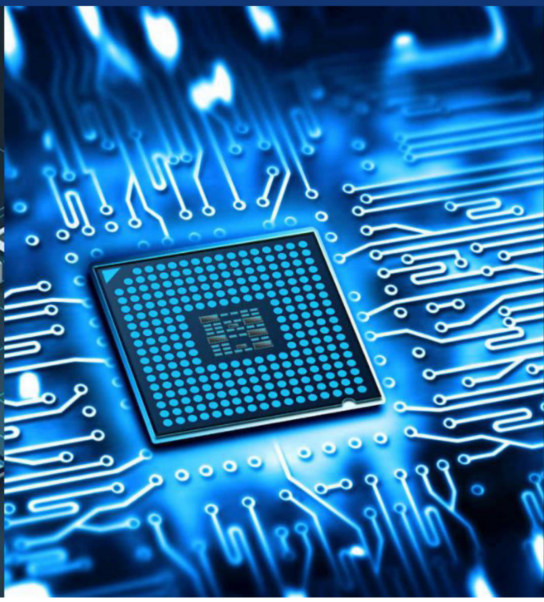
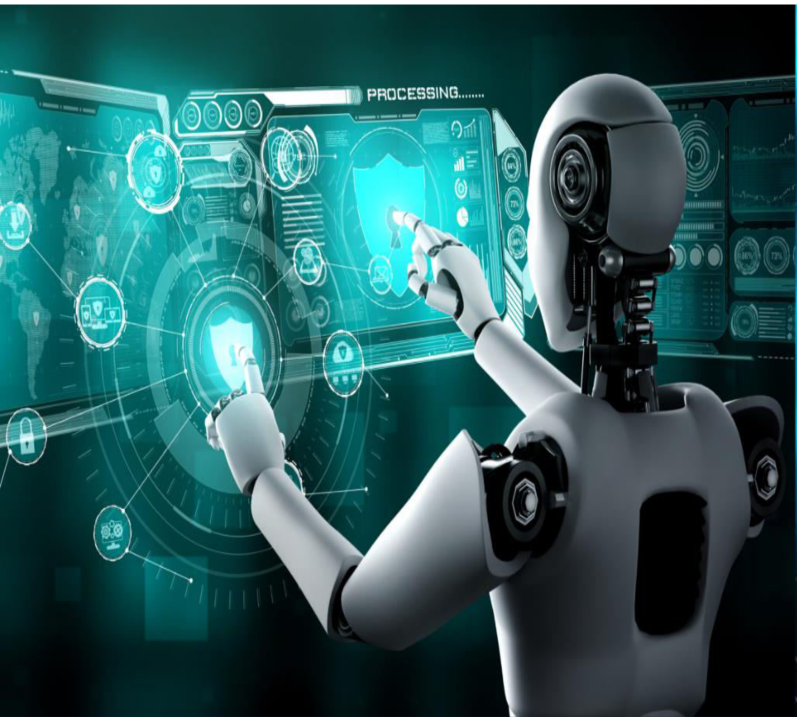
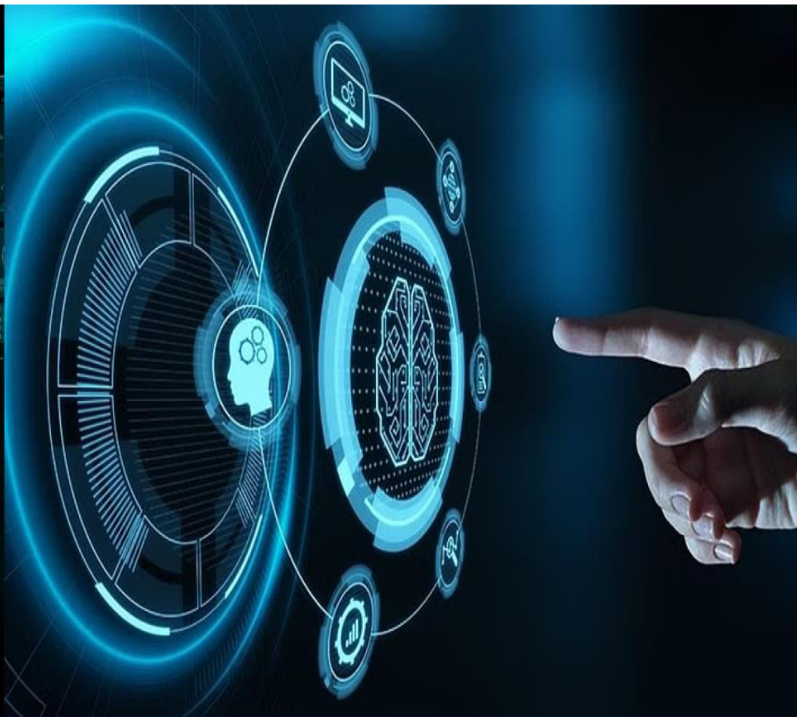
ISSN(O): 2320-9801
ISSN(P): 2320-9798


International Journal of Innovative Research in Computer and Communication Engineering

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)





Impact Factor: 8.771

Volume 13, Issue 4, April 2025

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.771| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

Smart Headset for Blind People

Amrita Bera[1], Snehal Borse[2], Yash Kadu[3], Yashas Awachar[4], Prof. Sonali Nayan[5]

Dept. of Computer Engineering, Terna Engineering College, Navi Mumbai, India[1-5]

ABSTRACT: The Smart Headset for the Visually Impaired is an Arduino Mega-based assistive device designed to improve spatial awareness and user safety. It features ultrasonic sensors for real-time obstacle detection with multi-directional buzzers that vary their beep interval based on distance. A touch sensor allows toggling obstacle detection and, when hold for five seconds, triggers an SOS mode that sends the user's live GPS location via mobile network to a predefined emergency contact. Bluetooth App control enables switching between indoor and outdoor modes by adjusting detection sensitivity and offers three volume levels for buzzers. The system also supports SMS-based location sharing; when any specified secret keyword is sent via SMS, the device replies with a Google Maps link showing the user's position. This compact system provides reliable navigation and emergency support for visually impaired individuals.

KEYWORDS: Assistive Technology, Ultrasonic Sensors, Obstacle Detection, SOS Alert, Smart Wearable.

I. INTRODUCTION

According to the World Health Organization (WHO), millions of individuals worldwide live with visual impairments, and this number is expected to grow significantly in the coming years. Navigating crowded streets, avoiding moving vehicles, and identifying unexpected obstacles can pose major challenges for the visually impaired, often making them reliant on others for mobility. Traditional aids like white canes or guide dogs provide only basic support and lack real-time environmental feedback, leaving users vulnerable in dynamic or unfamiliar environments.

To overcome these limitations, we present the Smart Headset for the Visually Impaired, an advanced Arduino Mega-based wearable assistive device that enhances spatial awareness, user safety, and independence. The system features ultrasonic sensors for real-time obstacle detection, offering directional feedback through dual buzzers with adjustable volume and varying beep rates according to obstacle proximity. A touch sensor enables users to toggle obstacle detection and, when pressed for five seconds, activates an SOS mode that transmits live GPS location via GSM to a predefined emergency contact. Bluetooth integration enables remote control for switching between indoor and outdoor modes, adjusting sensitivity, and selecting among three volume levels. Furthermore, the system can respond to SMS location requests using the secret keyword like "LOCATION", now the headset replies with a Google Maps link to the user's current position without triggering SOS mode whenever it receives the secret keyword.

This project aims to provide a compact, reliable, and intuitive solution to support the daily navigation and safety needs of visually impaired individuals. The rest of this paper is structured as follows: Section II covers related work; Section III explains the system design and components; Section IV discusses experimental results; and Section V concludes with findings and future directions.

II. RELATED WORKS

A significant number of works have been conducted to assist visually impaired individuals in navigating independently. However, most existing solutions focus on specific aspects, such as GPS navigation or obstacle detection, rather than providing an integrated system.

In reference [1], a system was proposed for obstacle detection using ultrasonic sensors. While it effectively detects obstacles, it lacks GPS navigation, making it difficult for blind users to find their desired destinations. Similarly, reference [2] introduced an algorithm to determine the shortest path using a GPS navigation system. However, it did

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.771| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

not include an obstacle detection mechanism, limiting its practicality for visually impaired users who require real-time environmental awareness.

In reference [3], an audio-based guidance system was developed to assist blind users by providing voice output navigation. Despite its usefulness, the system does not incorporate real-time obstacle detection, which is crucial for independent movement. On the other hand, reference [4] presented a camera-based vision system for object identification. However, the high processing power requirement and poor performance in low-light conditions restrict its effectiveness for blind users.

References [5,6] explored the use of Bluetooth and GSM modules for proximity sensing and emergency alerts, respectively. While these technologies contribute to user safety, they do not provide a complete navigation solution. Reference [7] focused on an audio navigation system that guides users along predefined routes, but its lack of adaptability to dynamic environments and real-time obstacle avoidance remains a major limitation.

Existing research highlights the need for an integrated system that combines obstacle detection, GPS navigation, Bluetooth connectivity, and emergency alerts. Our proposed system aims to bridge this gap by providing a wearable device that ensures seamless navigation for visually impaired individuals while addressing the shortcomings of previous studies.

III. METHODOLOGY

The Smart Headset for Blind People is designed to assist visually impaired individuals by providing obstacle detection, real-time feedback, and emergency communication features. The methodology is divided into two key parts: Design and Implementation.

DESIGN

The proposed system utilizes ultrasonic sensors to detect objects in the environment and provides feedback through auditory alerts.

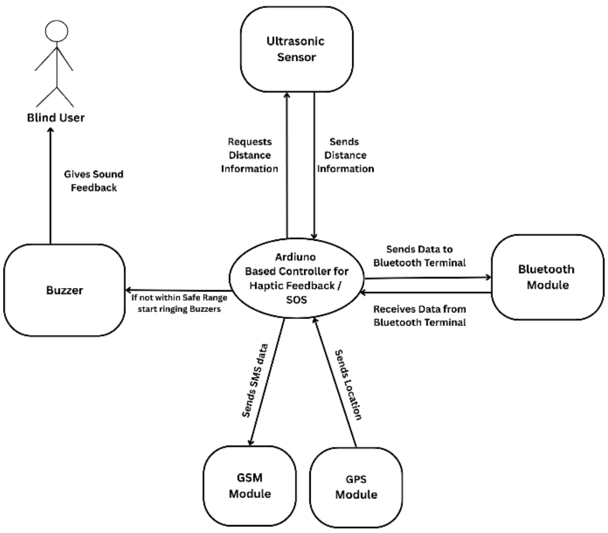


Figure 1: System Architecture of Smart Headset for Visually Impaired

© 2025 IJIRCCE | Volume 13, Issue 4, April 2025| DOI:10.15680/IJIRCCE.2025.1304226

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.771| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

The system, shown in Figure. 1, is a smart headset designed to assist visually impaired users with navigation and emergency alerts. It integrates ultrasonic sensors, a touch sensor, Bluetooth, GSM, and GPS modules—coordinated through an Arduino-based controller.

Three ultrasonic sensors measure distances in the left, center, and right directions. Based on obstacle proximity, buzzers provide directional auditory feedback. If the detected distance is below a safe range, the controller activates the corresponding buzzer(s). A Bluetooth module allows users or caregivers to send commands to the system—such as switching between indoor/outdoor modes, adjusting buzzer volume, or activating "Find My Device," which makes the buzzers ring continuously. The touch sensor offers two functions: a short press toggles obstacle detection, while a long press which is 5 seconds triggers SOS mode. In SOS mode, the GPS module fetches the user's location, and the GSM module sends an alert with a Google Maps link to a predefined emergency contact.

IV. IMPLEMENTATION

The proposed system is implemented in multiple phases, beginning with sensor integration and extending to feedback mechanisms and emergency communication.
Components Used:

1. Arduino:

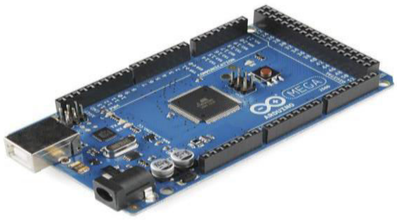


Figure 2: Arduino Mega

The Arduino ATmega2560, shown in Figure 2, acts as the system's central controller. It processes input from ultrasonic sensors, controls the buzzers, and manages communication with the Bluetooth and GSM modules for obstacle detection and emergency alerts.

2. Ultrasonic Sensor:

Figure 3: Ultrasonic Senor

The Ultrasonic Sensor, as shown in Figure 3, detects obstacles around the user by emitting sound waves and measuring the time taken for them to bounce back from nearby objects. Based on the measured distance, the system identifies the obstacle's direction and activates the corresponding buzzer with appropriate frequency.

© 2025 IJIRCCE | Volume 13, Issue 4, April 2025| DOI:10.15680/IJIRCCE.2025.1304226
www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.771| ESTD Year: 2013|
International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)
(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

3. Buzzers:

Figure 4: Buzzer

Buzzers, shown in Figure 4, provide real-time sound feedback based on obstacle position. The left or right buzzer activates when an obstacle is detected on the respective side, while both buzzers emit rapid beeps for obstacles ahead—helping the user respond promptly.

4. Bluetooth Module :

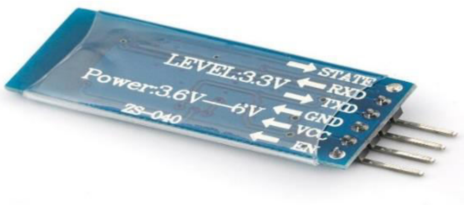


Figure 5: HC-05 Bluetooth Module

The HC-05 Bluetooth Module, shown in Figure 5, enables wireless communication with a smartphone. It allows remote control of headset features like mode switching, volume, and 'Find My Device' enhancing accessibility and user convenience.

5. GSM Module :

Figure 6: SIM800L GSM Module

The SIM800L GSM module, shown in Figure 6, handles emergency communication. Upon SOS activation, it sends an SMS with the user's GPS location to a predefined contact, ensuring quick assistance during emergencies.

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.771| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

6. Touch Sensor:

Figure 7: Touch Sensor

The touch sensor, shown in Figure 7, acts as a primary control input. A short press toggles obstacle detection, while a long press (5 seconds) activates SOS mode, sending the user's location via SMS. This simplifies system control and enhances usability.

V. RESULTS AND DISCUSSIONS

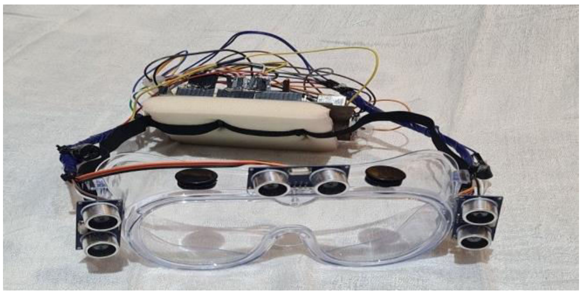


Figure 8: Prototype of the Smart Headset

Shown in Figure 8, illustrates the final working prototype of the smart headset developed for visually impaired users. It integrates three ultrasonic sensors on the front for obstacle detection in left, center, and right directions. The Arduino Mega 2560 is mounted at the top with all connections, supported by a foam pad for comfort. Buzzers are placed near the ears to deliver directional alerts. A touch sensor, integrated on the left side of the headset for toggling obstacle detection and triggering SOS mode. The system also includes Bluetooth and GSM modules for wireless control and emergency communication, making it a compact and functional assistive device.

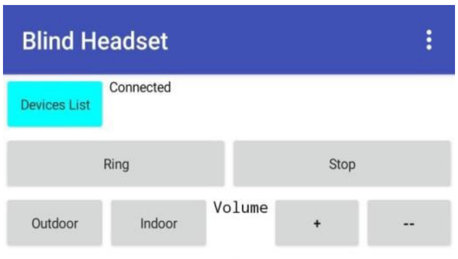


Figure 9: Bluetooth-based Android Application Interface

© 2025 IJIRCCE | Volume 13, Issue 4, April 2025| DOI:10.15680/IJIRCCE.2025.1304226
www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.771| ESTD Year: 2013|
International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)
(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

As shown in Figure 9, the mobile application provides a user-friendly Bluetooth interface to interact with the smart headset. It features buttons such as "Connect to Device", "Ring", and "Stop Ringing" to help locate the headset easily. The "Outdoor Mode" and "Indoor Mode" buttons allow users to adjust obstacle detection sensitivity based on their environment, while "Volume +" and "Volume -" control the buzzer's loudness across three defined levels. This interface ensures convenient remote access to key functions, enhancing overall usability and support for visually impaired users.

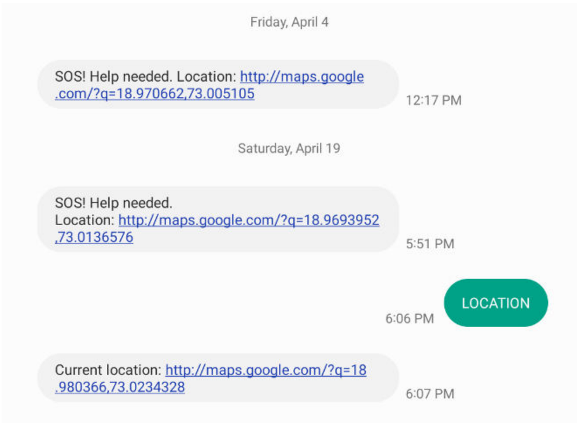


Figure 10: Emergency SOS and Location Response via SMS

As shown in Figure 10, illustrates the SMS communication received during an emergency or on-demand location request. When the touch sensor on the headset is pressed and hold for 5 seconds, the system sends an SOS alert via the GSM module to a predefined contact. The message includes “SOS! Help needed.” followed by a clickable Google Maps link showing the user’s live GPS location. Additionally, when a caregiver sends an SMS with the secret keyword for example “LOCATION” as shown in Figure 10, and the system responds with the current coordinates in a similar Google Maps format. This ensures timely location tracking in both emergency and normal scenarios.

VI. CONCLUSION

The Third Eye which is The Smart Headset for the Visually Impaired – is a wearable assistive system designed to enhance user independence and safety. It detects obstacles using three ultrasonic sensors and alerts the user via directional buzzers. The system integrates a touch sensor, Bluetooth module, GSM module, and GPS, providing real-time feedback and emergency communication. A short press on the touch sensor toggles obstacle detection, while a long press (5 seconds) activates SOS mode, sending the user’s GPS location to a predefined emergency contact. Bluetooth commands allow mode switching (indoor/outdoor), volume control, and a “Find My Device” feature. Additionally, SMS-based keyword detection (e.g., “LOCATION”) allows for discreet and efficient tracking without activating the SOS mode. With wireless connectivity and intuitive controls, this cost-effective solution offers improved mobility, accessibility, and peace of mind for visually impaired users.

REFERENCES

[1] Patole, S., Bhole, S., Patil, P., & Sahu, V. (2020). "Rainfall Prediction Using Machine Learning." International Journal of Recent Technology and Engineering (IJRTE), 9(3), 582–586.
[2] Mote, V., Kale, S., & Joshi, S. (2021). "Ensemble Methods for Rainfall Prediction: A Comparative Study." International Journal of Advanced Computer Science and Applications (IJACSA), 12(4), 105–110.
[3] Sharma, N., Singh, M., & Rana, R. (2019). "Comparative Analysis of Machine Learning Algorithms for Rainfall Prediction." International Journal of Computer Applications, 182(45), 28–34.

© 2025 IJIRCCE | Volume 13, Issue 4, April 2025| DOI:10.15680/IJIRCCE.2025.1304226

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.771| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

[4] Jadhav, R., Deshmukh, R., & Pande, A. (2021). "Feature Extraction and Machine Learning Models for Rainfall Forecasting." Journal of Computational and Theoretical Nanoscience, 18(3), 1169–1175.
[5] Khoenkaw, P., & Pramokchon, P. (2017). "A Software-Based Method for Improving Accuracy of Ultrasonic Range Finder Module." Journal of Digital Arts, Media and Technology, 17(1), 10–13.
[6] Xu, L., & Ding, F. (2017). "The Parameter Identification Method for the Over-Damping System Based on the Newton Iteration." Proceedings of the 29th Chinese Control and Decision Conference (CCDC), 29(1), 28–30.
[7] Radhika, R., Pai, P. G., Rakshitha, S., & Srinath, R. (2016). "Implementation of Smart Stick for Obstacle Detection and Navigation." International Journal of Latest Research in Engineering and Technology, 2(5), 45–50.
[8] Khoury, R., & Harder, D. W. (2016). Numerical Methods and Modelling for Engineering. Springer, Berlin/Heidelberg, Germany.Rice J.(2006).Mathematical Statistics and Data Analysis. Nelson Education, Scarborough, ON, Canada.
[9] Angrisani, L., Baccigalupi, A., & Moriello, R. S. L. (2009). "Ultrasonic-Based Distance Measurement Through Discrete Extended Kalman Filter." Kalman Filter: Recent Advances and Applications, IntechOpen, London, UK.
[10] Mudunuri, L. N. R., Hullurappa, M., Vemula, V. R., & Selvakumar, P. (2025). AI-powered leadership: Shaping the future of management. In Navigating Organizational Behavior in the Digital Age With AI (pp. 127-152). IGI Global Scientific Publishing.
[11] Wahab, M. H. A., Talib, A. A., & Kadir, H. A. (2011). "Smart Cane: Assistive Cane for Visually Impaired People." IJCSI International Journal of Computer Science Issues, 8(4-2), 1–5.
[12] Jose, A., George, G., Nair, M. R., Shilpa, M. J., & Mathai, M. B. (2012). "Voice-Enabled Smart Walking Stick for Visually Impaired." International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, 5, 80–85.
[13] Shen, J., & Wu, Y. (2018). An intelligent wearable device for visually impaired people in outdoor mobility. International Journal of Computational Vision and Robotics, 8(2), 136-151.