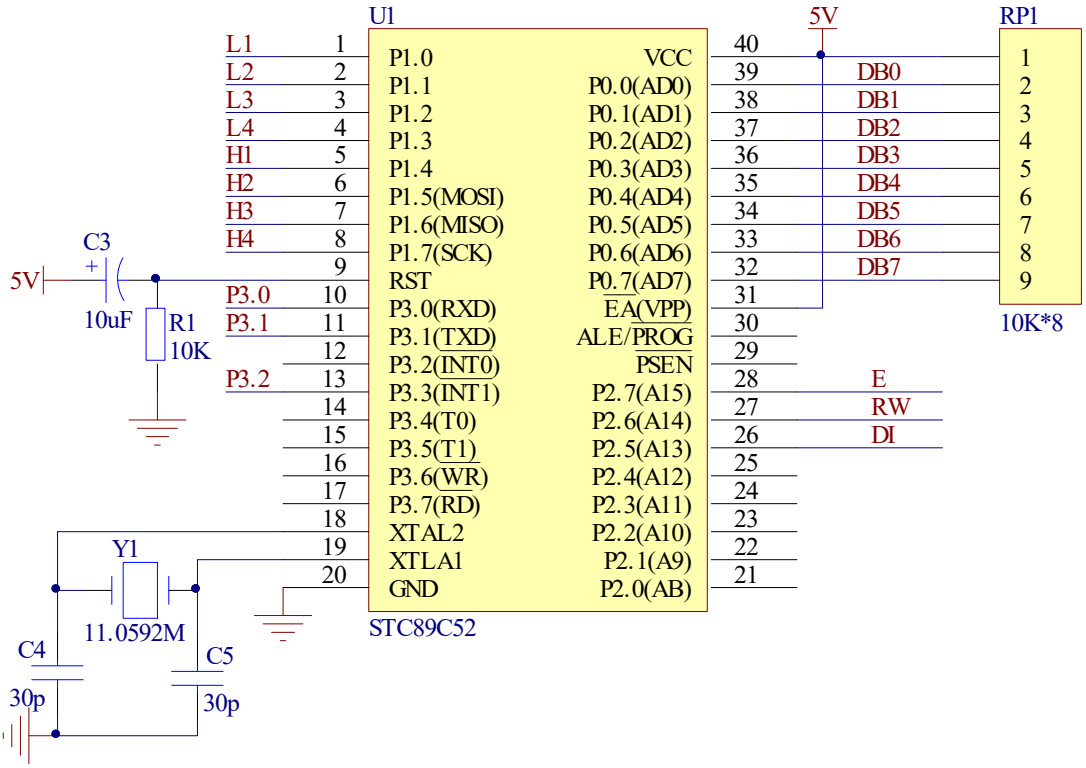

Figure 2 Minimum system circuit diagram

3.2 Matrix key circuit

In order to reduce the control difficulty, matrix key is adopted in the design, in which P1 port of the chip is connected to input control commands, and the corresponding functions are queried in the main control chip.

3.3 Positioning and communication module circuit

AIR801 module is used to detect wheelchair position information, and the data received by serial port is forwarded to the user's mobile phone.

Terminal VCC is connected to 5V power supply, GND is connected to power ground, RXD and TXD are connected to ports P3.1 (TXD) and P3.0 (RXD) respectively, and exchange data with the main control chip through serial communication and follow AT protocol instructions for data exchange Read and write operations to complete control commands.

3.4 Operation detection circuit

System design Hall detection circuit is mainly composed of A3144 and main control chip P3.2. VDD is connected to 5V power supply, GND is connected to negative pole of power supply, and OUT is designed with an LED indicator and limit. The flow resistance R2 is connected to the main control P3.2

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for circuit control operations.

3.5 Display circuit

The display circuit of the control system is shown in Figure 3. The P0 port is used as the data pin of the main control chip and the LCD screen, and they are connected to the data lines DB0~DB7 of the LCD screen after pulling up the resistors respectively. In the control pins, DI, RW and E pins are connected to P2.5P2.6 and P2.7 pins of the chip respectively. CS1, CS2, RST pin and power supply pin VCC are connected to 5V voltage. The VO pin is connected to the common terminal of RV1 resistor, and both ends of RV1 are connected to 5V power supply to complete the data display control of the control system.

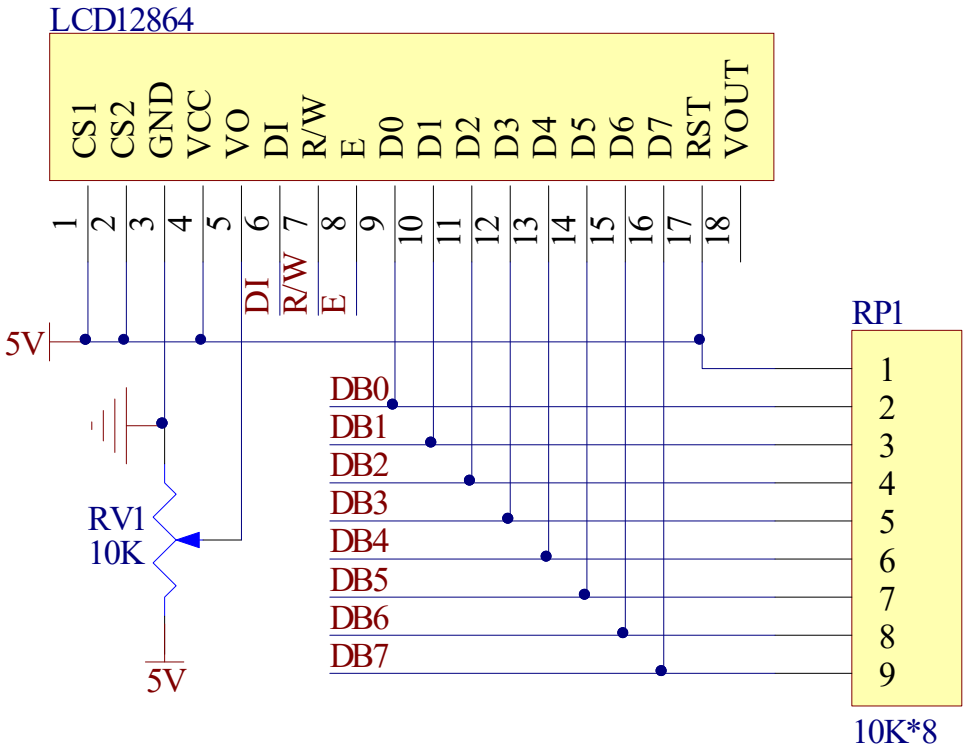

Figure 3 LCD screen physical and pin function diagram

4. System software design

The main control functions realized by the software design of the control system are as follows: first, the main program is mainly used to schedule and control each subprogram; secondly, the man-machine interaction mode of the control system is used to input and obtain relevant information of the control system according to the control of buttons; secondly, the positioning function of the control system is carried out; and finally, the function of displaying information is completed.

4.1 Main program

The execution process of the main program is as follows: firstly, initialize the button and display, operate the external interrupt 0 register, and set the external interrupt 0 as the falling edge interrupt; Operate the register of serial port to set baud rate to 9600bit/s. Configure Timer0 register to generate 50ms interrupt, execute EEPROM reading operation, and read out parameter information related to program operation. The main program flow chart is shown in figure 4.

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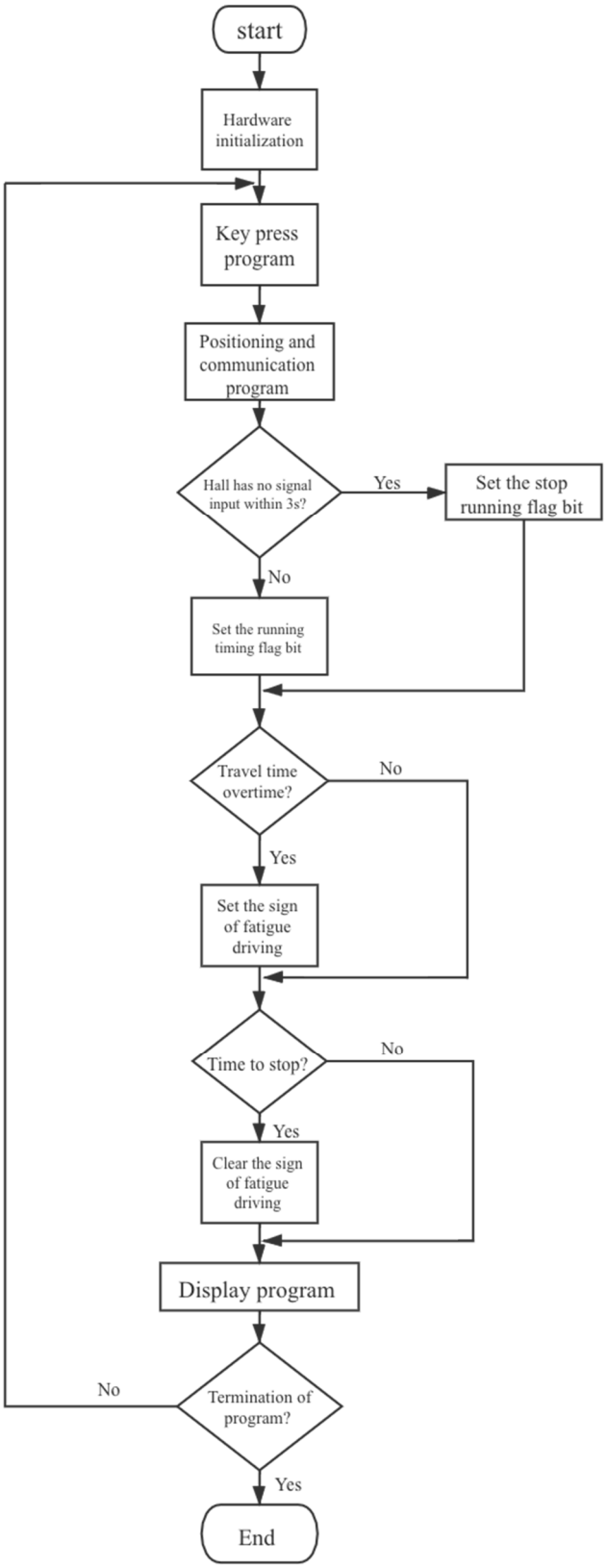

Figure 4 Main program flow chart

In the main program, parameters such as travel time parameter, stop time parameter, short message sending flag bit and position acquisition flag bit need to be obtained by timer. Therefore, when the software is designed, the above parameters are processed in the interrupt generated by Timer0. The

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specific processing flow is shown in Figure 5.

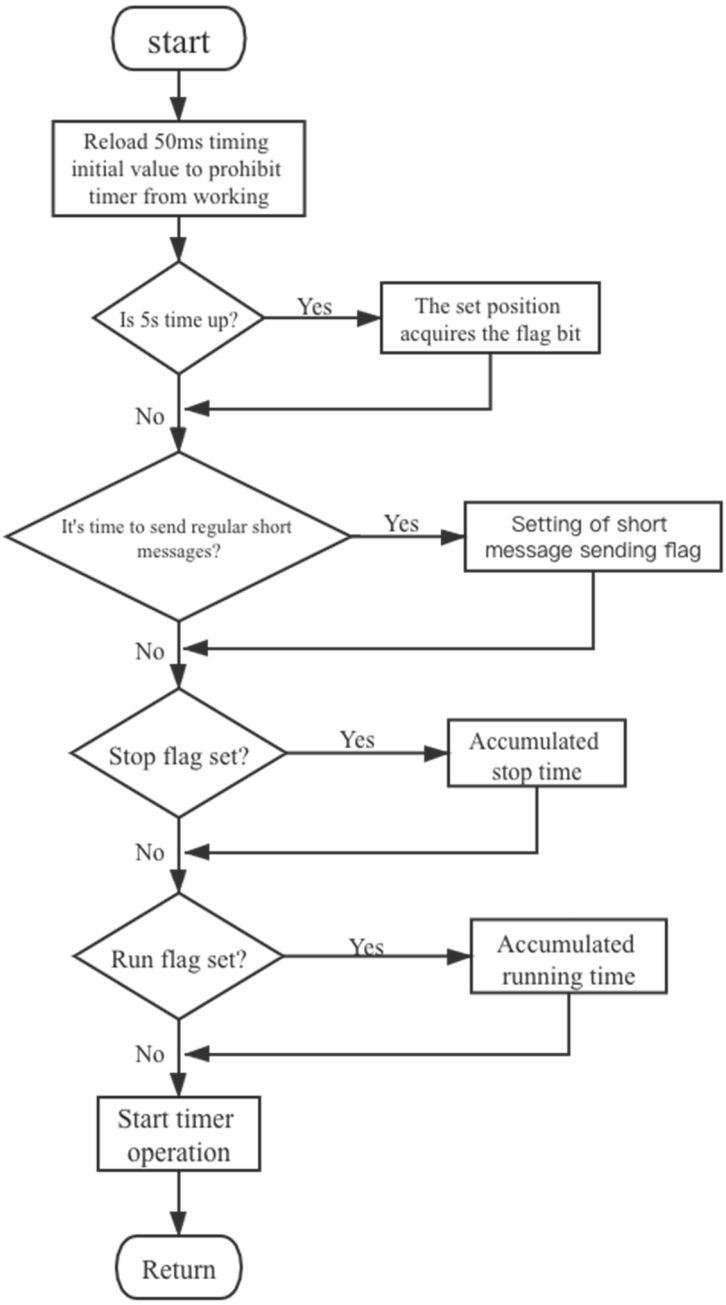

Figure 5 Interrupt handler flow chart

Enter the timer 0 interrupt program, first reload the initial value of timer 0 for 50ms, and then stop the timer. After the above operations are completed, the following operations are executed in the Timer0 program in sequence:

(1) Determine whether the 5S timing is over, and the timing time is over, and acquire the position information as a flag bit.

(2) Determine whether the timing time is the same as the set timing information sending time, and if so, set the SMS sending flag in the software.

(3) Judging whether the stop flag is set, and if the stop flag is set, continuing to accumulate the stop time.

(4) Judge whether the running flag is set, and if the stop flag is set, continue to accumulate running

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time.

(5) Start the timer and exit the Timer0 interrupt program.

4.2 Display program

According to the program execution process as shown in figure 6. E and RW control the operation to complete the display program design.

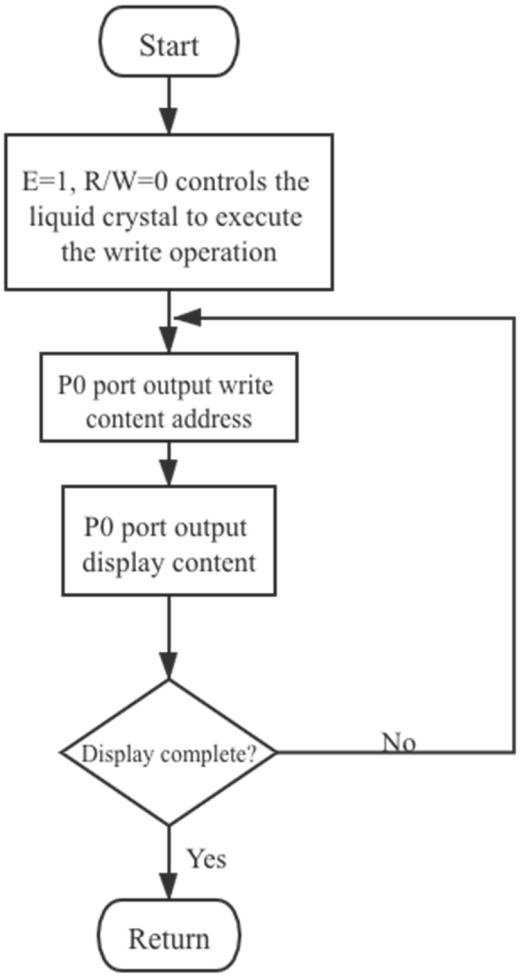

Figure 6 Displays the program flow chart

4.3 Key press program

4.3.1 Recognition program

According to the level change of P1 port, the system determines the key pressed by the user. The flow of identification program is shown in Figure 7.

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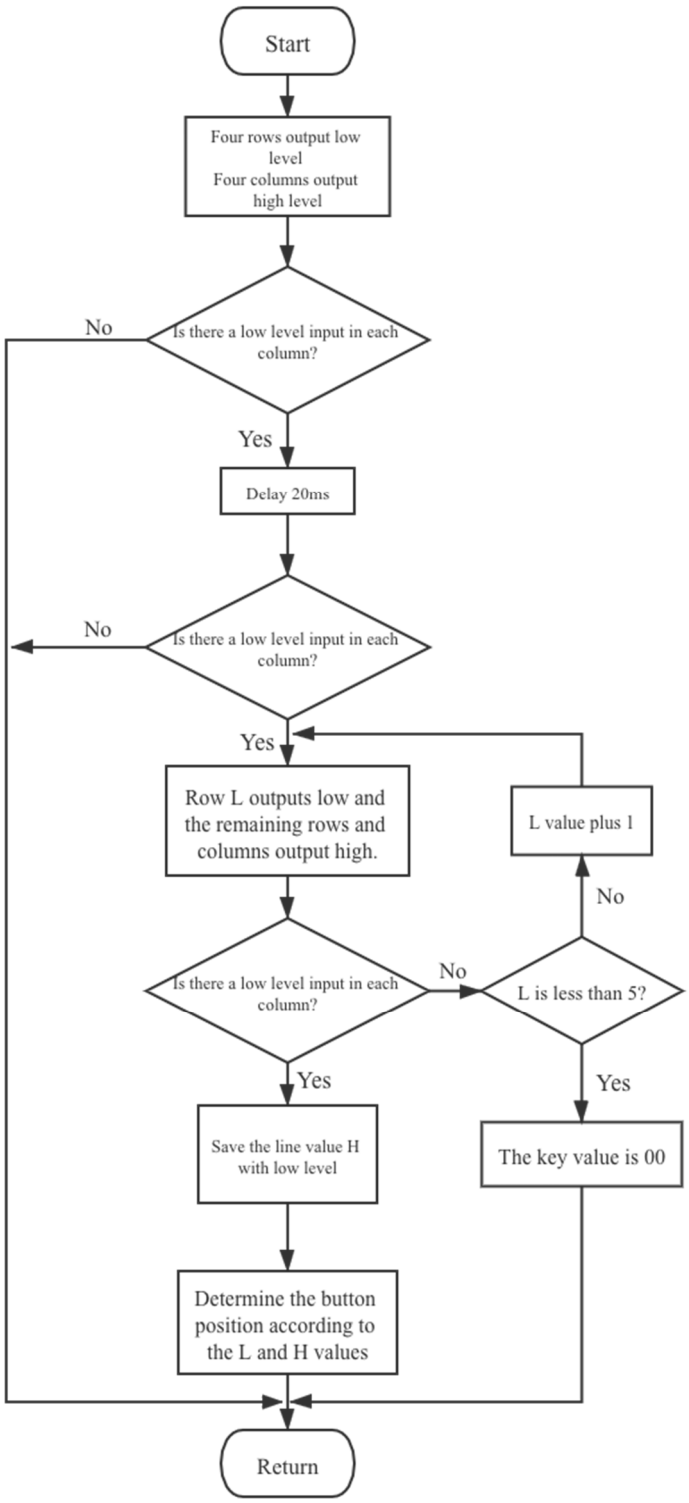

Figure 7 Key press program flow chart

4.3.2 Processing program

The processing flow is shown in Figure 8, and the "setting" situation is judged. If the key is pressed, the software performs the following operations.

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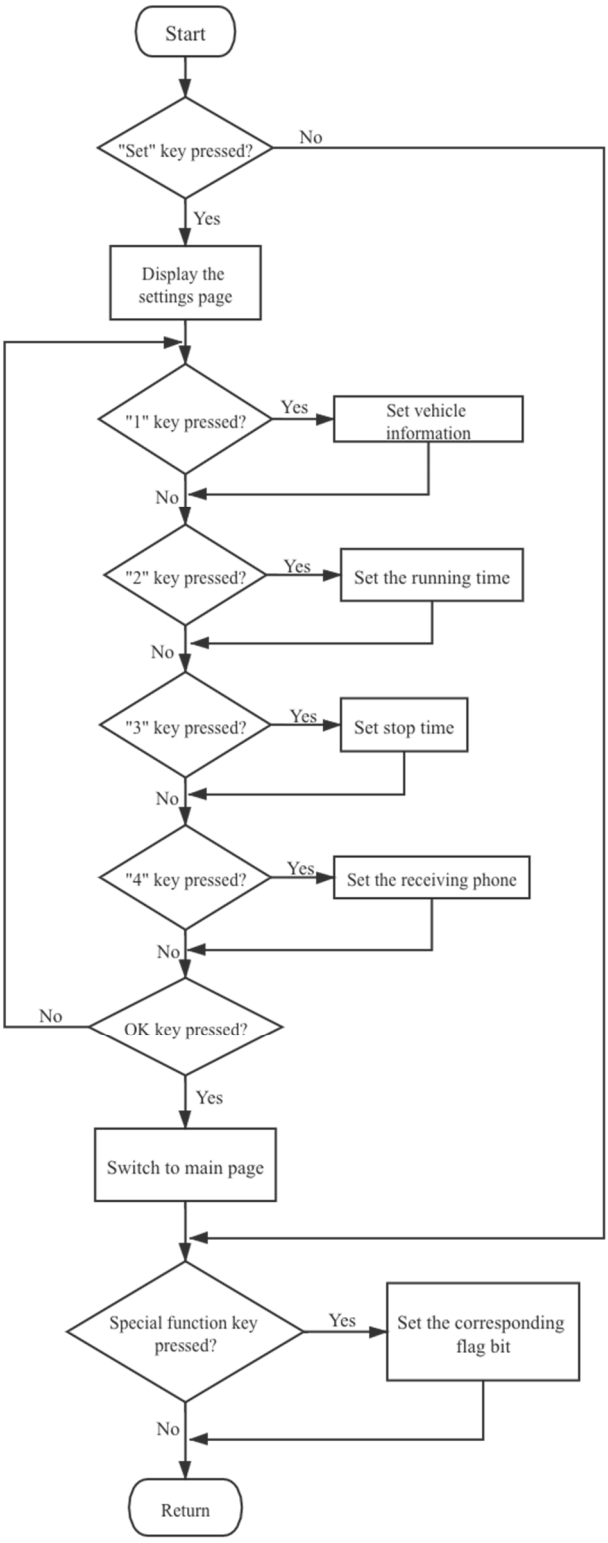

Figure 8 Flow chart of key processing program

4.4 Positioning and communication program

The positioning and program flow are shown in Figure 9. When the positioning and communication program is executed, the software performs the following operations:

(1) Send AT command AT+CGNSSEQ=\"RMC\"\r\n" to obtain the location coordinates of the device.

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(2) Analyze the longitude and latitude coordinates of the wheelchair according to the received content.

(3) Send AT command AT+CMGF=1\r\n to set the user to send text messages in TEXT format.

(4) Send the AT command AT+CSCS=\"UCS2\"\r\n and configure the text message content to be USC2 encoded Chinese and English text messages.

(5) Send AT command AT+CMGS=\r\n to send the user's mobile phone number to the module.

(6) Send the text message content in TEXT format to the module.

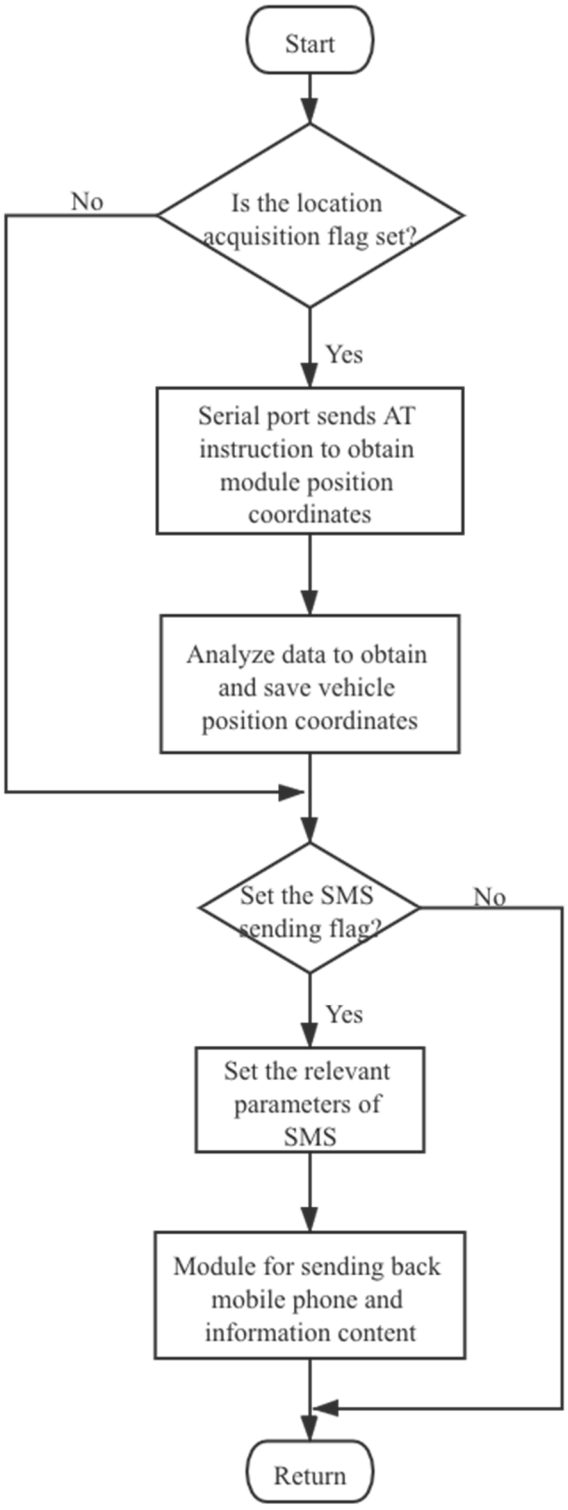

Figure 9 Positioning and communication program flow chart

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5. Summary

Design a wheelchair intelligent positioning system, which can effectively improve the help for the disabled and patients, and at the same time ensure the safety of patients and reassure family members. Although the previous positioning system can play the role of positioning, there are many reasons such as poor timeliness of information transmission and high bit error rate in the actual use process. Therefore, this design is innovative and improved on the basis of the past, and the products with high practicability and high-cost performance are designed to meet the needs of the market.

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