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Intelligent Walking Stick for Visually Impaired People Based on 51 Single Chip Computer

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Abstract: With the continuous development of contemporary society, people have increased their attention to the disabled. Among the disabled, the blind has taken up a large proportion. Therefore, raising the quality of life of blind people has become a focus of attention. To meet the needs of blind people, the blind cane came into being. Compared with the traditional bamboo sticks, the modern blind sticks have the advantages of high safety, complete functions, and high degree of intelligence. It has become a trend in today's society to popularize blind intelligent canes. This paper designs an intelligent blind cane based on 51 single-chip microcomputer. This smart blind cane system is controlled by STC90C516RD+ MCU and consists of ultrasonic distance module, recording player module, GSM module and fingerprint identification module. It has distance test alarm, Voice memo reminder, falling one-button alarm, family recognition and other functions. After many test results, the smart cane can realize the basic functions of the blind stick and realize the functions required by the subject. It is a low-cost, functional and practical blind cane only.
Keywords: Blind smart cane, MCU control, Ultrasonic ranging

I. INTRODUCTION

In today's society, where people are constantly pursuing higher life quality, people's investment in life has increased exponentially[1][2]. The same is true for special groups, and blind people are a representative of special groups. The traditional life of the blind relies on the old walking stick, which greatly reduces the living experience[3]. Moreover, there are many problems with the traditional walking stick, such as single function, insufficient use experience and low safety. With the rapid development of electronic information technology in the new century, the traditional cane got an earth-shaking change, there are many function modules of the walking stick for the blind development, such as ranging module, fingerprint identification, speech recognition, face unlock modules, such as in the above the background of The Times, the development of the smart cane in urgent need to solve.

At present, the blind cane based on single chip microcomputer technology occupies the main market at home and abroad[4][5]. Its principle is to use single chip microcomputer as the central control system of the whole system, which is simple and convenient. At the same time, the modern electronic information technology and the rapid development of computer science and technology, make SCM application development technology has a qualitative improvement, MCU processing performance, experience and application technology has been developing and perfecting, the function of the single chip microcomputer for the development of a comprehensive and profound. In the meantime, microcontroller has the advantages of small size, light weight, fast computing speed, high cost performance, low power loss, outstanding control ability, so in industrial facilities, a variety of electronic appliances and other fields have been more widely used[6].

Ultrasonic ranging technology, as the core module of the whole blind walking stick, measures distance by simple acoustic wave and time difference. At the same time, the ultrasonic ranging module has low cost and small volume, so it is very simple to use and can achieve accurate ranging, which greatly improves the use experience of the smart walking stick for the blind. Due to the adoption of ultrasonic module, the application range of the walking stick is greatly improved, which reduces the errors caused by severe environmental problems and improves the safety index of the smart walking stick. The power consumption of the whole walking stick is very low, which makes energy conservation and emission reduction more conducive to environmental protection. Ultrasonic wave won't produce directional error, won't cause interference to the signal that electric equipment produces, do not affect other electric equipment to be used normally, and ultrasonic wave reaction speed is fast, working efficiency is higher, working process is stable and reliable. Therefore, ultrasonic ranging technology has been more and more

widely used. This project combines ultrasonic ranging technology and 51 SCM, which can realize more powerful functions and make the intelligent walking stick for blind people get better perfection.

At present, the intelligent walking stick developed in China mainly has the following problems. First of all, the functional perfection of the walking stick for the blind is uneven. Secondly, the security issues are more prominent, the developers can not consider the special situation of users; Finally, the use cycle is too short, the cost is too high. In contrast, the cane features more prominent perfection, practical functions, at the same time, the security issues have been substantially resolved, in the cost, the adoption of ultrasonic ranging module and single-chip microcomputer cost has been a large savings space. A safe, reliable and comprehensive intelligent walking stick for the blind can be completed by the combination of 51 single chip microcomputer's strong control ability and relevant modules.

This design combines single chip microcomputer technology with ultrasonic ranging technology, and completes the manufacture of a blind intelligent cane based on 51 series single chip microcomputer. This design can not only make up for the shortage of traditional walking stick, but also meet the requirements of special people to improve the life happiness index. Besides, it has the advantages of affordable price, safe and reliable, green environmental protection and simple operation, which will be loved by users and have unlimited development prospects.

II. SYSTEM HARDWARE CIRCUIT DESIGN

This design consists of two parts in the design structure, namely the hardware part and the software part. First of all, we will pay attention to the hardware design of the smart cane for the blind. The whole hardware consists of power supply, LCD1602 display module, buzzer alarm module, ultrasonic ranging module, ISD1820 recording voice module, SIM900A module and so on.

A. STC90C516RD+ SCM basic function module configuration

In this module, the first thing we should pay attention to is the working frequency of this module. Under the normal working condition of this module, the normal working frequency range is 0-40 MHz. After the performance is equivalent, the chip and STC80C51 single-chip microcomputer have the same working frequency of 0-80MHz. Secondly, the module provides users with a large enough application storage space, which can reach 61K/ byte at most. The integrated part on the chip provides 1280 bytes of space and 256 bytes of RAM usage space, ensuring that users can obtain a large enough programming space when using the module. On the design of the I/O port, the module is quite has the humanized design, provides the user with a 35 I/O interface, at the same time, after the module is reset, P1 / P2, P3 / P4 this four interface is two-way mouth, so that users can use the number of interfaces to 39, compared with the traditional single chip microcomputer is a huge improvement, it should be noted that the particularity of P0 interface, this interface as the bus extension, don't need to add on the part of the resistance, or need to add some resistance; The compatibility of this module is superior and the code programming is relatively simple, which is a huge advantage of this module compared with the original single chip microcomputer. There is no need for special programming tools and simulation tools. The module has an independent reset circuit. When the external crystal is below 12M, when the reset condition is reached, the reset circuit can be completed by itself without referring to the relevant reset circuit of the development board, which plays the role of protecting the circuit. In terms of counter and interrupt circuit, this module is equipped with 3 16-bit timers, and timer 0 can also be used as two timers. There are 4 external interrupt circuits, which are triggered by falling edge starting or low level triggering mechanism, so it is convenient to use.

B. Ultrasonic ranging module design

Ultrasonic ranging is the core module of the whole design. In this module, ultrasonic wave ACTS as a carrier. The composition of ultrasonic ranging module is relatively simple. At the same time, ultrasonic receiving and transmitting module is equipped with core control chip, which is the composition of this module. In the ultrasonic generating module, the square wave of 40KHz is generated by the single-chip microcomputer, which directly drives the CD4049 chip, while the lower-level CD4049 adjusts the frequency signal of 40KHz, making the ultrasonic sensor produce resonance. After the above principle, ultrasonic waves will be generated and sent to the designated position. The ultrasonic emission structure is shown in figure 1.

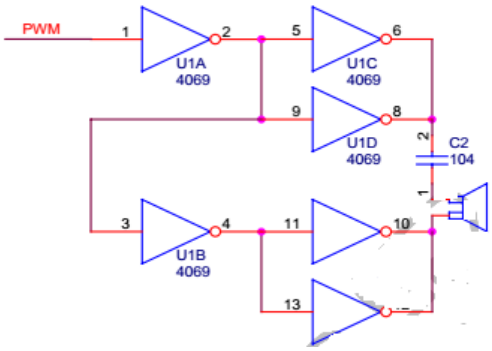

Figure 1 Ultrasonic emission structure

C. GPS positioning module design

Atk-neo-6m GPS module is the GPS module adopted in this design. From the Angle of production, the module production by ALIENTEK technology company, and with the company's products superior performance as well as the advantages of easy debugging, in use, configuration is also quite convenient adjustment, the module when debugging, it starts working just by turning on the power supply, convenient and quick, and single chip microcomputer connection as shown in figure 2. In the process of module positioning, the module receives satellite signals and combines time difference curve to determine the specific location. At this time, the determined location is longitude, latitude and altitude. In the later maintenance, it is necessary to combine the actual conditions with the data to determine the location. When using the location information, a certain module is transmitted to another terminal to complete the fall warning function in this design.

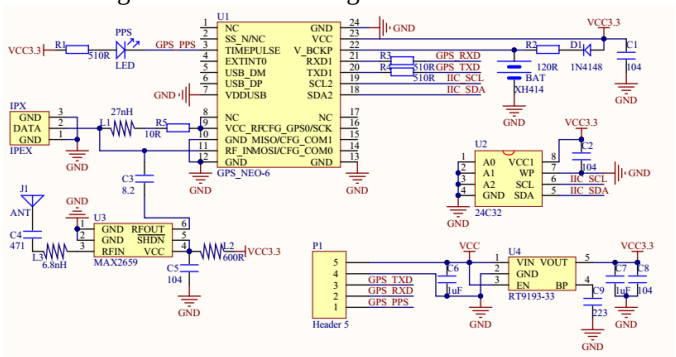

Figure 2 ATK-NEO-6M GPS module schematic

D. SIM900A module design

Due to the particularity of SIM900A structure, there will be disconnection, and the reconnection function is an important function in the communication chip. In this function, DCD, RI two pins ACTS as an important role, in the whole communication chip, DCD pin is the platform to realize d/a conversion, when the bolt is the module, DCD pin will receive a high level, to monitor the pin, will believe that the measures are taken, try to attachment, RI pins after module to reconnect, will maintain a high level of normal, when external information transmission in RI pins will be present in low level, said the external information refers to telephone messages of this kind, then, would be the corresponding mode. This process is called reconnection.

E. Buzzer alarm module design

This design USES a buzzer as an alarm module [9]. As one of the alarm modules, the importance of buzzer is self-evident. This module is one of the most commonly used integrated electronic sounders, which is powered by dc voltage. In terms of components, the buzzer is the core of the module, the audion realizes the role of amplification, and the resistance and capacitance play a protective role in the circuit. The component circuit of this module is shown in figure 3. Working mode of the whole module an electric current in a module passes through the resonance coil inside the module to generate vibration. At the same time, the vibration ACTS on the diaphragm inside the module, which will generate alarm sound.

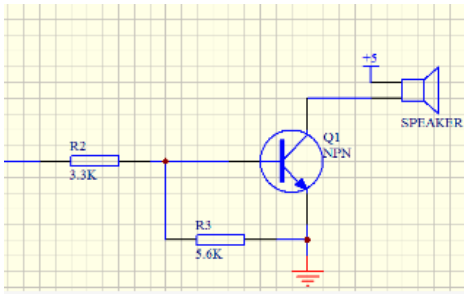

Figure 3 Buzzer circuit schematics

III. SYSTEM SOFTWARE DESIGN

In the selection of language writing for this design, combined with the programming courses learned in college, I used C language to complete the code writing. Compared with other coding languages, this language has advantaged that no other assembly language can replace, both in terms of the ease of coding and the complexity of code modification and maintenance.

About software composition. Firstly, it is the main procedure of ultrasonic ranging module, which completes the acquisition and measurement of the required distance data. Then data integration, some simple processing of the measured data to determine whether it is safe; Then, according to the judgment results, SIM900A module and voice recording playback module are introduced. Parallel event memo reminder.

A. Ultrasonic ranging procedure

Acoustic transmitter to the specified direction of the emission of ultrasonic, at the same time, the timer began to time, ultrasonic wave in the air transmission encounter obstacles will be reflected, ultrasonic receiver received the reflected wave stop time. The control unit will transfer the data to the display module after simple processing of the data. The single-chip microcomputer receives the command of the beginning of the system and begins to test the distance. After the test distance is completed, it is transmitted to the LCD1602 LCD module for display. Meanwhile, the data will be processed and compared to the next module.

B. SIM900A module program

After executing the distance test module, the system mechanism will continue in accordance with the original Settings. Now it comes to the use of this module. SIM900A module as the difficulty of this design, it is necessary to pay attention to the use process to realize the transmission of information. According to the design of system solutions, in the distance information such as complete testing is completed, the data are compared, and simple processing and conforms to the data will stimulate the use of the module, at the same time, the control buttons in simulations under the control of the module to the preset communication terminal to send information, in this way will receive information on the other end, this is the process of the module. When implementing the program, it should be noted that due to the inherent mechanism of this module, all the information needs to be converted into the unicon encoding form. For example, the mobile phone number of the sending terminal this time is "178XXXX4991", which needs to be changed into the unicon format.

IV. SYSTEM DEBUGGING AND PHYSICAL DRAWINGS

In this design, we use C language to write the language code. In terms of writing software, we choose Keil 4 software environment to write the program. Under this writing environment, it is easy to run and debug the code program, and it is also relatively simple to modify and make up the code content in the later stage. In the process of software debugging, data transmission of SIM900A and data incoherence of ultrasonic wave become difficult problems to solve. During the debugging of SIM900A, the program could not run due to the mismatch in frequency, so the phone card could not be detected, which affected the progress of the whole project. For example, in the process of debugging, I used my mobile phone number to accept the information, but in the process of burning, I could not find the matching frequency of microcontroller crystal oscillator and could not complete the burning. After a bug, the information could not be accepted. After the guidance of two teachers to determine the relevant parameters to solve the problem. Incoherent ultrasound data is also a problem. In the process of code writing, the wrong understanding of parameters led to the code running only five times of tests, which directly

affected the product testing. After the classmates' code checking, the problem was solved by rewriting the running code and giving a new data parameter.

In this design, this paper mainly focuses on the intelligent walking stick for the blind. The whole core control module is STC90C516RD+ single-chip microcomputer, which is composed of LCD1602 display module, buzzer alarm module, ultrasonic ranging module, ISD1820 recording voice module, SIM900A module, etc., which can complete the functions of distance test warning, reminder of reminder events and fall one-click alarm.

The realization of the paper design, STC90C516RD+ MCU super control power plays a very important role, at the same time, each module to the control module as the processing core, the realization of each part should have the function, after the overall integration, completed this design. The overall object is shown in figure 4.

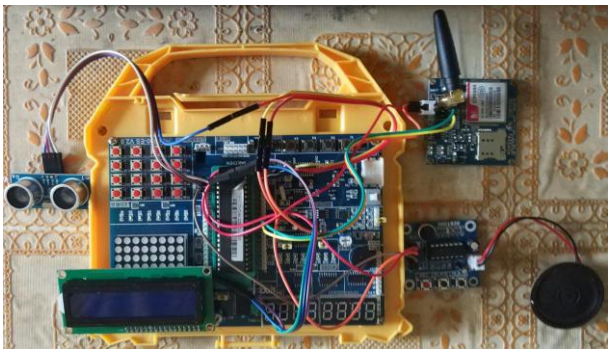

Figure 4 Physical map

V. CONCLUSION

This design is mainly composed of single chip microcomputer as control core module, ultrasonic distance measuring module, LCD1602 LCD display module, SIM900A module, a buzzer module and ISD1820 voice recording module, among them, the STC90C516RD + MCU as control center, the whole package receives and finishing range data, combined with the C programming language code, respectively to control other related modules; As the basis of the whole design, ultrasonic ranging module provides basic data information for the design and updates it in real time. LCD1602 LCD module is an important channel for the design to feedback information to users. To some extent, this module has the function of auxiliary error correction. SIM900A module serves as the information output channel of the design, combining with the corresponding data, to transmit information to the pre-set terminal, which is the bridge between the design and another terminal. The buzzer module and ISD1820 audio recording module constitute the warning module of the design, including feedback to the user about the setting information. In the later maintenance, we plan to improve and develop the design with more Internet of things technologies to ensure the design keeps pace with The Times. After many tests, the design meet the design requirements, with functions of the design of design, at the same time, the design of circuit is simple, development with low maintenance cost, safe and reliable, the function is all ready, combined with the test results show that the design can meet the using demand of the special groups, has the very broad application prospect of promotion.

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