Smart Blind Stick using Arduino

P DIWAKAR

Assistant professor of Electronics and Communication Engineering, GITAM (Deemed to be university), Rudraram, Patancheru mandal, Hyderabad, Telangana, INDIA.

NELLUTLA AMAN SRINIVAS, THIRAMDAS SRIKANTH, PAGIDOJU SAITEJA, CHILUKURI MADHUSUDHAN

Department of Electronics and Communication Engineering, GITAM (Deemed to be university), Rudraram, Patancheru mandal, Hyderabad, Telangana, INDIA.

Abstract:

The project describes ultrasonic blind walking stick with the use of Arduino uno. According to World Health Organization (WHO), 30 million people are permanently blind and 2.85 million people with vision impairment. If you notice them, you can very well know about it they can't walk without the help of other. One has to ask guidance to reach their destination. They have to face more struggles in their life daily life. Using this blind stick, a person can walk more confidently. This stick detects the object in front of the person and give response to the user either by vibrating or through command. So, the person can walk without any fear. This device will be best solution to overcome their difficulties. We are going to upgrade the project by increasing its application. In this project, we are going to use two ultrasonic sensors. So now, this smart stick will have an ultrasonic sensor to sense distance from any obstacle and a RF remote using which the blind man could remotely locate his stick.

Keywords: Arduino uno, ultrasonic sensors, RF remote.

1.INTRODUCTION:

Visually impaired people are the people who finds it difficult to recognize the smallest detail with healthy eyes. Those who have the visual acuteness of 6/60 or the horizontal range of the visual field with both eyes open have less than or equal to 20 degrees. These people are regarded as blind. A survey by WHO (World Health Organization) carried out in 2011 estimates that in the world, about 1% of the human population is visually impaired (about 70 million people) and amongst them, about 10% are fully blind (about 7 million people) and 90% (about 63 million people) with low vision. The main problem with blind people is how to navigate their way to wherever they want to go. Such people need assistance from others with good eyesight. As described by WHO, 10% of the visually impaired have no functional eyesight at all to help them move around without assistance and safely.

This study proposes a improved technique for designing a smart stick to help visually impaired people for their navigation. In this system, the ultrasonic sensors are used to detect obstacles by using ultrasonic waves. By sensing the obstacles, the sensor passes the received data to the microcontroller. The microcontroller processes the data and calculates if the obstacle is close enough to the person. If the obstacle is not close to the microcontroller, the circuit does not do anything. If the obstacle is close enough to the microcontroller, it sends a signal to buzzer. The system consists of two ultrasonic sensors, one for the detecting any obstacles in the path of navigation and the other one is used to detect pits (by finding the depth). We can assign two different buzzers for two ultrasonic sensors respectively. We are also using an RF transmitter and receiver as a remote, to find the stick when it is misplaced.

Ultrasonic sensors usually work in the frequency range of 40 to 70KHz. They have a range of measurement from 2cm to 5m. We are going to use a wireless RF module in this system and generally it has a range of 50m. The range of RF depends on the type of module and it varies up to 150m.

2. LITERATURE SURVEY:

1. Smart walking stick - An electronic approach to assist visually disabled persons by Mohammad Hazzaz Mahmud, RanaSaha, and Sayemul Islam in this paper are the sensor based circuitry consisting of sensors ,Ultrasonic Sensor is used to detect obstacles, A PIC16F690 microcontroller reads these sensors and drives a buzzer, a LED and a motor with PWM. An audio output is designated by a buzzer alarm.

2. Arm7 Based Electronic Travel Aid System for Blind People Navigation and Monitoring V. S. M. Madulika S #1, M. S. Madhan Mohan#2, CH.Sridevi#3, T. V. Janardhana rao#4 .This paper aims at the development of an Electronic Travelling Aid (ETA) kit to help the blind people to find obstacle free path. This ETA is fixed to the stick of the blind people. When the object is detected near to the blinds' stick it alerts them with the help of vibratory circuit (speakers or head phones). The system consists of ultrasonic sensor, GPS Module, GSM Module and vibratory circuit (speakers or headphones).

3. COMPONENTS:

The brief introduction of different modules used in the system.

Arduino Uno:

Arduino UNO is a microcontroller board based on ATmega328p. It has 20pins out of which 16 digital input and output pins and 6 analog input pins, 16MHZ Quartz crystal, power jack, ICSP header and reset button. It is very easy to perform with arduino since it is user friendly, The Operation Voltage is 5V, we can directly connect it to computer with USB cable, power it with AC-DC adapter or battery.

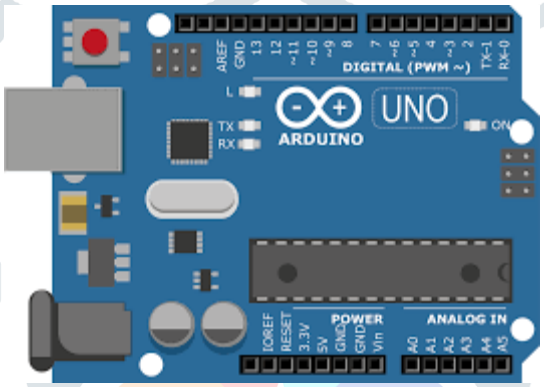

Fig1. Arduino UNO

Features of Arduino UNO:

- The operating voltage is 5V
- The recommended input voltage will range from 7v to 12V
- The input voltage ranges from 6v to 20V
- Digital input/output pins are 14
- Analog input pins are 6
- DC Current for each input/output pin is 40 mA
- DC Current for 3.3V Pin is 50 mA
- Flash Memory is 32 KB
- SRAM is 2 KB
- EEPROM is 1 KB
- CLK Speed is 16 MHz

Ultrasonic Sensor:

HC-SRC04 ultrasonic sensor has 4 pins-ground, Vcc, trigger and Echo. It ranging from 2cm to 500cm(5m). Mainly it has two opening –one is transmitter which is used to transmit the signal and another one is receiver which is used to receive the signal. It sends ultrasound waves at high frequency and receive back the signal.

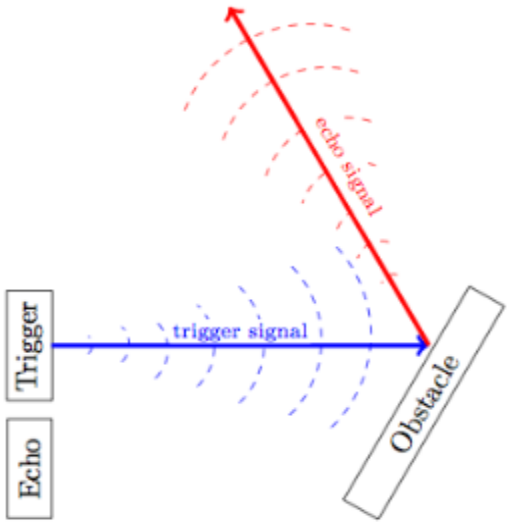

Fig2. Working of Ultrasonic signal

Distance = (time taken * speed of sound)/2

RF transmitter and receiver:

Basically, the RF modules are 433 MHz RF transmitter and receiver modules. The transmitter draws no power when transmitting logic zero while fully suppressing the carrier frequency thus consume significantly low power in battery operation. When logic one is sent carrier is fully on to about 4.5mA with a 3volts power supply. The data is sent serially from the transmitter which is received by the tuned receiver. Transmitter and the receiver are duly interfaced to two microcontrollers for data transfer.

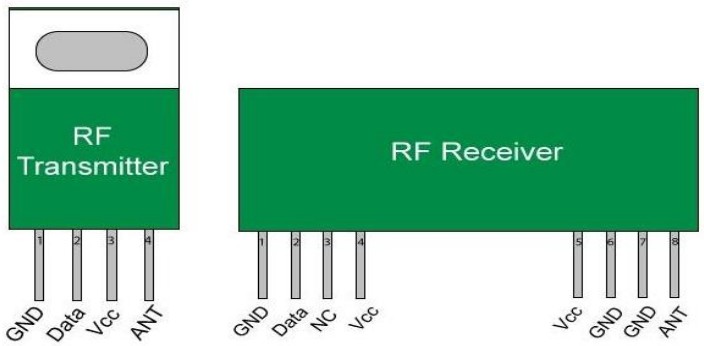

Fig3. RF module

Features of RF module**:**

- Receiver frequency 433MHz
- Receiver typical frequency 105Dbm
- Receiver supply current 3.5mA
- Low power consumption
- Receiver operating voltage 5v
- Transmitter frequency range 433.92MHz
- Transmitter supply voltage 3v~6v
- Transmitter output power 4v~12v

Buzzer:

A buzzer is a small yet efficient component to add sound features to our project/system. It is very small and compact 2-pin structure hence can be easily used on breadboard, Perf Board and even on PCBs which makes this a widely used component in most electronic applications.

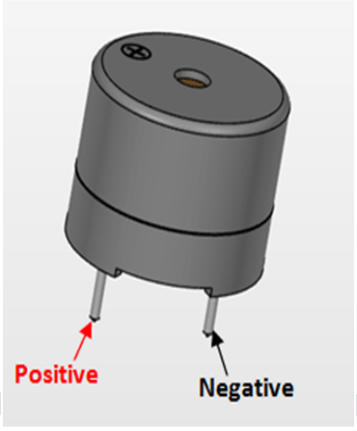

Fig4. Buzzer

4. WORKING OF THE PROJECT:

Connect the ultrasonic sensors to the Arduino UNO. The input pins of trigger and echo of front ultrasonic sensor is pin no. 9 and 10. The input pins of trigger and echo of ultrasonic sensor for pit detection is pin no. 2 and 3. The buzzers are connected to pins 5 and 7. The buzzers are of different frequency and generate different sounds. First, we should calculate the distance of the obstacle with the help of ultrasonic sensor, which is

Distance = (time taken * 0.034)/2

The Arduino code to detect the obstacle and generate buzzer output is:

```
if (dist<50) {
  Serial.println(time_taken);
 Serial.println(dist); Serial.println("Object Alert");
   digitalWrite(Buzzer1,HIGH);
 for (int i=dist; i>0; i--)
    delay (100);
  digitalWrite(Buzzer1,LOW);
 for (int i=dist; i>0; i--)
    delay (100);
}
```

The Arduino code to detect the pit and generate buzzer output is:

```
if (dist2>50) {
  Serial.println(time_taken2);
  Serial.println(dist2); Serial.println("Depth Alert");
  digitalWrite(Buzzer2,HIGH);
  for (int i=dist2;i<100;i--)
  delay (100);
  digitalWrite (Buzzer2,LOW);
  for (int i=dist2; i<100;i--)
  delay (100);
}
```

RF wireless module is used to detect the misplaced blind stick. The receiver is connected to the Arduino uno while the transmitter acts as a remote and it is with the user. With the help of transmitter, signal is sent to the receiver and output is given to the buzzer and it helps in navigating the misplaced blind stick.

5.CONCLUSION:

It is worth mentioning at this point that the aim of this study which is the design and implementation of a smart walking stick for the blind has been fully achieved. The Smart Stick acts as a basic platform for the coming generation of more aiding devices to help the visually impaired to navigate safely both indoor and outdoor. It is effective and affordable.

In a developing country like India, there is a need for a cost-effective solution so that most of the people can have an effective product as proposed in this paper.

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