Smart Wearable Belt for the Blind

Goopika D, Pooja jiresh, Sucheta G S, S P Bhanu prashanth, Beena Ullala Mata BN

Department of Medical electronics engineering, BMS College of engineering, Bangalore 19

Abstract— This project aims to administer a sensible design to create the simplified version of a smart wearable belt which can be utilized by blind people to assist in navigation. Wearable electronic equipment is intended therefore to create it compact and comfy. Embedded system layout is explored for this model. This could even be more developed using machine learning algorithms, to discover potholes and alternative irregularities on the road. Smart belts are being developed for the blind, to move without the assistanceof a cane.

Keywords—Ultrasonic sensor, Arduino, GPS module, Voice assistant.

INTRODUCTION

Blind people face many problems in their lifestyle due to their blindness, one of the main problems is to detect objectsor obstacles around them. They have been struggling to induce around independently in an unfamiliar environment. When they are walking they use blind stick or guide to assisttheir daily walking for detection of objects, but it might happen that the blind stick will hit some person when it's wagging so there's a need to develop a device which will detect obstacles automatically[1]. The aim of this project is to provide an integrated electronic travel aid for blind's mobility, with minimal cost, that covers the blind's requirements to do what it has to navigate, move and travel independently and safely. Based on International Standard Organization (ISO), the World Health Organization earlier in 2011 defines Assistive Technology as "any piece of equipment, product, or tool, whether it is acquired commercially, modified, or customized, that is used to increase, maintain, or improve the functional capabilities of people with disabilities"[2]. The introduced electronic travelaid is a smart integrated assistive belt consisting of three major parts: addressing the obstacles from different aspects ,voice assistant for guiding them and a GPS module for locating the person just in case of emergency.

OBJECTIVE

The objective of this project is to come up with a hassle-freesolution for the blind, in this case, a wearable device to assist them navigate and interact with society.

It provides the following:

1. assistance for Blind individuals in navigation by victimization ultrasonic device that detects the distance ofobstacles
2. Use of smart sensors and high end technology for creatingtheir life easier
3. Sharing the location of the visually impaired to their dearones, by victimizing GPS technology and connecting it withArduino. [3]

IMPLEMENTATION

The wearable belt was to be tested under a closed environment where the presence of sunlight is less, so the test was performed inside a room. The testing phase had several parts, the first one was testing for detecting an object and the second test was measuring distance between sensor and object/obstacle. To test the belt for obstacle detection, it has to succeed in the test conditions. The wearable was tested for its range by placing it 30cm away from the obstacle and the sensor detected the presence of the object/human/obstacle. Hence the first test was successful. The second test was checking the boundary conditions by placing the prototype at 5m and 10m away from the obstacle. It detected the presence of objects in both the ranges. The final test was to place the robot 20m away from the object, where detection is not possible and the prototype didn't detect it. Hence the phase of checking the range was successful. Second phase was to test the distance between objects and the prototype. The test for measuring the distance was successful up to a certain range.

A. The Arduino Uno R3 is a microcontroller board dependent on a removable, double inline-bundle ATmega328 AVR microcontroller. It has 20 computerized input/yield pins.[4] Programs can be stacked onto it from the simple-to-utilize Arduino PC program. The R3 is the third, and most recent, update of the Arduino Uno.

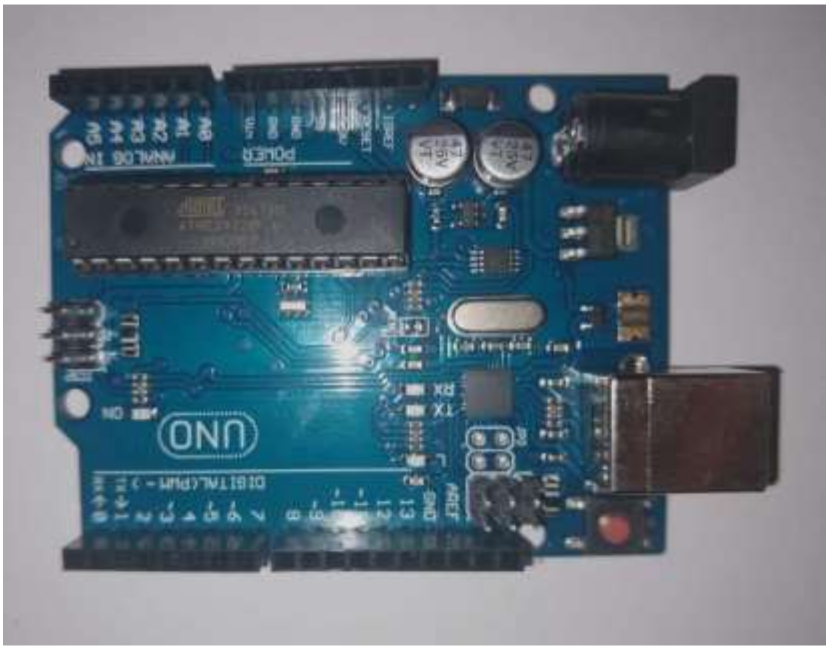

Fig 1. Arduino Uno microcontroller

B. Ultrasonic sensors - A ultrasonic sensor is an electronic gadget that actions the distance of an objective article by producing ultrasonic sound waves, and converts the reflected sound into an electrical signal.

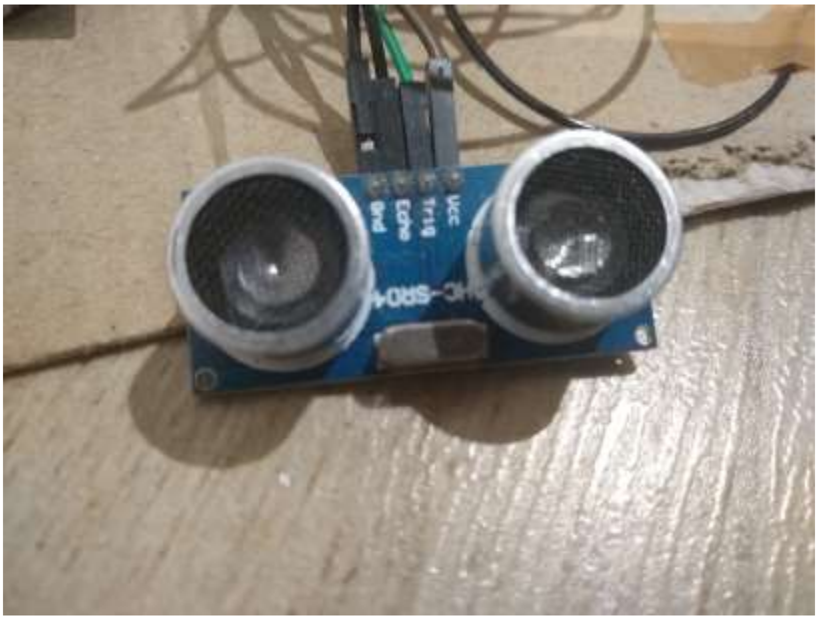

Fig 2. Ultrasonic sensor

C. Neo 6m GPS module - The NEO-6M GPS module is a well-performing total GPS beneficiary with an implicit 25 x 25 x 4mm earthenware radio wire, which gives a solid satellite pursuit ability. With the force and sign markers, you can screen the situation with the module. [6]

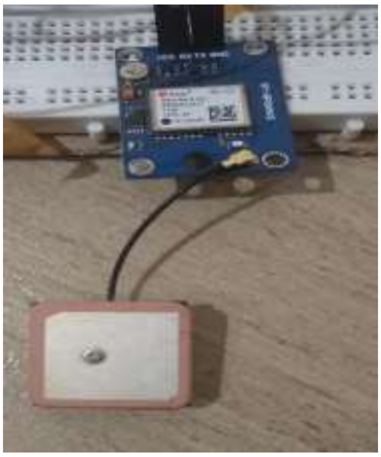

Fig 3. GPS module

D. Smart phone for the voice assistant application: Through the app, visually challenged people canget audio alerts about the distance of the obstacles.

Fig 4. Mobile phone

E. Battery: The circuit is given a 9V battery for powersupply.

Fig 5. Battery

F. Buzzer: It is a sounding piezoelectric gadget whichwill convert audio signals to sound signals.

Fig 6. Buzzer

II. SMART WEARABLE BELT MODULE

The Ultrasonic sensors are safely power-driven by Arduino 5V and GND pins and its data signal pin is monitored employing a digital input pin of Arduino. The entire circuit is powered by a 9V reversible battery pack for extended operation. Arduino are often power driven from its power connector safely up to 12V as a result of it's internal voltageregulator. [7]Arduino can also be powered directly from its

+5V power pin which suggests that it can also be power-driven by 4 AA rechargeable batteries providing4.8V.

Fig 7. Block diagram

A. *Work flow of the process*

- Initially, the Arduino board, the Bluetooth module and the GPS module are initialized.
- The Bluetooth module gets connected to the mobile phone which acts as the voice assistant.
- There is an initialization of the back and the frontultrasonic sensors.
- If there is an obstacle detected within 10 meters range, then the LED glows for the back sensor and the buzzer rings high for the front sensor andthis message is communicated via the mobile where the obstacle detection, the distance and the current location of the blind person is alerted.
- If there is no obstacle detected within 10 meters range, then the LED does not glow for the back sensor and the buzzer does not ring for the front sensor and this message is communicated via themobile where the obstacle detection, the distanceand the current location of the blind person is alerted.
- This entire process keeps running on the loop.

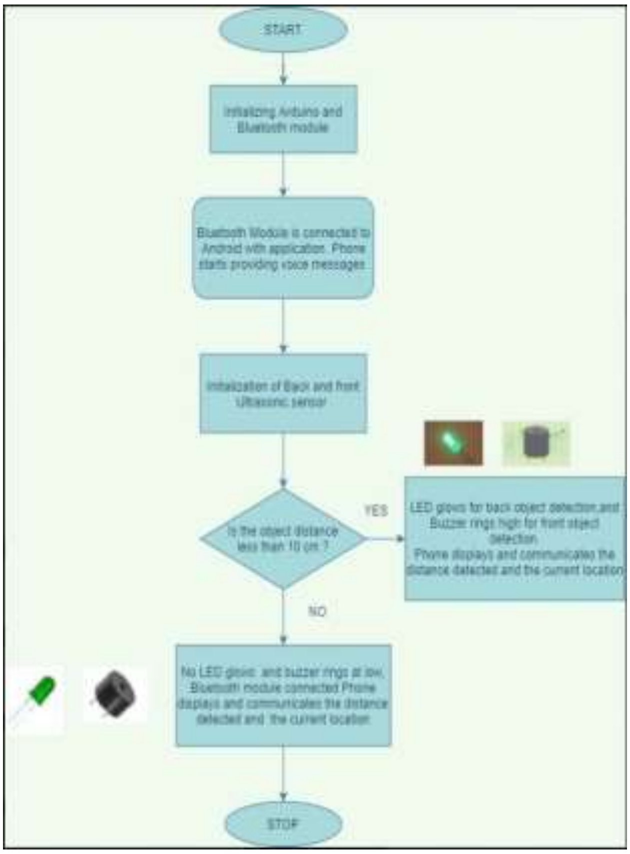

Fig 8. Flowchart of Smart wearable belt

1. *Algorithm for Arduino Uno R3*

Require

Inputs from ultrasonic sensor and Gps module

Ensure

Arduino and Bluetooth module connected to USB CableNotions

1. START

2. Trigpin = 5; Echopin = 4;buzzer= 10

3. Phone displaying "connected"

4. if (distance < 10)

5. LED=1

6. Buzzer=1

7. Phone audio alert "obstacle detected"

8. Phone audio alert "obstacle in x cm "

9. Phone "current location"

10. else

11. LED=0

12. Buzzer=0

13. Phone "current location"

B. ***END***

Working Model of Smart Wearable Belt

First , we started with circuit building. We designed using Arduino, Bluetooth module and ultrasonic sensors to detectthe obstacles in the front and the back of the person.

Next , we connected the GPS module to find out the currentlocation of the person.

Connections were created through the wires and the circuitboard.

And afterward we incorporated the Arduino IDE(IntegratedDevelopment Environment) programming to run the program.

Fig 9 shows the working model of the belt.

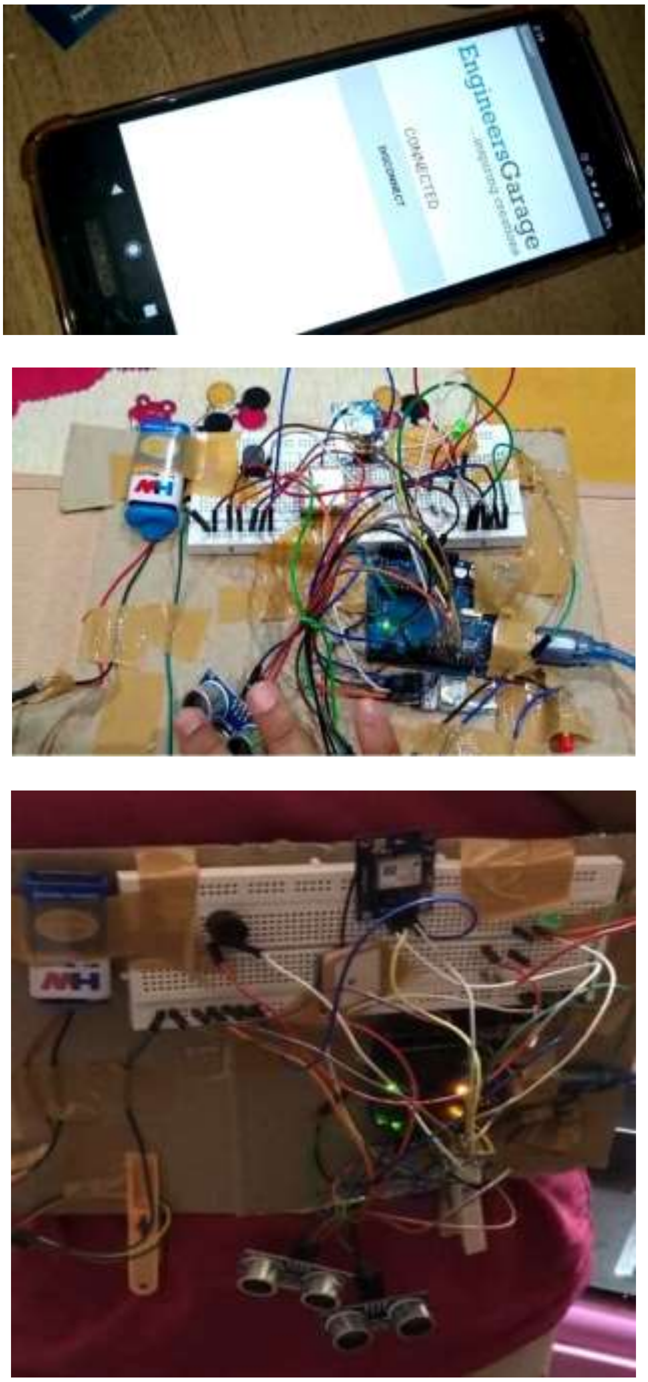

Fig 9. Working model of the belt

CONCLUSION

We have built a prototype of a wearable belt for helping thevisually impaired. We have several features like ultrasonic sensors, which detect range and a led and buzzer for notifying the distance between the obstacle and human . [8]As it is a wired prototype, it has its limitations. Features like Infrared camera, for locating the position of the obstacles can be added for a wireless prototype.

ADVANTAGES

Ultrasonic sensors work by causing an acoustic wave at a frequency higher than the vary of a human hearing ultrasonic sensors, like many others, use a single transducer to send a pulse and to receive the echo. It operates at 5V DC. The front and back sensors help in guiding the visually impaired both ways[9]. Ultrasonic sensor range is 10 meters. Analyzing the data the visually impaired can take necessary steps to navigate away from obstacles.

APPLICATIONS

A wearable smart belt is for the visually impaired to help them lead a cane-free life. Using this, they can walk confidently, by knowing what is around them through the smart technology. They are integrated with a live GPS location system, by which the coordinates can be sent to another mobile to track the blind people[10]. During an emergency situation, we will be able to find the location of the subject and can rescue them from any difficulties.

ACKNOWLEDGMENT

We would like to express our deep and sincere gratitude to our Professor and the person who guided us in this mini project, Dr.S.B. Bhanu Prashanth, Department of Medical Electronics Engineering, BMS College of Engineering, Bengaluru, for giving us the opportunity to do research and providing invaluable guidance throughout this research. His dynamism, vision, sincerity, and motivation have deeply inspired us. He has tutored us with the methodology to hold out the analysis and to present the research works as clearly as possible. It absolutely was a great privilege and honor to work and study below his guidance. We are very grateful forwhat he has offered us.

REFERENCES

[1] Guerrero, L.A.; Vasquez, F.; Ochoa, S.F. An indoor navigation system for the visually impaired. Sensors 2012, 12, (pp. 8236–8258)

[2] Hossain, E., Khan, R., Muhida, R. and Ali, A. (2011) ‘Analysis and implementation for a walking support system for visually impaired people’, International Journal of Intelligent Mechatronics and Robotics, Vol. 1, No. 3, pp.46–62

[3] Tang, J.; Jing, X.; He, D.; Liang, S. Blind-road location and recognition in natural scene. In Proceedings of the 2009 WRI World Congress on Computer Science and Information Engineering, Los Angeles, CA, USA, 31 March–2 April 2009(pp. 283–287)

[4] Shoval, S.; Ulrich, I.; Borenstein, J. Navbelt and the guide-cane obstacle-avoidance systems for the blind and visually impaired.IEEE Robot. Autom. Mag. 2003, 10(pp. 9–20)

[5] Ulrich, I. and Borenstein, J. (2001) ‘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

[6] Jothi, R.; Kayalvizhi, M.; Sagadevan, K. Smart walking stick for visually challenged people. Asian J. Appl. Sci. Technol. 2017, 1, 274–276.

[7] Sangami, A.; Kavithra, M.; Rubina, K.; Sivaprakasam, S. Obstacle detection and location finding for blind people. Int. J. Innov. Res. Comput. Commun. Eng. 2015, 3, 119–123.

[8] Kher Chaitrali, S.; Dabhade Yogita, A.; Kadam Snehal, K.; Dhamdhere Swati, D.; Deshpande Aarti, V. An intelligent walking stick for the blind. Int. J. Eng. Res. Gen. Sci. 2015, 3, 1057–1062.

[9] Nalavade, K.C.; Bharmal, F.; Deore, T.; Patil, A. Use of ultrasonic sensors, GPS and GSM technology to implement alert and tracking system for blind man. In Proceedings of the International Conference of Advance Research and Innovation (ICARI), New Delhi, India, 1 February 2014; pp. 272–274.

[10] Wawrzyniak, P.; Korbel, P. Wireless indoor positioning system for the visually impaired. In Proceedings of the Federated Conference on Computer Science and Information Systems (FedCSIS), Krakow, Poland, 8–11 September 2013; pp. 907–910.