Impact Factor (SJIF): 5.301

International Journal of Advance Research in Engineering, Science & Technology

e-ISSN: 2393-9877, p-ISSN: 2394-2444

Volume 5, Issue 6, May-2019

Detects Obstacles and Warn to VIP by using Smartphone

Prof. Chavan Ganesh B.[1], Bhosale Kalyani A.[2], Jagtap Suraj C.[3], Kumbhar Ankita S.[4], Solanke Jyoti T.[5]

[1]*Department of Information Technology*

[1, 2,3,4,5] *SVPM's COE Malegaon (BK) Baramati, India*

Abstract —**Proposed system provide detection and classification of obstacle in real time, used to aid visually impaired people to provide safety within indoor and outdoor environment, by using Smartphone device. When a blind person walking in an unfamiliar area, they faces so many problems like they does not identify true obstacles, potholes, bumps, etc in his way. To avoid these problems, there are various ETA tools are available in market for helping visually impaired people. But most of visually impaired people are not affordable these kind of ETA tools. And also they does not provide complete information about the environment in which the user is present. So this paper describes a real-time system which makes use of the ultrasonic sensor and Smartphone for detection of obstacles that helps to find the path of visually impaired peoples. In which the ultrasonic sensor detects the measure of distance of obstacles in front of the user. The output is given to the user in the form of audio or vibration on the mobile.**

Keywords- Ultrasonic Sensors, Smartphone, Raspberry pi, IR Sensor, Bluetooth module, Visually Impaired (VIP), Electronic Travel Aid (ETA).

I. INTRODUCTION

Travelling in crowed environment is a challenge for the visually impaired people. And these visually impaired people do not have any contextual and spatial information around them. According to WHO (World Health Organization) there are 39 million people are blind and as of 2010 there are more than 285 million have low vision and in the world 90% visually impaired have low income[1][2]. Therefore there is a constant need of a device which assists them in the unknown environment. For that there is broad range of ETA tools are available in the market which can help them in their day-to-day activities. White cane and Guide Digs are the primary tools which are preferred by the visually impaired people. But these systems also have some drawbacks such as Guide Dogs are not allowed in some places and White cane cannot detect the obstacles which are above the ground level such as tree branches, open windows, etc. Some other work done in this field is as explained below:

ECHOLOCATION [3] is the system which is made up of two ultrasonic sensors which are attached to the conventional eyeglasses. In this system the reflected ultrasound waves transmitted by the sensor gives the different directions and the size of the object, which create the form of localized sound images. But the drawback of this system is that it requires a lot of training.

NAVBELT [4] is a guidance system that used mobile robot obstacle avoidance system. This system uses ultrasonic sensor, a computer and the earphones. The computer in this system receives data from ultrasonic sensor and produces different sounds depending on the direction of the obstacles. The disadvantage of this system was it is expensive and user needs an extensive training period.

GUIDE CANE [5] is the updated version of navbelt system. This system consists of handle which is connected to the main device which is consists of wheels, ultrasonic sensors, a steering mechanism and a computer. When user moves with guide cane and when the obstacle is found then this system selects the different directions until obstacle is cleared. The disadvantage of this system was it has limited scanning area and also it is bulky, difficult to hold or carry when needed. Moreover, the user requires training to operate this system.

Most of the project based on the GPS [6] i.e. it require internet connection which is difficult to attain in certain areas and it also require additional cost of data usage. However, the different end products that were created in the past have some of the disadvantages like some are difficult to wear; some are non-portable and also expensive which is not affordable to common people.

All these reasons resulted in the research of a device, which is portable, cost-effective, and can also work without any additional internet connectivity. This system also makes the visually impaired person aware of the obstacles in an easier way. In this paper, section II explains the proposed design of this system. Section III explains the Obstacle Detection and Distance Calculation. Obstacle Recognition is explained in section IV. Complete working of this system is explained in section V. And last test result and conclusion is discussed in the remaining sections.

PROPOSED DESIGN

The proposed system uses the Ultrasonic sensors, IR Sensor, Raspberry pi, Bluetooth Module, and the Smartphone. In this system, the Ultrasonic sensor is used for object detection. Ultrasonic sensor sends a short burst signal and then listening for the echo signal [7]. Then the raspberry pi which is connected to the sensors calculates the distance of the obstacle based on the echo signal which bounces back from the obstacle. This system in integrated on the stick, making it portable. This system is made up of five main components: (A) Ultrasonic sensors, (B) Raspberry pi, (C) Bluetooth Module, (D) IR Sensor and (E) Smartphone.

A. Ultrasonic Sensors

The ultrasonic sensor belongs to the category of sensors which emits the sound of frequency more than 20 kHz.

As shown in the fig. the sensor is four pin modules, whose pin names are VCC, Trigger, Echo and Ground (GND) respectively.

- **VCC:** This pin is used to provide the +5V power supply to the sensor.
- **Trigger:** This pin is used to take the input pulse to trigger the sensor.
- **Echo:** This pin is used to receive the output pulse.
- **Ground (GND):** This pin is used to connect the sensor to the ground.

Fig.1. Ultrasonic Sensor (HC-SR04)

At initially, using the raspberry pi the trigger plus is given as an input to the ultrasonic sensor. Then the ultrasonic sensor transmit the ultrasonic waves (40 kHz), this waves travels in the air at 343ms-1 and when it gets objected by any material it gets reflected back towards the sensor. This reflected wave is observed by the ultrasonic receiver resulting in an output pulse. Then this output pulse is captured by the Raspberry pi. Depending on the time taken by the pulse to return back we calculate the distance from the obstacle.

B. Raspberry pi

Raspberry pi is credit card size and the low cost computer. It takes inputs from the GPIO pins which can be connected to the other devices. For our proposed design Raspberry pi 1 model B+ is used. It has 4 USB ports, HDMI port audio jack port and an Ethernet port. In our system, need to connect the GPIO pins to the ultrasonic sensor. It requires 5V power supply for operations and micro SD card for storage purpose.

Fig.2. Raspberry pi 1 Model B+

This runs our algorithms that help us to calculate the distance of obstacle and obstacle detection based on the input which is received from the ultrasonic sensor and IR Sensor.

C. Bluetooth Module

In our system, the Bluetooth module is used for data transmission from Raspberry pi to the Smartphone. The Information collected by the ultrasonic sensor is transferred to the Smartphone using Bluetooth module.

Fig.3. Bluetooth Module

D. Smartphone

The Smartphone is used for giving the Audio Feedback to the user.

II. DISTANCE CALCULATION

This section describes the process of distance calculation using ultrasonic sensor between the obstacle and the Person in detail. This sensor works with the simple high school formula that is

Distance = speed * time

Now, to calculate the distance using above formula, the speed and the time must be known. The universal speed of ultrasonic wave at room condition is 343m/s. The circuitry inbuilt will calculate the time taken for the ultrasonic waves to come back and turns on echo pin high for that same particular amount of time, this way we can also know the time taken. Now simply calculate the distance by using the formula that is

OD = {[Speed of sound * Time taken] / 2}

Where,

- **OD:** It is the distance between an obstacle and person in centimeter.
- **Speed of sound:** The speed of sound is 343m/s.
- **Time taken:** It is the time interval between pulse transmitted and pulse received.
- The taken by pulse is twice the distance travelled, hence divide the equation by 2.

III. OBSTACLE DETECTION

Ultrasonic sensors are used for obstacle detection and distance calculation between obstacle and the visually impaired people. **HC-SR04 Ultrasonic distance sensor** is commonly used with the microcontroller and microprocessor platforms like Arduino, ARM, PIC, Raspberry Pie etc. This sensor is used in the pair as transceivers i.e. single sensor can both send and receive the signal. This action will trigger an ultrasonic wave at frequency of 40Hz from the transmitter and the receiver will wait for the wave to return. Once the wave is returned after it getting reflected by any object the Echo pin goes high for a particular amount of time which will be equal to the time taken for the wave to return back to the sensor.

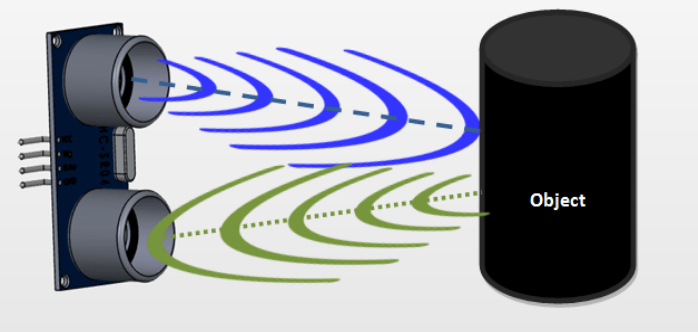


Fig 5. Working of ultrasonic sensor

In the proposed system, we using the algorithm which is implemented in the python programming language and it is deployed on the raspberry pi. This algorithm is used to calculate the distance of obstacle from the user.

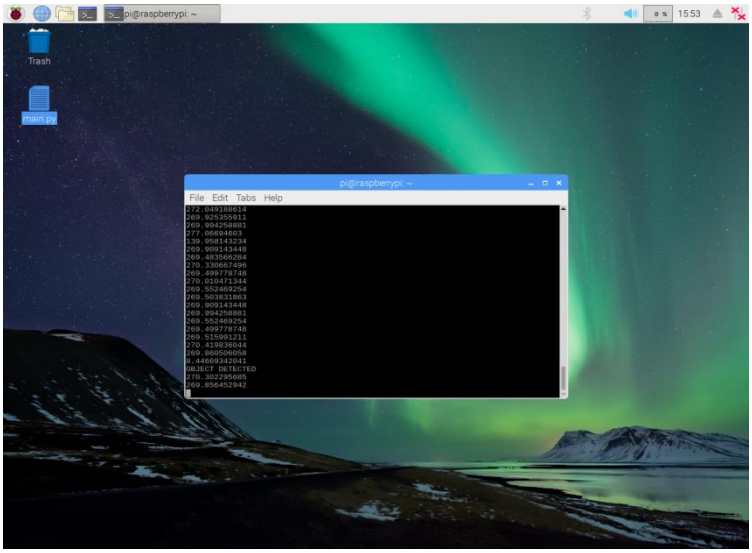
IV. WORKING

When the power is supplied to the Raspberry pi the entire process is start. When the Raspberry pi boots its operating system, then it trigger the ultrasonic sensor and start to send the burst signal. The working of Raspberry Pi is to read the Echo pin for calculating the time [8] after the signal return back to the receiver of the sensor i.e. Echo pin of the ultrasonic sensor. By using this time calculate the distance of obstacle from the object. It checks if the calculated distance is less than the distance specified in the algorithm then alert the user by raising buzzer and also gives audio feedback on the Smartphone i.e. “obstacle detected”.

V. RESULT

Object distance position	Sensor Reading	Buzzer	Smartphone
5cm	5	Create voice	Obstacle Detected
10cm	10	Create voice	Obstacle Detected
15cm	15	Create voice	Obstacle Detected
20cm	20	Create voice	Obstacle Detected
25cm	25	Create voice	Obstacle Detected

Table 1.Testing result



VI. CONCLUSION

This paper proposes to develop a device i.e. Stick using the Raspberry pi and the other components like ultrasonic sensor, IR sensor, buzzer and the Bluetooth module.

It has the features like:

- This device helps the blind person to walk in the unknown environment.
- This device uses the sensor for collecting the information in the environment.
- This device does not require internet connectivity.
- This is cost effective, easy to use and portable.
- This device notifies the user about the obstacle in the form of buzzer and the voice.

REFERENCES

[1] WHO Fact Sheet of Visual impairment and blindness. http://www.who.int/mediacentre/factsheets/fs282/en.

[2] Pascoloni D, Mariotti SPM. Global estimates of visual impairment: 2010. British Journal Ophthalmology Online First Published December 1, 2011 as 10.1136/bjophthalmol-2011-300539.

[3] T. Ifukube, T. Sasaki, and C. Peng, "A blind mobility aid modeled after echolocation of bats," IEEE Trans. Biomed. Eng.,vol.38,no.5,pp.461– 465, May 1991.

[4] Shraga Shovel, Iwan Ulrich, and Johann Borenstien, "NavBelt and the Guide Cane", IEEE Transactions on Robotics &Automation, Vol.10, No.1, pp. 9-20, March 2003.

[5] I. Ulrich and J. Borenstein, "The guidecane – applying mobile robot technologies to assist the visually impaired people," IEEE Trans. Syst., Man Cybern., A: Syst. Hum., vol. 31, no. 2, pp. 131–136, Mar. 2001.

[6] Z. Hunaiti, V. Garaj, W. Balachandran and F. Cecelja, "Mobile Link Assessment for Visually Impaired Navigation Systam," 2005 IEEE Instrumentation and Measurement Technology Conference Proceedings, Ottawa, Ont., pp. 883-887.

[7] A. Carullo and M. Parvis, "An ultrasonic sensor for distance measurement in automotive application," in IEEE Sensors Journal, vol. 1, no. 2, pp. 143-, Aug 2001.

[8] https://www.electronicshub.org/raspberry-pi-ultrasonic-sensor-interface-tutorial/