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Smart Navigation Shoes for Visually Impaired Persons using IoT

Priyanka Bharbade[1], Priyanka Jogi[2], Neeta Manakawad[3], Pankaj Dhakate[4]
[1,2,3]*Student, Department of E & TC Engg., G.H Raisoni College of Engineering and Management, Pune, India*
[4]*Professor, Department of E & TC Engg., G.H Raisoni College of Engineering and Management, Pune, India*

***Abstract*: A blind person walking in an unfamiliar environment faces many problems, this issue may be of identifying true obstacle or may be of identifying potholes, bumps in his way. A wearable system is designed to provide directional information to visually impaired people. It consists of a mobile phone and haptic shoes. To enable effective direction sensing, a few alternative configurations are proposed, whereby the position and strength of vibrations are modulated programmatically. Upon receiving the instructions, the shoes combine them with the user's walking status to produce unique vibration patterns. The system has great potential to provide smart and sensible navigation guidance to visually impaired people especially when integrated with visual processing units. The Smart Shoes along with the application on the Android system shall help the user in moving around independently.**

***Keywords*: navigation, on-shoe device, assistive technologies, Internet of Things.**

1. Introduction

According to W.H.O (World Health Organization), there are approximately 285 million people who are visually impaired out of which 39 million are blind and 246 million have low vision. About 90% of the world's visually. [1]. There is a constant need of an assistive device for them. There is a broad range of navigation system and ETA's are available for visually impaired individuals. White cane and Guide Dogs are the primary tools preferred by a visually impaired person. But they have some limitations, for example, Guide Dogs are not allowed in some places. White canes have a shorter range. They cannot detect obstacle above ground level such as tree branches or open window etc. Apart from that there are various ETA's (Electronic Travel Aid's) available in the market. But the problem with ETA's is that if it is effective then it is very costly and is not affordable by 90% of visually impaired individuals as they have low income. If it is affordable, then it is not effective.

The main paradigm that we focus on is to find the balance between the affordability and efficiency of the ETA's and thus providing assistance to more and more visually impaired individuals. The main concept simply focuses on the calculation of the distance of the obstacle from the user. A normal looking and usable pair of shoes are embedded with IR sensors and obstacle sensors interfaced with an Arduino Nano board, for real time obstacle detection.

The contributions of the paper are twofold. First, it proposes user can actively input his source to destination path to the Google Maps service within the application using speech.. Second, it presents empirical evidence of the effectiveness of vibration patterns for direction sensing based on well-structured usability testing. The system has great potentials to provide smart and sensible navigation guidance to visually impaired people.

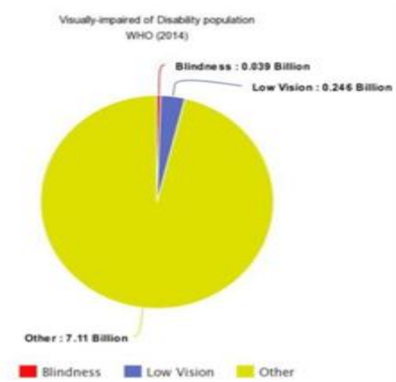

Fig. 1. Visually impaired of disability population

2. Objective

- This Project is useful in time when a blind person wants to reach a destination without any person help.
- It is possible to set a particular location with the help of voice.
- It detects the obstacle with the help of sensors.
- The blind person safely achieve the destination.
- It is possible to navigate a location through the voice as well as motors used.

3. Implementation

Smart navigational shoe is proposed by proposing novel technique based on IOT implementation. Electronic kit is fixed in shoe which can be used by visual impaired person. Hardware kit consists of one Arduino, Bluetooth connection, Ultrasonic sensor and one battery. Sensors will sense any obstacle detected while moving along path. It will be informed to users. An Android application is developed which is integrated with smart navigational shoes.

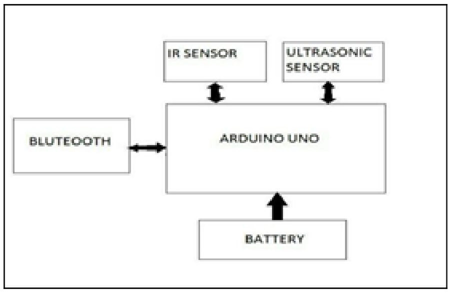

Fig. 2. Block diagram

A. Arduino

Arduino Uno is microcontroller board based on ATmega328. It has 14 digital input/output pins in that 6 can be used as PWM outputs, and 6 can be used as analog inputs.16MHZ ceramic resonator, a USB connection and power jack, and a reset button.


Fig. 3. Arduino ATMEGA328

B. Ultrasonic sensor

An Ultrasonic sensor HCSR04 is used to detect the obstacle and measure the distance between object and person. To send and receive the ultrasonic pulses it uses a transducer. It can measure a distance up to 400cm from 4 cm. pin number 2 and 3 of Arduino microcontroller are connected to echo and trigger. and another two terminals are connected to V_{cc} and ground.

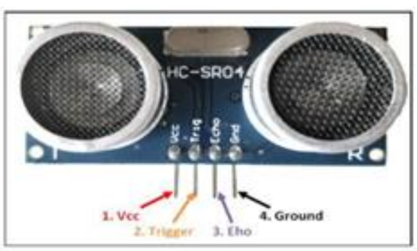

Fig. 4. Ultrasonic sensor

C. LCD display

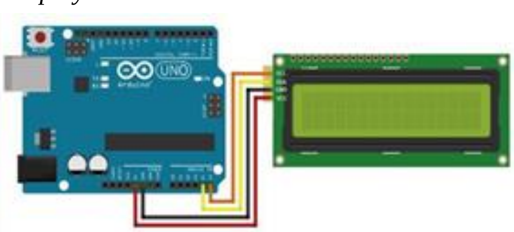
Fig. 5. LCD Display Using Arduino

LCD Display is a flat panel display. Display format of LCD is 16 character*2 Line. Input data 8-bit interface available. display font 5*8 dots. Single power supply is used that is 5v.and yellow backlight is used. Arduino microcontroller pin number 4,5,6,7,8, and 9 are connected to LCD Display.

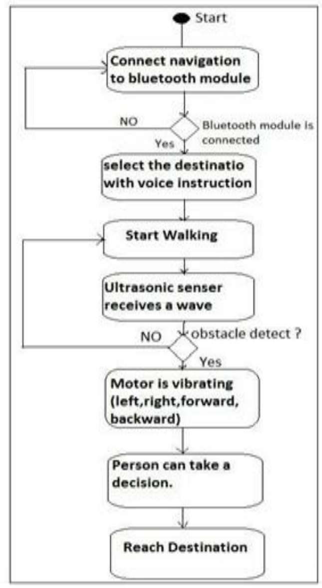

Fig. 6. Activity diagram of smart navigation shoe

4. Result

- When navigation give a command left than Bluetooth detect that command and result is:

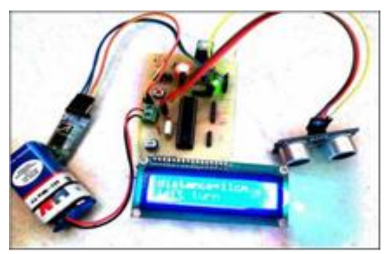
Fig. 7. Result of LEFT command

- When navigation give a command Right than Bluetooth detect that command and result is:

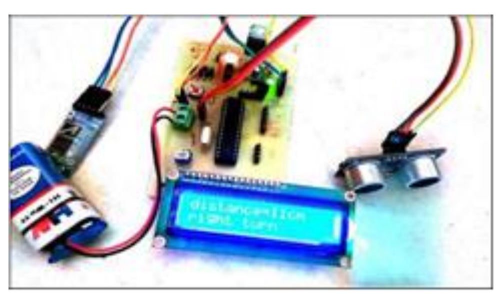
Fig. 8. Result of RIGHT command

- When navigation give a command go backward than Bluetooth detect that command and backward motor is vibrated.

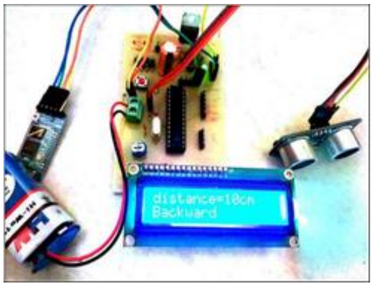

Fig. 9. Result of BACKWARD command

- When navigation give a command forward than Bluetooth module detect that command and forward motor is vibrated.

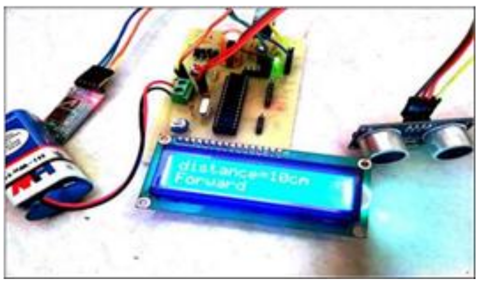

Fig. 10. Result of FORWARD command

- Bluetooth module detect the command of navigation at that time which command is detect that motor is vibrated.
- Left side vibrating motor is connected to pin no.11 of the mc IC.
- Right side vibrator is connected to pin no.10
- Forward side vibrator is connected to pin no.13
- And backward vibrator is connected to pinno.12

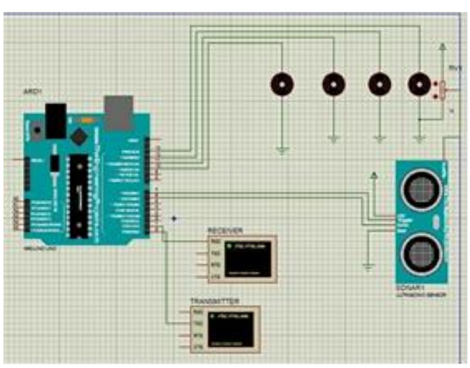
Fig. 11. Simulation

5. Conclusion

In order to make use of latest technology, we have proposed android of this proposed system is to provide navigation assistance for this visually impaired person. Sensors will detect obstacles and vibrators will vibrate according to direction. Our approach is to make easy application to visually impaired person to live independently.

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