ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

Vol. 5, Issue 5 , May 2018

Ultrasonic Aid for Visually impaired Person

Ramchandani P, Maheshwari K

M.E Student, Department of Mechatronics Engineering, Mehran University of Engineering Technology jamshoro, Pakistan
M.E Student, Department of Computer Science, Mehran University Of Engineering Technology jamshoro, Pakistan

ABSTRACT: According to the Pakistan Press International (PPI) almost 1.5 million people in Pakistan are suffering from blindness and it is estimated that by the year 2020 approximately 54 million people, worldwide, will be suffering from blindness. Fall is the main suffering of the blind and blind people have to depend on someone else for their help and guidance. In order to aid such people many devices have been developed but they are costly for the people residing in developing countries. By keeping in mind the financial conditions of the people of developing countries we have designed an ultrasonic based helmet that aids people having visual impairment. This system is completely self-controlled which means a visually impaired person would not be needing any assistance. In this system Arduino mega 2560 has been used to as the controller to detect any obstacle in the path of the person wearing a helmet and serves as a guide to avoid any collision.

KEY WORDS: Electronic device, visually impaired system, Arduino, obstacle detection and ultrasonic sensors.

I.INTRODUCTION

In recent years with the advancement of automation and control systems various new devices have been designed to aid people in all aspects of life including business, sports, education, automotive, health care and entertainment. But the most promising aspect of it is the development of bio-medical technology which can aid not only in making the lives of disabled people better but also by saving lives and making the world a safer and better place.
The recent developments in the field of sensors and open source controllers have not only made such systems cheaper but also readily available to people.

II. LITERATURE SURVEY

There is a definite lack of information of the surroundings for the blind and visually impaired due to which they cannot efficiently and effortlessly perform their day to day task, even as simple as walking around their own home. This work presents an assistive device which helps in providing the useful information of close proximity to the user and guides them to move around without any collisions An electronic system is built in a cane which detects obstacles above the waste height and sends signals to the user in the form of a sound or vibration. It is important to have a vision to extract information from a dynamic environment so as to avoid collisions. The requirement of synchronized actions is vital to mobility [1]. The design of everyday environment around us is fashioned for people without any physical handicaps which puts people with disability at disadvantage to perform without any aid .[2]. According to Hersh and Johnson [3], there are a lot of studies which employ current technology to enhance mobility of visually impaired people so as to avoid any obstacles in their paths. A guidance system [4] consisting of sensors positioned on the shoes to assist the blind was proposed, the Mobility technique department at ACIC Santa Catarina Association for the Visually impaired citizen Integration performed the evaluation of the initial prototype, a further improved and modified device was later developed [5] show in Figure 1.

ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

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Figure 1 Cane prototype

A simple, low weight and cost-effective device named as Ultrasonic assistive headset was developed for the aid of visually impaired people. [6]

A device weighing 3.4 kg was developed at the University of Michigan to allow quick and easy walk by a blind person. The device consumed 18 W of power. [7].
A system augmenting a stereo camera and haptic glove was developed for the aid of blind by Zelek [8].

IV. METHODOLOGY

The components used in the Ultrasonic aid for visually impaired person are the Ultrasonic sensor, DC vibrator motor, Arduino Mega 2560 board, Helmet and DC power supply.

A. Ultrasonic Sensor

The working principle of ultrasonic sensors is very simple, it sends waves and when the collide with an obstruction and return it utilizes the time-span to find the distance from that object shown in figure 2.
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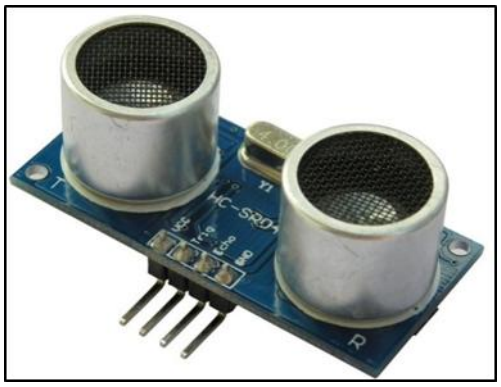

Figure 2 Ultrasonic Sensor HRSO4

This ultrasonic module measures the distance accurately which provides 0cm - 400cm with a gross error of 3cm. Its compact size, higher rangeand easy usability make it a handy sensor for distance measurement and mapping. The module can easily be interfaced to microcontrollers where the triggering and measurement can be done using two pins. The sensor transmits an ultrasonic wave and produces an output pulse that corresponds to the time required for the burst echo to return to the sensor [9].

B. DC Vibration motors

Vibration motor operates on 3-volt dc. The microcontroller sends the signal to vibration motor. The vibration motors are utilized to give input to the human wearing the cap. At the point when the sensor detects any object nearby within

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
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the range then the vibration motor of that specific angle begins vibrating and gives a sign to the person that there is a threat of collision at that point [10].

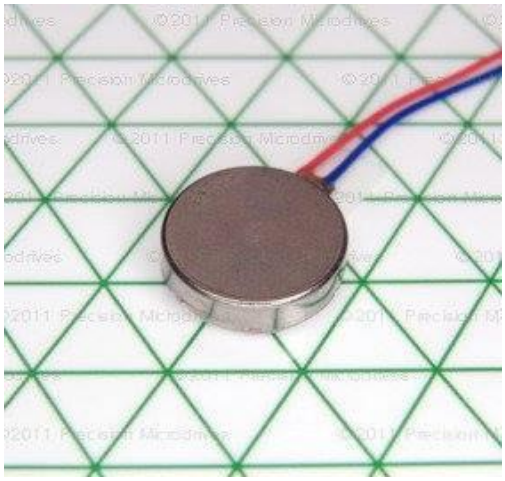

Figure 3 Simple DC Vibrator motor

C. Arduino Mega 2560

It is a simple open source platform with a microcontroller board and a software development environment for writing executable codes for the board.

3.3.1 Specification

- Microcontroller ATmega2560
- Operating Voltage = 5V
- Input Voltage = 7-12V
- Input Voltage (limits) = 6-20V
- Digital I/O Pins 54

D. Circuit

Our project basically works on three different blocks Arduino microcontroller, Ultrasonic sensor, vibration motors. All blocks in our project communicate with each other. Arduino microcontroller is the main block of our project. It receives the Ultrasonic signal from the ultrasonic sensor and rotates vibrating DC motor with speed according to the distance from object as it moves away or far from ultrasonic sensors continuously. It accomplishes the tasks of a good Haptic Vision System.

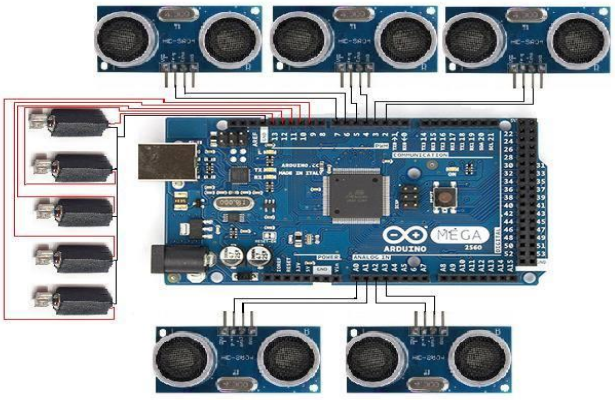

Figure 4 Schematic Diagram

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 5, Issue 5 , May 2018

Five sensors are placed on the helmet at different angles so it provides sufficient information form environment and a DC vibration motor is placed below each sensor. If any object comes in the range of any sensor, the relevant vibrator will vibrate with a speed according to the distance from object, if it comes nearer to sensor the vibration will increase and if it moves away from the sensor the vibration will decrease and when the object goes out of range the relevant vibrator will stop. The Range can vary from 0cm to 400cm. The helmet is shown in Figure 5.

Figure 5 Designed helmet

V.CONCLUSION AND FUTURE WORK

We concluded that our device is very capable to aid any blind person and its features make it very portable and user friendly. After wearing this helmet the user will be self-sufficient and wouldn't need any help. The blind person just needs to recharge the battery**.** The relevant motors vibrate as the sensor gets near to the obstacle and thus translates the information of distance and direction of the obstacle to the user. The intensity o of vibration is also regulated by the distance from the obstacle and increases as the obstacle approaches.

The following can be the modification for this device

- Rechargeable battery.
- Warning for battery states.
- Audio instruction.
- Can be wearable on the arm and knee.
- Use GSM or GIS for location of user.

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International Journal of Advanced Research in Science, Engineering and Technology

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