

## Smart Guide Crutches

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### Abstract

In order to provide a safe and reliable environment for the blind when traveling, we designed an intelligent walking stick for the blind. The device is mainly composed of three modules: ranging module, voice prompt module and alarm vibration control module. Its core processor is STM32, which uses the characteristics of fast processing speed, good control function, and simple use of the single-chip microcomputer to effectively combine the knowledge of the sensor and the knowledge of ultrasonic distance measurement, that is, to calculate by using the time of ultrasonic echo The distance between the blind and the obstacle, and then the voice broadcast distance reminds the user to avoid the obstacle. Especially in a loud environment, the vibrating rail stick is used for prompting, so as to avoid potential safety hazards.

### Keywords

Intelligent; Guide; Crutches.

### 1. Introduction

With the development of society, the problem of blind people's travel has become a social problem that can not be ignored. At present, there are a lot of auxiliary equipment for the blind to use, but these equipment have their own advantages and disadvantages, not suitable for promotion and use. Most of our common blind guide devices take anti-skid shock absorption as the main design point. These devices require the blind to hit the ground or nearby obstacles to travel, and it is difficult for such devices to find the obstacles that are suspended or hard to reach by walking sticks. The main functions of some intelligent guide devices sold in the domestic market are: voice prompt, radio, mp3 card insertion, Bluetooth connection and other functions. There have been some problems, big and small, such as

some of the speech guide devices that fail to work properly after the speaker is damaged, and lapos;m not very good at driving for blind people. There are also some auxiliary guide dogs, such as guide dogs or other electronic devices, which are difficult to train and relatively expensive, time-consuming and labor-intensive, and ignored in many cases. Electronic devices can be expensive or require an Internet connection, which is not practical.

In this paper, multiple ultrasonic sensors are designed to detect the obstacle information in multiple directions, and then the voice alarm system is used to remind the blind person of the directional distance and other information of the obstacle nearby. When the distance to the obstacle is less than the set value, the vibration module will give an alarm. Not only can the guide function be realized effectively, but also the price is relatively cheap. It must provide great convenience for the life of the blind.

### 2. Overall design

In order to provide a safe and reliable environment for the blind when traveling, we have designed an intelligent walking stick for the blind. The device is mainly composed of three modules: ranging module, voice prompt module and alarm vibration control module. Its core processor is STM32, which uses the characteristics of fast processing speed, good control

function, and simple use of the single-chip microcomputer to effectively combine the knowledge of the sensor and the knowledge of ultrasonic distance measurement, that is, to calculate by using the time of ultrasonic echo The distance between the blind and the obstacle, and then the voice broadcast distance reminds the user to avoid the obstacle. Especially in a loud environment, the vibrating rail stick is used for prompting, so as to avoid potential safety hazards.

### 3. Partial design

#### 3.1. Ultrasonic Ranging

Compared with other ranging methods, ultrasonic ranging is simpler and faster. The principle is easy to understand, the sensor is relatively cheap, and the measurement accuracy can also meet the design requirements, and predecessors have conducted a lot of research, and there are many excellent examples for reference. Therefore, the use of ultrasonic ranging in this design is very suitable.

The principle of ultrasonic ranging is very simple. An ultrasonic wave is emitted from the transmitting end of the ultrasonic wave. At the same time as it is transmitted, the timing starts. The transmitted ultrasonic wave propagates in the medium. The sound wave has reflective characteristics and will be reflected back when encountering obstacles. , When the ultrasonic receiving end receives the reflected ultrasonic wave, the timing stops. When the medium is air, the speed of sound is 340m/s. According to the recorded time  $t$ , use formula (1.1) to calculate the distance between the launch position and the obstacle.

$$s = 340t / 2 \quad (1.1)$$

This is the so-called time difference ranging method.

The principle of ultrasonic ranging is to know the propagation speed of ultrasonic waves in the medium, measure the time from transmission to reception, and calculate the distance of obstacles based on the measured time. Therefore, the principle of ultrasonic ranging is the same as echolocation.

#### 3.2. Voice prompt

Considering that the user of the product is blind, the form of voice broadcast vibration alarm is adopted. When there is an obstacle in the front, the system first calculates the distance. When it is less than the set value, the vibration system starts to vibrate and alarm. When the obstacle is too far away, it will broadcast the distance of the obstacle by voice.

WT588D voice module is a powerful voice module that can be erased repeatedly. The supporting WT588D VoiceChip upper computer operating software can change any control mode of the WT588D voice module at will, just download the information to the SPI-Flash<sup>[8]</sup>. The operation mode of the software is simple and easy to understand, combined with voice combination technology, greatly reducing the time of voice editing. Online download is fully supported. Even when the WT588D is powered on, you can download information to the associated SPI-Flash through the downloader, reset the WT588D voice module circuit, and then update to the control mode just downloaded.

#### 3.3. Vibration alert

The vibration alarm module uses an ordinary motor. First, the system needs to set a fixed value. When the system detects the distance of the obstacle, it must first judge. The measured distance is less than the set distance, and the vibration module starts to work. When the distance to the obstacle is greater than the set distance, the vibration module stops immediately. In some noisy environments, the blind may not be able to hear the voice prompts. At this time, the vibration

module can also serve as a warning. The vibration system and the voice system can work at the same time without conflict.

#### 4. Summary

The intelligent blind guide system design combines single-chip technology and sensor technology. The transmitter sends ultrasonic waves through the sensor, and the receiver detects the echo to get the time consumed in the whole process, and then calculate the distance of the obstacle. Then through the coordination of the single-chip microcomputer, the voice system broadcasts the location information of the obstacle. Through the research on some of the predecessors' related ultrasonic distance measurement products or theories, design a set of blind guide system with multiple ultrasonic sensors. The system not only detects the obstacle information directly in front, but also detects the obstacles on the left, right and above, and it does not need to constantly adjust the direction of the blind guide device, just walk normally, when the obstacle is too close, the vibration module starts to vibrate Call the police to alert the blind.

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