

Ultrasonic Glove Guider For Blind

Mrs.Ch.Kamala Kumari¹, Mrs.B.Thriveni², P.Khaja Shareef³, M.Priyanka, P.Sravanthi⁴,
Electronics and Communication Department, Tirumala Engineering College
Jonnalagadda, Andhra Pradesh, India.

kamalaeece.au@gmail.com, bollavaraputhriveni1@gmail.com, patankhajashareef@gmail.com
priyankamule0@gmail.com, sravanthipudota@gmail.com

Abstract: The paper proposes an effective way to assist visually impaired people in identifying and avoiding obstacles coming in their way. The proposed system takes the obstacle itself as a input and follows a algorithm to generate corresponding response. The proposed system helps the blind to freely commute and perform their daily activities by sensing obstacles, also the user can hear the distance between him and obstacle by triggering a push button. The proposed system uses a ultrasonic sensor which is compatible to any of the micro controllers, here a arduino uno board is preferred.

It uses the arduino IDE(integrated development environment)software platform for programming the system operations using embedded C language.Limitations may occur as a result of unavailability of fast moving objects such as bus or car. Generally speaking, the proposed framework gives a simple way to utilize and precise content information modality without putting limitations on the users, the proposed system works effectively under environments such as home and office.

Keywords: Ultrasonic sensor , Arduino Uno board, Arduino IDE , SD-card module.

1. INTRODUCTION:

Sound is a longitudinal wave ,converse to electromagnetic waves it vibrates and propagate in same direction. Ultrasound is a sound wave with a

frequency greater than 20KHz.The ultrasonic wave when hits a obstacle, it turns back to the ultrasonic source, this phenomenon is called 'reflection'.

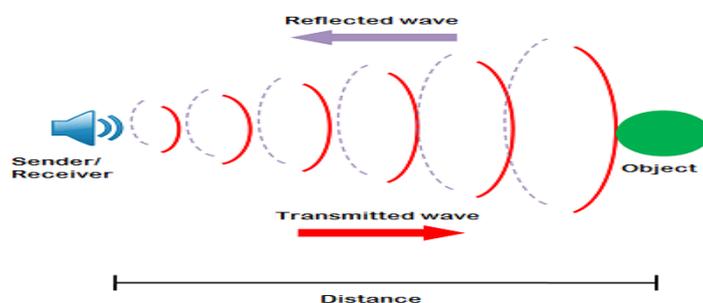


Fig 1: reflection

The proposed system uses the principle of sound reflection, where obstacle reflects the ultrasound wave .We use a ultrasonic sensor(HCSR-04) to transmit the ultrasound signals ,also the reflected signals are received by the same ultrasonic sensor.

So by the principle of reflection, the proposed system uses the ultrasonic sensor transmits the ultrasound signals ,when these signals

hit the obstacle(wall, furniture , home appliances etc..) reflected signals (echo) transmit to ultrasonic sensor from the obstacle. The ultrasonic sensor processes the received echo to determine the distance between user and the obstacle .The user get different responses depending on the distance values determined.

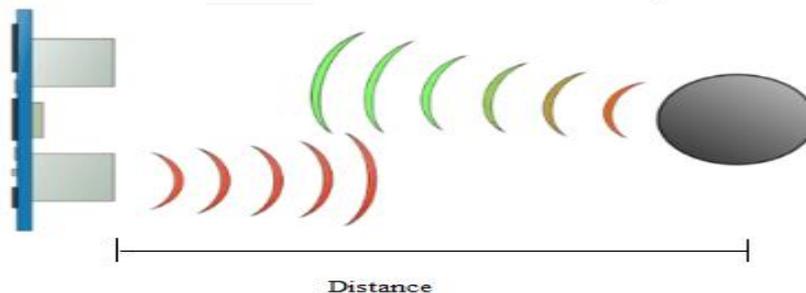


Figure 2 : Ultrasound reflection

By using the process the user can avoid hitting any obstacle which is under his proximity, the user can also hear the distance between a specific object and him upto an approximation of 5 centimeters, by this the user can easily pick up or hold any object with ease. For smooth running of the system and providing high accuracy, Arduino IDE (integrated development environment) software platform is used. Corresponding to the need of the user different threshold distances are set to generate different responses. Using the software

the intensity of specific response can be varied depending on the user's comfort. However the proposed system maintains three different distance thresholds to generate three different responses varied in intensity. The three different distance thresholds that are used in the proposed system are at less than 50 centimeters, between 51 and 150 centimeters and finally between 151 and 250 centimeters respectively, the vibrations are generated.

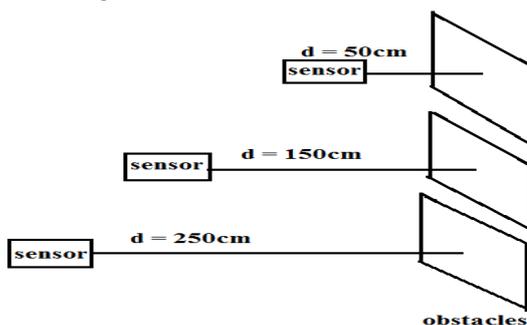


Figure 3 : Different distances between sensor and obstacle

The proposed system uses a Arduino Uno board to store the software program. The Arduino Uno board acts as a micro-controller. Different sensors

are connected to the Arduino Uno board, these include a ultrasonic sensor, a sd card module, a speaker, a 9 volt DC-battery and a vibration motor

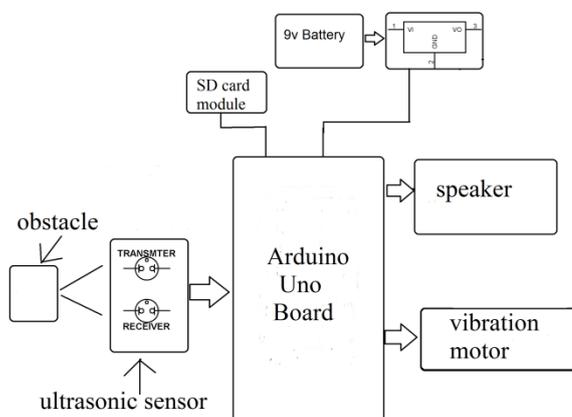


Figure 4 : Block diagram

The response from the proposed system is different for different distances measured and there is also a audio response which is activated by a simple push button. So ,the proposed system have two sets of response to the user ,one in terms of

vibration and other in the form of audio signals .The whole process can be understood from the following flow chart.

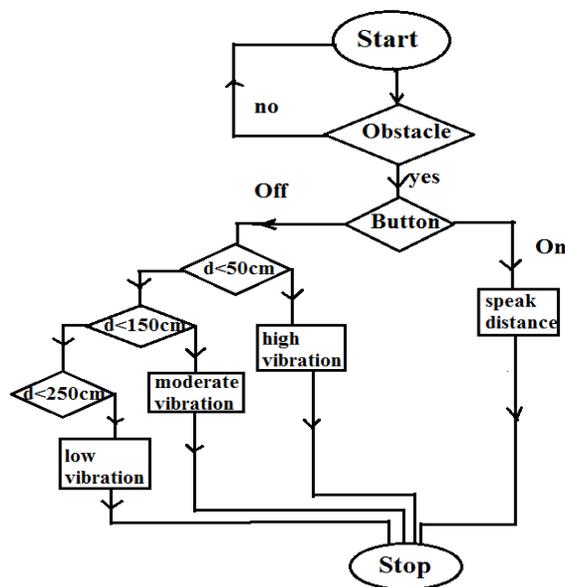


Figure 5 : Flow chart

2. WORKING :

The working of the proposed system involves mainly three stages.They are obstacle detection ,distance –calculation , response to glove. The three stages precisely explains the overall working of the system.

A. Obstacle Detection :

When the system is supplied with power , the arduino uno board sends a 10 micro second pulse to the ultrasonic sensor ,the ultrasonic sensor generates 8 pulses of ultrasonic frequency 40 KHz.

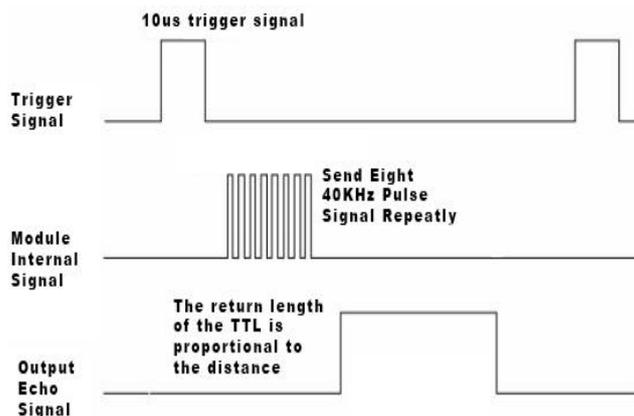


Figure 6 : Timing signals

The ultrasonic signals are transmitted through free air by the transmitter of the ultrasonic sensor. When the transmitted signals hit any obstacle in their way, the ultrasound signals are reflected towards the ultrasonic sensor .The reflected echo signal is received by the receiver on ultrasonic

sensor. In this way the obstacle is identified by the system. While the maximum range for the obstacle detection is 400 centimeters , the minimum is 2 centimeters . Therefore the range for detection of obstacle in the system is 2- 400 centimeters .Generally speaking the system works best under

an angular range of 30 degrees .At maximum range case(400 -centimeters) the system can detect

a obstacle or object which is approximately 100 centimeters on either sides of the user

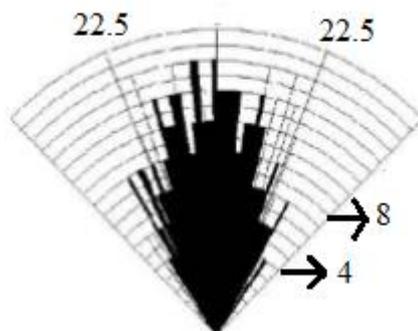


Figure 7 : Performance in angular range vs distance range

B. Distance Calculation :

Considering the fact that sound travels at the rate of 340 meters per second , i.e 34000 centimeters per second, the proposed system determines the time gap between the actual ultrasound signal and its echo.Once the time gap is known the distance is calculated in centimetres as

$$\text{Distance} = \text{time} * 0.017150 \text{ (in centimetres)}$$

Therefore the distance between the obstacle and the user is calculated with an accuracy of 3 millimeters.

C. Response To The Glove :

As the proposed system assists the user in two waysby generating vibrations at obstacle proximity by playing a audio file on speaker which speaks out approximate distance.Generation of vibration is done through a vibration motor , the motor vibrates once or twice or thrice depending on the proximity of the obstacle to the user.While audio files are preloaded into a memory card,memory card is connected to arduino using a device called SD

(secure digital) card module in it.Which is made compatible to the Arduino Uno board using a sd-card module. The audio files are converted to '.wav' format which assures lossless transmission of the audio. The file format assigns 16 bits per each sample using LPCM(linear pulse code modulation).The distance audio is played only when a push button in on state.

3. EXPERIMENTAL RESULTS :

When the user points the sensor towards the air if there is no obstacle in the range of 400cm, then the user is not going to get any response. Here is another case where the presence of obstacle is there, and then the response is depends on push button.

The response by the speaker is rounded of to certain level due to high memory requirement issue , as the proposed system is targeted to be cost effective too. So, the distances read below 30 centimeters are rounded off to nearest 3 multiple and above that the values are rounded off to nearest 5 multiple

Table 1 : Sample response by the speaker

distance measured	distance on speaker
28 cm	27 cm
153 cm	155 cm

The case in which the push button is OFF and if the distance is less than 50cm then the user will get high vibration as the obstacle is very near to him. If the distance is less than 150cm then the user will get medium vibration. And if the distance is less than 400cm then the user will get low vibration.

However the response is completely based on the distance between the obstacle and the user when the push button is in OFF state. If the push button is in ON state then the user is going to get the response in the form of audio.

Table 2 : Sample response by the vibration motor

distance read	response on vibration motor
upto 50 cm	hard vibration
between 50 and 150 cm	moderate vibration
between 150 and 250 cm	low vibration

4. CONCLUSION :

The proposed system can help blind by measuring and notifying the users with an accuracy of 3 millimeters . The angular range of the system can be improved by incorporating more than one sensor. Thereby the system can provide accurate responses to the user. The sensor's future scope can be found in dark image processing with advanced ultrasonic sensors with high accuracy, it's scope is also towards industrial uses by measuring most accurate values.

REFERENCES :

- [1] www.electroschematics.com/8902/hc-sr04-datasheet/
- [2] https://www.itead.cc/wiki/Ultrasonic_Ranging_Module_HC-SR04
- [3] [.https://en.m.wikipedia.org/wiki/Ultrasound](https://en.m.wikipedia.org/wiki/Ultrasound)
- [4] <https://store.arduino.cc> > usa > arduino-uno
- [5] [.https://copradar.com/rdrange/](https://copradar.com/rdrange/)