iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH
IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 Issue: IV Month of publication: April 2023

DOI: https://doi.org/10.22214/ijraset.2023.50148

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue IV Apr 2023- Available at www.ijraset.com

Sensing the Environment with Sensors: A Smart Wearable Band for Obstacle Detection for the Visually Impaired

Mrudula M. Gudadhe[1], Vishal V. Panchbhai[2], Prajwal B. Patle[3], Dileep D. Kushwaha[4], Yogesh A. Rahangdale[5], Aachal S. Jenekar[6], Piyush V.Suryavanshi[7]
[1, 2, 3, 4, 5, 6, 7]*Department of Information Technology, Priyadarshini College of Engineering, Nagpur*

Abstract: Even after numerous remedies have been suggested, the issue of improving the mobility of individuals with visual impairments remains today. A clever wearable is described in this article.
A sonar is an ultrasonic instrument that can produce a band for the user to recognize obstacles. Wearable technology such as ultrasonic sensors and tactile input is used in smart bands to help blind or visually disabled individuals navigate their surroundings. Vibration and auditory signals or messages can be used to tell the user of their position, adjacent barriers, and other crucial information. This technology can significantly improve the freedom of visually impaired people who are blind or visually impaired, allowing them to move more boldly and easily through new situations.

I. INTRODUCTION

The human eye is a visual organ that allows individuals to conduct everyday activities and learn about their surroundings. The eyes acquire 80 percent of the information received by the human brain, making them by far the most important sensory cues. Blindness is a disease characterized by poor eye perception. There are approximately 285 million visually impaired individuals globally [1]. 246 million of them have poor eyesight, and 39 million are blind [1]. While ordinary people benefit from new technologies that make their lives simpler, visually impaired people still lack an appropriate method to sense and see the world.

However, because visually impaired people frequently journey to unfamiliar regions, it is essential to confirm information using tools regularly. Visually impaired individuals use their auditory abilities to identify and locate impediments [2]. Human echolocation is the capacity of humans to identify things by detecting the echo sound emitted by objects. However, if it is to be used with visually impaired individuals, they must be taught to identify echoes [3].

In the actual world, bats and dolphins sense objects using bio-sonar ping. If bats and dolphins use ultra-sonar to identify obstructions, devices such as ultrasonic monitors should be able to use the same technique to assist visually disabled people in traveling. This is the primary motivator for this study. This research looked at a prototype of a customized Smart wearable band for an obstruction recognition system for the visually disabled, which can be used to enhance their movement in daily life. This prototype makes use of radar. Echolocation or environmental perception. This gadget uses vibration and auditory signals or messages as tactile input to alert the user of obstacles in their line of sight. This wearable obstacle recognition system can be personalized using a mobile device based on the user's recommendations and requirements. This article examined or surveyed the relevant work in contemporary obstacle recognition methods for the visually impaired in Section II. Section III discusses the design of a customized smart wearable band for an obstacle recognition system, and Section IV discusses the execution or components of this system. Sections V and VI show the benefits, Experiments, and findings of this research. Part VII concludes this work. Section VIII represents future work, Section IX represents acknowledgment, and Section X ends the document with sources.

II. RELATED WORK / LITERATURE SURVEY

A study of the literature on smart wearable bands for the blind found that these devices are designed to assist people with visual problems manage their environments by providing auditory and tactile input. Sensors such as ultrasonic, infrared, and stereo cameras are commonly used to detect obstructions and collect data about the surroundings. Some devices also have GPS features for exterior navigation. According to research, these gadgets can improve the mobility and freedom of visually impaired individuals. However, there are some disadvantages, such as expensive costs, bad accuracy and durability, and issues with data security and privacy.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue IV Apr 2023- Available at www.ijraset.com

III. DESIGN (WORKFLOW)

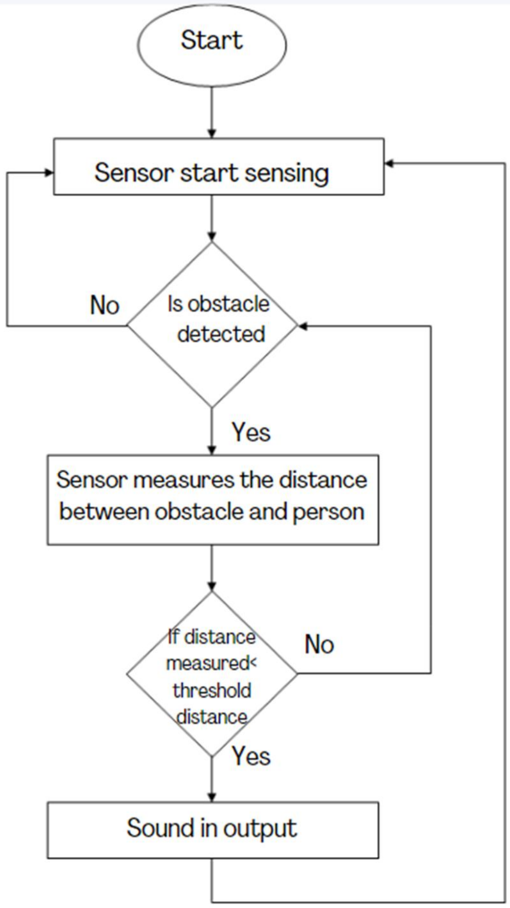

Fig 1.Flowchart

The device automates the completion of different chores. Above is a comprehensive flowchart of the device's operation. When the electricity to the device is switched on. The sensor starts detecting obstacles in front of the blind. After identifying the obstacle, it measures the distance between it and the individual. If the distance is less than the expected distance, it instantly reacts to the user with a sound message. If the distance is greater than the threshold number, the process is repeated.

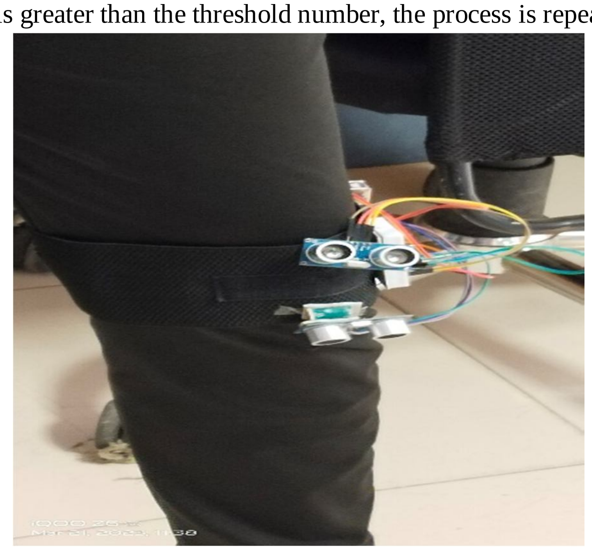

Fig 2. Integrated Model

IV. SYSTEM’S SUB – COMPONENTS

This device includes the following components:

A. Arduino UNO

The Arduino UNO is an electrical device that can be programmed. This microcontroller device can recognize and operate real-world objects. To accomplish the job, three components are required: inputs, sensors, and a switch. These are connected to the processor and provide data.

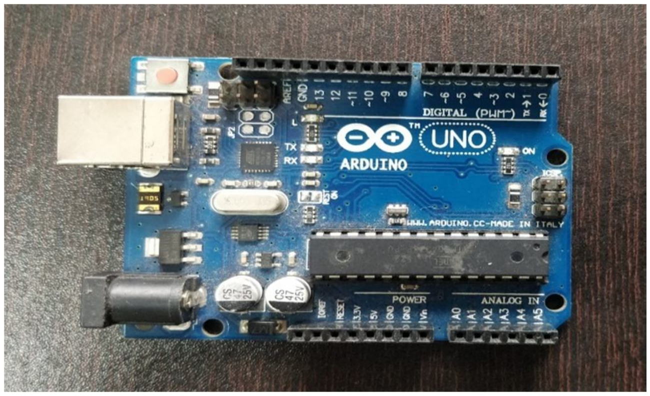

Fig 3. Arduino UNO

B. Ultrasonic Sensor

Like bats, the ultrasonic sensor employs sound to calculate the distance between two items. It offers superior non-contact range sensing with high precision and consistency. It consists of a sender and receiver instrument that uses ultrasonic waves. The ultrasonic devices are wired with four connections, as shown in the diagram below: +5V, Trigger, Echo, and GND.

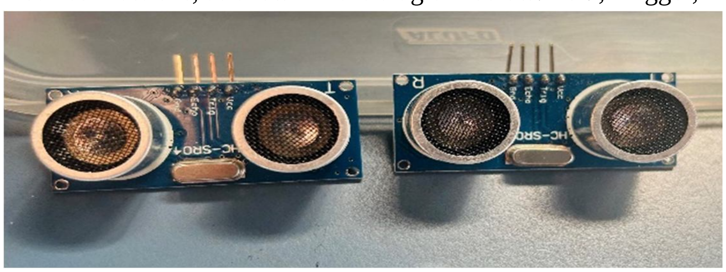

Fig 4. Ultrasonic Sensor

C. Breadboard

A breadboard, also known as a prototyping board, is a reused device that enables the connection and disconnection of electrical components. It is a popular tool among electronics hobbyists and pros for rapidly building and testing circuits without the use of solder. Breadboards are usually made of plastic board with a pattern of rows and columns of holes. Metal strips join the holes, allowing components to be attached in a variety of combinations. To make it simpler to follow a circuit layout, the top of the board is typically designated with numbered rows and columns.

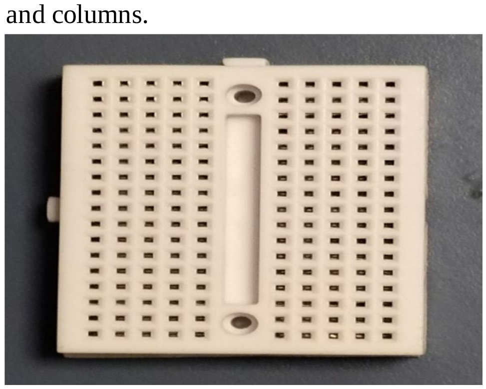

Fig 5. Breadboard

D. Jumping Wire

A jumping wire is a method used in electronics to briefly link two locations on a circuit board with a wire to circumvent a defective or damaged component in a circuit. This method is typically used when a circuit board has a fractured trace or a damaged component and replacing the defective part is not possible or realistic. A jumper cable can be used to circumvent the defective component and reestablish circuit performance in such situations. Jumping wire necessitates some electrical skill and knowledge, as it entails finding the proper points to join and ensuring that the wire is securely attached without causing any harm to the circuit board or other components.

Fig 6 Jumping Wire

E. Buzzer

When an electrical current is passed through a buzzer, it creates a constant or intermittent sound. It's prevalent in warning systems, doorbells, timers, and other uses that require an auditory indication or notification. Buzzer circuits usually include a power supply, a control device, and a transducer, which transforms electrical energy into sound waves. To create sound, the transducer is usually a piezoelectric element or an electromagnetic coil and diaphragm that moves at a specific frequency.

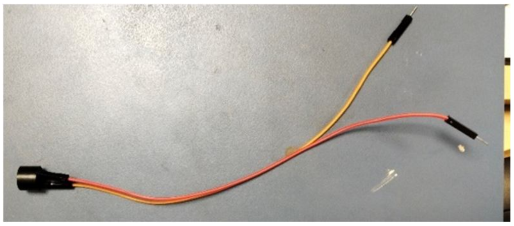

Fig 7 Buzzer

V. BENEFITS

By sensing and displaying obstacles within a specified range, this Smart Wearable Band for Obstacle Detection gadget can enhance the safety and convenience of blind people. This wearable bracelet is inexpensive when compared to other gadgets on the market. This instrument is lighter and simpler to carry than the bias requested, such as the west band. Because of the lightweight materials used in its creation, the gadget is more portable for stoners. This device's instruments are considerably less costly than those used in conventional systems. The gadget transmits the idea via sound. In a busy or noisy setting, it is difficult to detect the sound over other continuing noises.

VI. TESTING RESULTS

Sr.no	Surface	Actual Distance	Calculated Distance by sonar
1.	Plain surface (Front sonar)	195cm 250cm	193cm 250cm
2.	Rough surface (front sonar)	130cm 98cm	129cm 97cm
3.	Slant surface (front & angled sonar)	126cm 55cm	126cm 56cm
4.	Stairs (front & angled sonar)	64cm 58cm (1 step) 79cm 70cm (2 steps)	62cm 56cm 75cm 70cm

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue IV Apr 2023- Available at www.ijraset.com

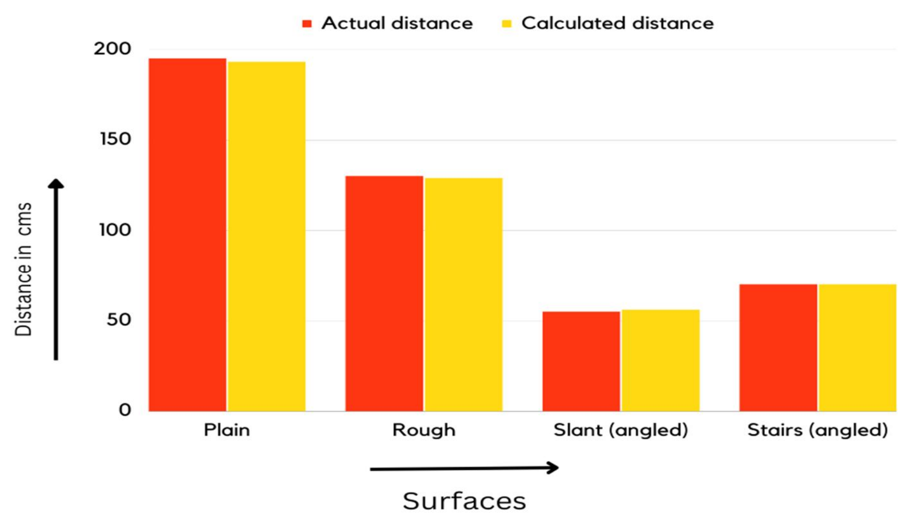

Fig. Analysis of Actual vs Calculated Distance

Accuracy = 98%

VII. CONCLUSION

Lastly, smart bands have proven to be a useful aid for physically impaired people. They increase independence and safety by giving real-time feedback on various parts of their surroundings. By employing sophisticated technology such as haptic input, speech aids, and GPS monitoring, smart bands can provide a variety of advantages that significantly enhance the quality of life for visually disabled people. Smart bands will become even more sophisticated and available to a wider variety of individuals with different degrees of visual impairment as technology improves. Overall, the development of smart bands for visually impaired individuals represents a major advance in the continuing endeavor to develop more inclusive and accessible technologies.

VIII. FUTURE WORK

Detecting and alerting visually impaired people to obstacles: The smart band can be made to detect and notify visually impaired people of obstacles in their route. This can be achieved by embedding sensors in the band that identify close objects and transmit a warning indication to the wearer. A smart band could be developed to measure the health of a physically disabled individual. Monitoring their pulse rate, blood pressure, and other vital indicators and alerting them if any data are abnormal is one example. GPS monitoring: To help visually impaired individuals in navigating their environments, a smart band with GPS tracking features can be created. The wearer can receive turn-by-turn directions from the band, receive notifications when they reach their destination, and even use the band to locate misplaced goods. Social networking: A smart band could be developed to connect neighboring physically disabled people. As a result, they will be able to establish a supportive community and share guidance and information.

IX. ACKNOWLEDGMENT

The authors would like to convey their gratitude to everyone who assisted with this study project. We would like to thank our coworkers and partners for their substantial efforts and help throughout this project. We would also like to acknowledge M.M. Gudadhe and V.V. Panchabhai of Priyadarshini College for their help. Finally, we'd like to thank our families and loved ones for their tolerance and support throughout this research.

REFERENCES

[1] K P Venkat Vivek1, J Vandana2, K Sripooja3, Abhishek Choubey4 1, 2, 3 Student, 4Professor, Department of Electronics & Communications Engineering Sreenidhi Institute of Science & Technology. A Smart Wearable Guiding Device for The Visually Impaired People(2022).
[2] Marion Hersh Biomedical Engineering, University of Glasgow, Glasgow G12 8QQ, Scotland, UK; marion.hersh@glasgow.ac.uk. Wearable Travel Aids for Blind and Partially Sighted People: A Review with a Focus on Design Issues. (2022).

[3] Adegboro, S. and 2Faniran, T. S. Department of Computer Science, Lead City University, Ibadan, Oyo State, Nigeria. Development of Smart Intelligent Walking Aid 3rd Eye for the Blind Using Ultrasonic Sensor(2022).

[4] USMAN MASUD 1,2, TAREQ SAEED3, HUNIDA M. MALAIKAH4, FEZAN UL ISLAM1, AND GHULAM ABBAS1 1Department of Electrical Communication Engineering, University of Engineering and Technology, Smart Assistive System for Visually Impaired People Obstruction Avoidance Through Object Detection and classification(2021).

[5] Ishwarya Sivakumar 1 · Nishaali Meenakshisundaram 1 · Ishwarya Ramesh 1 · Shiloah Elizabeth D 1 · Sunil Retmin Raj C 2. VisBuddy - A Smart Wearable Assistant for the Visually Challenged. (2021).

[6] Yokesh Babu Sundaresan, Kumaresan P., Saurabh Gupta, and Waseem Ali Sabeel. SMART WEARABLE PROTOTYPE FOR THE VISUALLY IMPAIRED (2020).

[7] F. Barontini, M G. Catalano, L. Pallotinno, B.Leporini, M. Binachi, Integrating Wearable Haptics and Obstacle Avoidance for the Visually Impaired in Indoor Navigation A user-centered approach, IEEE Trans. Haptic(2020).

[8] J. Bai, Z. Liu, Y. Lin, Y. Li, S. Lian, D. Liu, Wearable travel aid for environment perception and navigation of visually impaired people, Electronics (2019).

[9] Ali Jasim Ramadhan ID Department of Computer Techniques Engineering, Al-Kafeel University College, Kufa 31003, Province of Najaf, Republic of Iraq; ali.j.r@ieee.org or ali.j.r@alkafeeluc.edu.iq. Wearable Smart System for Visually Impaired People(2018).

[10] Bourne, R.R.A.; Flaxman, S.R.; Braithwaite, T.; Cicinelli, M. V.; Das, A.; Jonas, J.B.; Kee_e, J.; Kempen, J.; Leasher, J.; Limburg, H.; et al. Magnitude, temporal trends, and projections of the global prevalence of blindness and distance and near vision impairment: A systematic review and meta-analysis. Lancet Glob. Health (2017).

[11] Juliana Shetara1, Sharmin Mazumder2, Shatabdi Acharjee3, Sharith Dhar4 Dept. of Electrical and Electronic Engineering Premier University, Chittagong, Bangladesh. Smart Wrist Band for Obstacle Detection(2015).

[12] Y.M.K Priyadarshana, G.D.S.P Wimalaratne.Sensing Environment through Mobile: A Personalized Wearable Obstacle Detection System for Visually Impaired People (2014).