Asian Journal of Convergence in Technology *Volume III, Issue III*
ISSN No.:2350-1146, I.F-2.71

Survey on Obstacle Detection and its Notification through an Android App for Visually Impaired People

Aarti A. Walimbe, Sanchita S. Rao, Aishwarya K. Sureban, Mrinal S. Shah

Department of Computer Engineering
Pimpri Chinchwad College of Engineering
Pune, India

aartiaw@gmail.com, sanchitasrao@gmail.com, ash.sureban@gmail.com, shahmrinal30@gmail.com

***Abstract* - Assistive technology is an emerging research area, where adaptable devices can be developed to help older people to achieve independence in their daily activities. Ultrasonic sensors attached on the device used will generate the data about the obstacle it detects and will notify the user through an android application. The visually impaired as well as a person having impaired hearing can use the proposed wearable device which will help to improve his mobility and make it hassle free.**

***Keywords*--Visually impaired people, Android app, Ultrasonic sensor, Arduino UNO microcontroller, Bluetooth.**

I. INTRODUCTION

The number of Blind people around the world is 37 million and out of them India is the home to 15 million of them. This also makes them more accident prone. Also, there are 190 million smart phone users in India out of the total population. These statistics clubbed together is the proposed system which helps in developing a system that reduces the effort of the visually impaired people and makes their mobility hassle free. The proposed system aims at taking advantage of the number of smart phone users in the country and inducing a system which will notify the visually impaired user through the android application.

A. Purpose

To ensure that the visually impaired person can detect obstacles in any unstructured environment and can overcome all the hassles and obstacles without any human assistance using the proposed system. Also, safety of blind people is an issue in unknown environments and so the proposed system will ease their efforts and will improve their mobility.

B. Project Scope

The proposed system uses ultrasonic sensors which removes drawback of infrared sensors that cannot be efficiently utilized at day time. Also, the ultrasonic sensors can detect obstacles upto the range of 3m with an angle of 60° which is more than infrared sensors and thus detects obstacles effectively. Infrared sensors do not provide accurate ranging and also it needs line of sight for measurement. Whereas ultrasonic sensors calculates the distance of the obstacle accurately and can also be used in sunlight. Therefore our proposed system chooses ultrasonic for obtaining the optimal solution.

Further classification of the paper is as follows:
Section II : Survey details
Section III : Proposed system
Section IV : Conclusion

II. SURVEY DETAILS

Visually impaired people use a cane stick for identifying objects in front of them. Some of the existing systems are embedded onto this stick making it difficult to carry or use some wearable device that may not be comfortable. The existing systems also consists of wearable glasses and embedded cameras to detect static and dynamic objects and notify through audio assistance [1], use of multiple sensors and alarm models to alert the user [2], use of laser range finder to detect and acquire information of dynamic obstacles [3], detecting obstacles upto 1.5m [4], use of smart glasses to process and detect image of obstacles [5]. The advantages and disadvantages of each of these existing systems is elaborated in the following sections :

A. Wearable Audio Assistance

This system uses glasses that are embedded with RGB camera and other sensors that helps to locate objects. The notification of the location of the object is given to the user through audio assistance. This system however becomes costly and is good for indoor navigation.

B. Obstacle Detection with Multiple Alarm Units

The system here uses multiple sensors and multiple alarm models to alert user about the obstacle. The system majorly uses infrared sensors wherein detection of obstacles during daytime becomes difficult due to infrared sensor limitation. It also requires high maintenance cost.

C. Laser Range Finder for Dynamic Obstacles

The system detects static, dynamic and static with dynamic objects like human beings by use of laser. However, use of laser system is not very cost effective and is good for indoor navigation only.

D. Shoes to Detect Obstacles

Here, the system uses shoes that are embedded with ultrasonic sensors and infrared sensors to detect an object. Notification about obstacle detection is given by sound and vibrations to the user. The drawback of this system is that when the objects are exposed to direct sunlight they cannot be detected efficiently and these shoes cannot be used in rainy season.

E. Smart Glasses and Smart Phone System

The system here uses smart glasses to detect obstacles of various size and notify the user about the same through smart phones. Due to the use of smart glasses the system becomes less cost effective.

III. PROPOSED SYSTEM

A. Architecture

The Ultrasonic sensor and the Bluetooth module will be interfaced with the Arduino microcontroller. Arduino microcontroller is responsible for controlling the entire operation. It will be powered using batteries. Notification of the detected obstacle will be given by users' android phone. Following architectural diagram shows the conceptual view of the entire system.

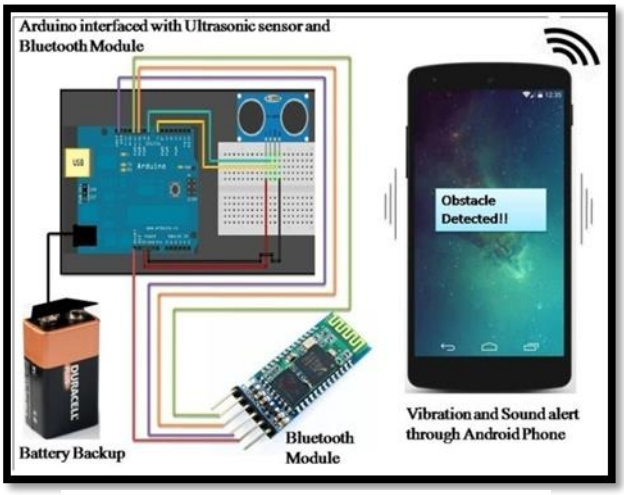

Fig. 1:Architecture of Proposed System

The interfacing of Ultrasonic sensor and Arduino is as shown:

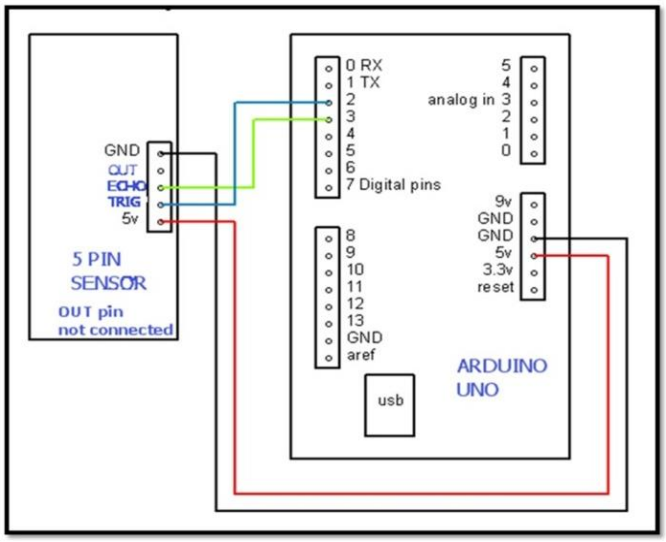

Fig. 2:Arduino UNO and Ultrasonic Sensor Interfacing

B.Working of the Proposed System

When triggered by the Arduino UNO microcontroller, ultrasonic sensors will start sending ultrasound signals continuously. When an object is encountered, these signals will be echoed back , captured by the ultrasonic sensor and will be given as an input to the Arduino UNO microcontroller. Through programming, these signals will be converted to distance in meter. The distance will then be send to an Android app that will give a warning beep and vibration to the user if it is 2 meter or more than 2 meter distance far or will give continuous beep and vibrations if the distance between the user and the obstacle is less than 1 meter. Following diagram shows the working of the proposed system:

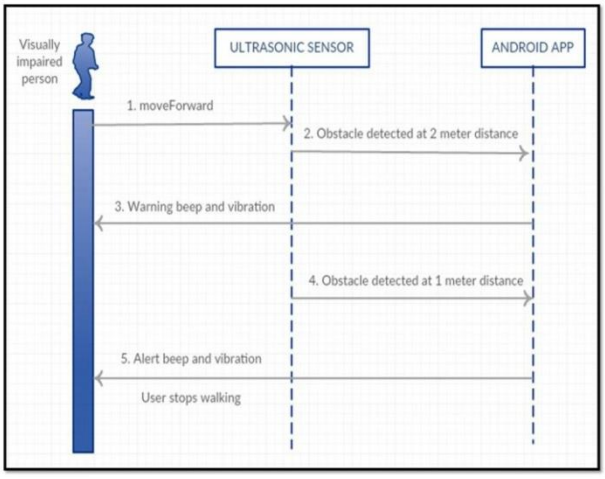

Fig. 3: Overall Working of the Proposed System

C. Assumpti

The basic assumption for the use of proposed system is that the user has an Android mobile. Dependencies for this system are : obstacles encountered are not made up of sound absorbable material, else the ultrasound will not be echoed back to the sensor and the system will work as long as the batteries are not drained out.

D. Hardware and Software Requirements

Hardware required for the proposed system consists of Arduino UNO microcontroller, Ultrasonic Sensors, Bluetooth module and a smart phone with Android operating system. For Arduino and ultrasonic sensor programming, Arduino IDE will be used and android app will be coded using Android Studio.

E. Advantages of the Proposed System

Following are the advantages of the proposed system :

- As alert about obstacle is given through vibration, system can be used by a user who is visually challenged as well as, has impaired hearing.
- Use of less number of sensors, thus has an optimal cost.
- Provides accurate distance of obstacle.
- Removes drawback of infrared sensors that cannot be efficiently utilized at day time.
- Can be used for indoor as well as outdoor obstacle detection.
- The system makes a visually challenged person walk hassle free.

F. Drawbacks of the Proposed System

Following are the drawbacks of the proposed system :

- Cannot be used to detect very small obstacles in the way of the user.
- Obstacles above and below a particular height cannot be well detected.
- The system depends upon battery supply. Thus, it can be used only until the battery provides power supply.
- The system can be used only if user has an Android mobile.

G. Applications of the Proposed System

The system can be used for following applications:

- To detect obstacles in the way of visually impaired people and notify them using an android application.
- Can also be used by a person who is visually challenged as well as has impaired hearing.

IV. CONCLUSION

The proposed system therein aims at removing the drawbacks in the existing system and adding features that enables the visually impaired person to travel in any desired environment without any human guidance. It gives the blind person a sense of independence as well. The purpose of the proposed system is reduced accidents of the visually impaired people and also to create hassle free environment for everyone and make the country a safe place to live.

ACKNOWLEDGMENT

We express our sincere thanks to our Guide Prof.Atul Pawar, for his constant encouragement and support throughout our project, especially for the useful suggestions. We would also like to thank our Project Coordinator Prof. Sudarshan Deshmukh and Prof. Archana Kadam,for their assistance, genuine support and guidance from early stages of the project. We would like to thank Prof.Dr.K Rajeswari, Head of Computer Department, PCCOE for her unwavering support during the entire course of this project work. We are very grateful to our Principal Dr.A.M.Fulambarkar for providing us with an environment to complete our project successfully. We also thank all the staff members of our college and technicians for their help. Finally, we take this opportunity to extend our deep appreciation to our family and friends, for all that they meant to us during the crucial times.

REFERENCES

[1] W. C. S. S. Simões ,V. F. de Lucena, " Blind user wearable audio assistance for indoor navigation based on visual markers and ultrasonic obstacle detection", Universidade Federal do Amazonas, IEEE 2016.
[2] B. Mustapha, A. Zayegh, R.K. Begg, "Obstacle Detection System for Elderly and Visually Impaired People with Multiple Alarm Units", College of Engineering and science, Victorial University, Australia, IEEE 2014.
[3]Chunshan Liu, Erbao Dong*, Zhuo Duan, He Huang, Min Xu , Jie Yang, "Tracking and Claasification of Dynamic Obstacles with Laser Range Finder in Indoor Environments", IEEE Conferrence on Robotics and Biomimetics 2015.
[4] Shapina Abdullah, Noorhayati Mohamed Noor, Mohd Zaki Ghazali, "Mobility Recognition System for the Visually Impaired", IEEE 2014.
[5] Sung-Ho Chae ; Jee-Young Sun ; Mun-Cheon Kang ; Byoung-Jun Son, "Collision detection based on scale change of image segments for the visually impaired", Korea University, IEEE 2015.
[6] Joselin Villanueva, Rene Farcy "Optical Device Indicating a Safe free Path to Blind People", IEEE 2013.
[7] Kabalan Chaccour, Rony Darazi, "Multisensor guided walker for visually impaired elderly people", ICABME 2015.
[8] Bing Li, Xiaochen Zhang ; J. Pablo Xiao ; Xuejian Rong ; Yingli Tian, "Assisting blind people to avoid obstacles: An wearable obstacle stereo feedback system based on 3D detection",State University of New York, IEEE 2015.
[9] Shripad Bhatlawande ;Manjunatha Mahadevappa ; Jayanta Mukhopadhyay; "Way-finding Electronic Bracelet for visually impaired people",Indian Institute of Technology Kharagpur, IEEE 2013.
[10] D. Y. K. Sampath ; G. D. S. P. Wimalarathne; "Obstacle classification through acoustic echolocation", Sch. of Computer, Univ. of Colombo, Colombo, Sri Lanka, IEEE 2015.
[11]Ayat Nada, Mahmoud Fakhr, Ahmed Seddik, "Assistive Infrared Sensor Based Smart Stick for Blind People", Science and Information Conference 2015.