



Research Paper

Third Eye Smart Vision: A Support System for Disabled People

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Abstract: People who are blind or have low vision have a lot of trouble getting around on their own and finding their way around on public transportation. This project introduces a Third Eye- Smart Vision-Based Support System for Individuals with Disabilities, aimed at aiding blind individuals through real-time detection of obstacles and public bus recognition. The system uses an Arduino microcontroller and an ultrasonic sensor to find things in the user's way. It then uses a vibration motor to let the user know right away, without relying on sound. An EM18 an RFID tag is also used to find buses that have RFID tags, which makes it possible to accurately read bus numbers. Once the system correctly identifies the user, it activates a DF (standard) Mini Player component that uses a speaker to make voice announcements about a bus details. This mix of touch and sound feedback makes users safer, more confident, and more independent. The suggested system is affordable, portable, and easy to use, so it can be used in the real world to make things easier for people who are blind or have low vision.

I. INTRODUCTION

Visually impaired individuals face significant challenges in navigating their surroundings safely and independently. Everyday tasks such as walking in crowded areas, avoiding obstacles, and using public transportation become difficult without adequate support. Traditional mobility aids, such as canes or guide dogs, offer some assistance, but they have limitations in detecting obstacles at a distance or identifying specific objects like buses, signs, or

routes. As a result, visually impaired individuals often depend on external assistance, limiting their independence and mobility.

Advancements in technology, particularly in microcontrollers, sensors, and embedded systems, have enabled the development of assistive devices that provide real-time environmental feedback. Vision-based and sensor-based systems can detect obstacles, recognize objects, and deliver information to users through tactile or audio outputs. These solutions aim to enhance safety, increase confidence, and promote independent living for people with disabilities.

The Third Eye Smart Vision Based Support System for People with Disability is designed to assist visually impaired individuals in safely navigating their surroundings and identifying public transportation. The system uses an Arduino microcontroller integrated with an ultrasonic sensor to detect obstacles in the user's path. When an obstacle is detected, the system immediately alerts the user through a vibration motor, providing tactile feedback without reliance on sound, which is essential in noisy environments.

For public transportation support, the system employs an EM18 RFID reader to detect buses equipped with RFID tags. Upon successful identification of a bus, the DF Mini Player module generates a voice-based announcement via a speaker, informing the user about the bus number and relevant details. This combination of tactile and audio feedback ensures both safety and convenience, allowing visually

impaired individuals to move more confidently and independently.

The proposed system is cost-effective, portable, and user-friendly, making it suitable for real-world deployment. By integrating sensor-based obstacle detection with RFID-enabled public transportation recognition, the Third Eye Smart Vision Based Support System addresses critical mobility challenges faced by visually impaired individuals, improving accessibility, independence, and quality of life.

II. RELATED WORK

“Third Eye A Writing Aid for Visually Impaired People”

In olden eras, Braille technology was developed to eradicate the darkness of visually impaired people (Divyanjan) which made them to gain knowledge for proper interaction with the world. Students who read braille can also write braille. Using a variety of low- or high-tech devices, the trainer of students with visually challenged can use braille translation software, which converts the braille into conventional text and prints it. But recognizing the dots on the braille slate and writing the letters is a difficult task faced by many blind kids. Hence the major scope of this proposed project work is to develop a Smart writing system for blind that overcomes many complications faced by a blind child between the age 3-8 years and also to helps them to read and write a standard alphanumeric character. Henceforth helping them to read and write like a person without disability. Therefore, the project aims to design a writing and reading system for visual impaired person mainly alphanumeric characters. The proposed idea is implemented on Raspberry Pi 4 model interfaced with Speaker and a display unit. Deep Learning algorithms namely CNN is used to recognize the scribbled handwritten text/digits. Overall Performance analysis is made by using MNIST dataset.

“An Artificial Eye for Blind”

A blind person always remain dependent on assistant to move from one place to another. If they move by themselves they can harm themselves because they are not able to identify the obstacle in their path. To make them independent a smart stick is proposed in this paper. This stick makes the blind person independent. A smart stick consists of different sensors to identify the obstacle. A speaker and buzzer to give the output in recorded voice after sensing the obstacle. In addition smart stick also consists of GPS

and GSM module to navigate the path. The GPS module also plays a major role as it provides safe and precise navigation to the users. It also help relatives to track the blind person. The paper describes the different component and working of smart stick. The Smart Blind Stick automatically detects the obstacle in front of the person by use of sensors present in the systems, it also incorporates moisture detection at its bottom in order to detect the moisture of the soil or ground so that the person will be aware if it's feasible to walk on that particular ground.

“A Smart Infrared Microcontroller-Based Blind Guidance System”

Blindness is a state of lacking the visual perception due to physiological or neurological factors. The partial blindness represents the lack of integration in the growth of the optic nerve or visual centre of the eye, and total blindness is the full absence of the visual light perception. In this work, a simple, cheap, friendly user, smart blind guidance system is designed and implemented to improve the mobility of both blind and visually impaired people in a specific area. The proposed work includes a wearable equipment consists of head hat and mini hand stick to help the blind person to navigate alone safely and to avoid any obstacles that may be encountered, whether fixed or mobile, to prevent any possible accident. The main component of this system is the infrared sensor which is used to scan a predetermined area around blind by emitting-reflecting waves. The reflected signals received from the barrier objects are used as inputs to PIC microcontroller. The microcontroller is then used to determine the direction and distance of the objects around the blind. It also controls the peripheral components that alert the user about obstacle's shape, material, and direction. The implemented system is cheap, fast, and easy to use and an innovative affordable solution to blind and visually impaired people in third world countries.

“Effective navigation for visually impaired by wearable obstacle avoidance system”

This paper presents a wearable obstacle avoidance system for blind people to navigate safely using cane and eyeglass methods. In cane method, an ultrasonic sensor is placed in cane which detects the obstacle in the ground level. In eyeglass method, an ultrasonic sensor is used which detects obstacle above the head up to certain angle. The information obtained is informed to users using audio messages and also by sense of feel as vibration in case of born both deaf and blind. These algorithms are implemented using MP Lab and Proteus tools.

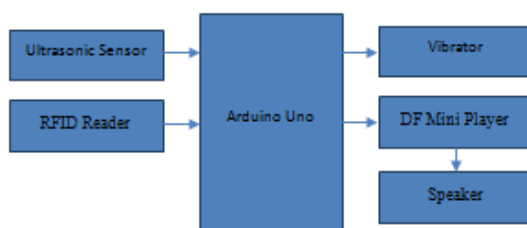
"IoT Based Assistive Technology for the Visually Impaired" – Sharma, R.

This paper explores IoT-enabled devices designed to assist visually impaired individuals in navigation and daily activities. The authors propose integrating ultrasonic sensors with microcontrollers to detect obstacles and provide feedback through vibration or audio signals. The study emphasizes cost-effectiveness, portability, and real-time monitoring, highlighting how IoT can enhance accessibility and independence.

III. IMPLEMENTATION

The proposed Third Eye Smart Vision Based Support System integrates ultrasonic sensing, vibration feedback, RFID-based identification, and voice announcements into a single portable solution. The ultrasonic sensor continuously scans the surroundings and measures the distance to nearby obstacles. When an object is detected within a predefined range, the Arduino activates a vibration motor to provide immediate tactile feedback, allowing blind users to react safely. For public transport assistance, an EM18 RFID reader scans RFID tags installed on buses. Once a tag is detected, the Arduino triggers a DF Mini Player, which plays pre-recorded voice messages through a speaker announcing the bus number or route. This dual alert mechanism—vibration for obstacle detection and voice for identification—ensures reliable guidance in various environmental conditions. The system is lightweight, low-cost, and easy to use, enhancing mobility and independence for visually impaired individuals.

Block diagram:



Working

The Third Eye Smart Vision system works by combining ultrasonic sensing, RFID technology, and audio-tactile feedback to assist visually impaired individuals. An Arduino microcontroller processes input from an ultrasonic sensor to detect obstacles, activating a vibration motor to provide immediate

tactile alerts. For public transportation identification, an EM18 RFID reader scans bus-mounted RFID tags, enabling accurate recognition of bus numbers. Once identified, a DF Mini Player triggers voice announcements through a speaker, informing the user of bus details. This integration of vibration and audio feedback ensures safe navigation, reliable bus identification, and greater independence for visually impaired users, while remaining cost-effective, portable, and practical for real-world deployment.

ARDUINO

The Arduino is one of the most popular and widely used Arduino boards. It's based on the ATmega328P microcontroller and offers a good balance of features, performance, and affordability, making it suitable for a wide range of projects, from simple to moderately complex.

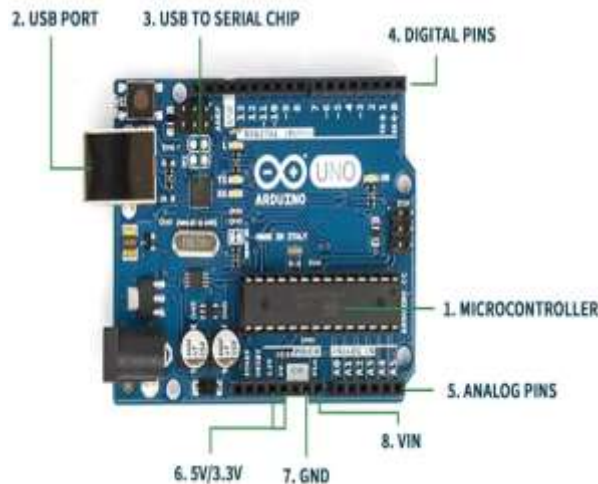
Most electronic devices involve circuit-making using hardware components. The purpose of introducing Arduino was to make an easy-to-use device that can offer the feature of programming along with circuit making. Therefore, Arduino is a programmable device that is used mostly by artists, designers, engineers, hobbyists, and anyone who wants to explore programming in electronics.

The Arduino uses its components to gather information from the surroundings and generate a precise output accordingly. The information is gathered using some components like sensors, and input pins, and an output is generated depending on the programming done. This output can range from illuminating an LED to turning the motors on.

Arduino are great devices that can be used for creating interactive projects. They can either be used alone to create basic projects or they can be integrated with Arduino, Raspberry Pi Pico, Node MCU, or nearly anything else using some programming in their software to create some advanced level of projects. It is good to know the specifications of different Arduino so that you can select the right Arduino for your project.

Arduino Hardware

Let us look at the hardware components of Arduino:



- **Microcontroller:** The Microcontroller controls the execution of all the programs and codes uploaded on Arduino. The microcontroller is equipped with components that can perform different functions.
- **USB port:** This port is used to establish a connection between the computer and the Arduino board.
- **USB to Serial chip:** The USB to Serial port is used for adding data from the computer to the microcontroller. This is how the code is uploaded from the computer to the Arduino board.
- **Digital pins:** These pins are used for turning the LEDs on and off by using digital logic ('0' and '1').
- **Analog pins:** These pins are used for taking analog input.
- **5V / 3.3V pins:** These pins are used for supplying power to devices.
- **GND:** This pin is used for setting a reference level.

ULTRASONIC SENSOR

Ultrasonic sensors are electronic devices that calculate the target's distance by emission of ultrasonic sound waves and convert those waves into electrical signals. The speed of emitted ultrasonic waves traveling speed is faster than the audible sound. There are mainly two essential elements which are the transmitter and receiver. Using the piezoelectric crystals, the transmitter generates sound, and from there it travels to the target and gets back to the receiver component.

To know the distance between the target and the sensor, the sensor calculates the amount of time required for sound emission to travel from transmitter to receiver. The calculation is done as follows:

$$D = 1/2 T * C$$

Where 'T' corresponds to time measured in seconds

'C' corresponds to sound speed = 343 measured in mts/sec

Ultrasonic sensor working principle is either similar to sonar or radar which evaluates the target/object attributes by understanding the received echoes from sound/radio waves correspondingly. These sensors produce high-frequency sound waves and analyse the echo which is received from the sensor. The sensors measure the time interval between transmitted and received echoes so that the distance to the target is known.

Ultrasonic Sensor Specifications

Knowing the specifications of an ultrasonic sensor helps in understanding the reliable approximations of distance measurements.

- The sensing range lies between 40 cm to 300 cm.
- The response time is between 50 milliseconds to 200 milliseconds.
- The Beam angle is around 5°.
- It operates within the voltage range of 20 VDC to 30 VDC
- Preciseness is ±5%
- The frequency of the ultrasound wave is 120 kHz
- Resolution is 1mm
- The voltage of sensor output is between 0 VDC – 10 VDC
- The ultrasonic sensor weight nearly 150 grams
- Ambient temperature is -25°C to +70°C
- The target dimensions to measure maximum distance is 5 cm × 5 cm

The ultrasonic sensor pin diagram is:



RFID

Radio Frequency Identification (RFID) is a form of wireless communication that incorporates the use of electromagnetic or electrostatic coupling in the radio frequency portion of the electromagnetic spectrum to uniquely identify an object or person. It uses radio frequency to search, identify, track, and communicate with items and people.

RFID (Radio Frequency Identification) is a technology that uses electromagnetic fields to automatically identify and track tags attached to objects. These tags contain electronically stored information that can be read from several meters away, without requiring direct line-of-sight. RFID is commonly used in inventory management, asset tracking, access control, and supply chain logistics due to its efficiency and accuracy in tracking and managing items.

It is a method that is used to track or identify an object by radio transmission over the web. Data is digitally encoded in an RFID tag which might be read by the reader. This device works as a tag or label during which data is read from tags that are stored in the database through the reader as compared to traditional barcodes and QR codes. It is often read outside the road of sight either passive or active RFID.

RC522 RFID Reader Module

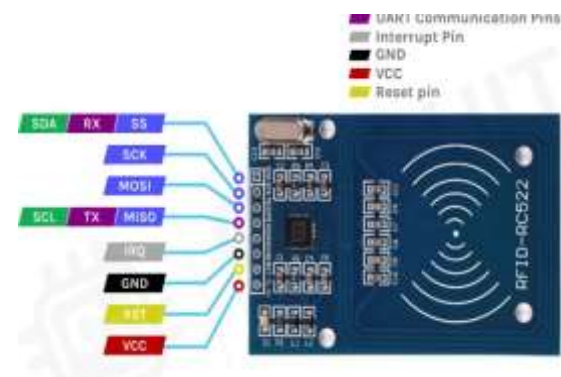
RC522 is a Multi-communication RFID Module for Arduino and Microcontrollers. The RC522 is known as MFRC-522 due to its NXP semiconductor microcontroller. The module allows the developers to interface it with any other SPI, I2C, and UART based microcontrollers. The RC522 module works on 13.56 MHz frequency and it can act as a reader and write for UID/RFID cards. The RFID cards communicate with the module at a short distance with radio frequency due to the mutual induction technique. In most of the security and commercial products, the module is effective because the errors and issues with RFID Tags are detectable by it.

RC522 Pin Configuration Details

In this module, there are only two kinds of pins. So, the first one is power and the second one is the communication pins. Therefore, the device may have its microcontroller chip on itself but it only makes it to work as an RFID. The on-board microcontroller won't make the module a stand-alone device.

RC522 Pinout Diagram

All the pins of MFRC/RC522 RFID card Reader are:



RC522 RFID Reader Features

- RFID RC522 uses mutual induction to activate the cards and 13.56MHz for data transfer.
- The RFID Cards are useable from both sides of the module at max 5cm.
- The only 3.3V is required to activate the device.
- Its auto-sleep mode makes it less power consumption module.
- The module has three kinds of communications (UART, SPI, and I2C). Therefore, it is useable with almost every microcontroller or device in the market.
- The RFID cards and reader (RC522) can transfer data up to 10Mb/s.

RFID cards

An RFID card is a smart card that integrates **radio frequency identification (RFID)** technology. Each RFID card is embedded with an antenna connected to an RFID IC, so it can receive, store, and transmit data via radio waves. The core function of an RFID card is to automatically identify objects and transmit data in a contactless manner.



Fig: RFID cards

VIBRATION SENSORS

A vibration sensor is a measuring device. As the name implies it senses the vibration or to-and-fro movement of any equipment or system at the location where it is applied. It measures the amplitude and frequency of vibration of the system under study. The most widespread application of vibration sensors is found to measure the vibration of rotating equipment and machines like pumps, compressors, steam turbines, and connected lines. These measured outputs are then studied to detect any imbalance or issues in the asset or equipment under investigation to predict the condition of the system. Vibration sensors are very important components of a vibration-measuring tool.

As vibration impacts the reliability and durability of the system in working conditions it must be measured. Industrial vibration sensors can help in monitoring the vibration issues of systems. Monitoring and measuring the vibration of equipment or systems provide several benefits like:

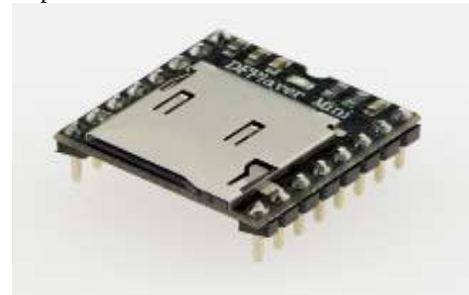
- Root cause analysis of any problem.
- Deciding repairing needs.
- Checking the overall plant or equipment condition.
- Overall it reduces plant operating costs by avoiding costly shut-downs in advance.



Fig: vibration sensor

DF PLAYER MINI

The **DFPlayer Mini** is a small, low-cost MP3 module that allows users to add audio playback capabilities directly to DIY electronics projects, such as those built with Arduino, Raspberry Pi, or ESP32. It is highly popular for its built-in 3W amplifier and MicroSD card slot, allowing it to directly drive a small speaker without needing an external audio amplifier.



SPEAKER

A **speaker module** is an electronic output device used to convert **electrical audio signals into audible sound**. In embedded systems and microcontroller-based projects, a speaker module is commonly used to provide **voice messages, alerts, alarms, and notifications**. It is widely used in assistive devices, security systems, and IoT applications.

In projects like the **Bus Identification System for the Blind**, the speaker module plays a crucial role by delivering **clear audio announcements** to help visually impaired users receive information without relying on visual displays.



IV. RESULT ANALYSIS



Fig1:project kit

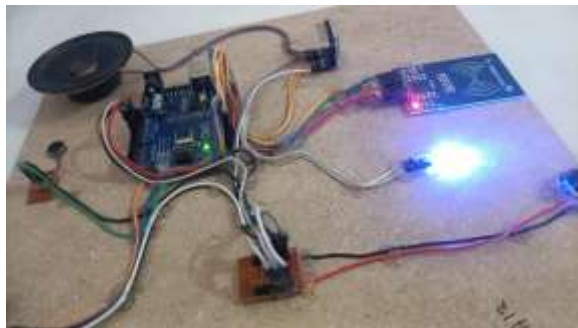


Fig2:kit working indication

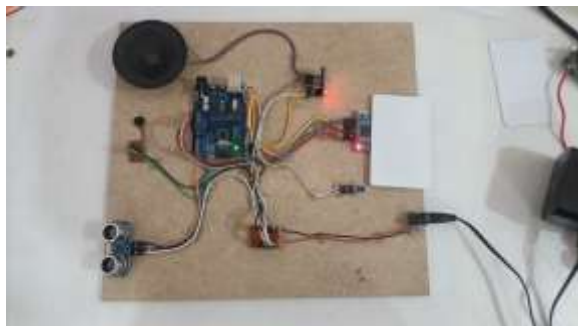


Fig3: reading tags data

V. CONCLUSION

The Third Eye Smart Vision Based Support System for People with Disability provides an effective and practical solution to enhance the independence and mobility of visually impaired individuals. By integrating ultrasonic sensors for real-time obstacle detection with tactile feedback through a vibration motor, the system ensures immediate and intuitive alerts without relying on sound, making it suitable for use in noisy or crowded environments.

The incorporation of an EM18 RFID reader allows accurate identification of public buses equipped with RFID tags. Voice-based announcements delivered through the DF Mini Player module provide clear and timely information about bus numbers and details,

enabling safe and independent public transportation usage. The combination of tactile and audio feedback ensures that users can navigate both indoor and outdoor environments with increased confidence and safety.

The proposed system is cost-effective, portable, and user-friendly, making it highly suitable for real-world deployment. Overall, this project demonstrates how IoT and embedded systems can be applied to assistive technology, improving accessibility, independence, and quality of life for visually impaired individuals. With further enhancements such as GPS integration and smartphone connectivity, the system could offer even greater functionality and broader support for mobility-challenged users.

REFERENCES

- U. Masud, T. Saeed, H. M. Malaikah, F. Ul Islam and G. Abbas, "Smart Assistive System for Visually Impaired People Obstruction Avoidance Through Object Detection and Classification," IEEE Access, vol. 10, pp. 1–1, Jan. 2022, doi: 10.1109/ACCESS.2022.3146320.
- S. Park, L. Kim, S. Ha, H. Cho, and S. Lee, "An Electronic Aid for a Visually Impaired Person Using an Ultrasonic Sensor," in 2009 IEEE International Conference on Consumer Electronics (ICCE), pp. 1–2, Jan. 2009, doi: 10.1109/ICCE.2009.5012244.
- Y. Sáez, "Indoor Navigation Technologies Based on RFID Systems to Assist People with Visual Impairments," IEEE Transactions on [latam.iteer9.org], 2021.
- M. Anto Bennet, V. T. Tharshini, V. Vinothini, M. Aaryani, S. Soundarya, and S. Akshara, "Navigation and Obstacle Detection for Visually Impaired Individuals Using RFID and Supersonic Sensor," International Journal of Engineering and Technology, vol. 7, no. 4.6, pp. 487–489, 2018, doi:10.14419/ijet.v7i4.6.28671.
- G. Revathi, T. Nandhini, S. Priyadarsini, and K. Preethi, "Implementation of RFID in Bus Boarding System for Visually Impaired People," Asian Journal of Electrical Sciences, vol. 6, no. 1, pp. 36–40, 2017, doi:10.51983/ajes-2017.6.1.1990.
- S. N. Nikanfar, "A Survey on Assistive Technologies for Visually Impaired Users," ACM Computing Surveys, 2025 (review of sensor technologies like ultrasonic and RFID for navigation).
- Bhagwat, V. B. (2026). Creating A Dashboard For Monitoring HCM Fusion Payroll Processes To

Prevent Possible Errors. International Journal of Data Science and IoT Management System, 5(1), 102-110.

Poojari, R. INTELLIGENT SYSTEMS+B108 AND APPLICATIONS IN ENGINEERING.

Pavan Kumar Adabala. (2026). Smart Retail Fuel Systems: IoT-Enabled Solutions for Loss Prevention and Environmental Safety. Computer Fraud and Security, 868–875. <https://doi.org/10.52710/cfs.995>

Gummadi, V. P. K. (2021). Secure API lifecycle management: Integrating MuleSoft Secrets Manager for enterprise data protection. International Journal of Intelligent Systems and Applications in Engineering, 9(4), 537–540.

Shashank, A. (2025). AI-Enhanced ETL Processes: Leveraging Artificial Intelligence for Optimized Data Integration Systems. Journal Of Multidisciplinary, 5(8), 219-225.

Maturi, S. Y. (2021). Blockbond hardening: Securing pooled-hash protocols against traffic tampering, MITM hash-rate hijacking, and template coercion. International Journal of Communication Networks and Information Security, 13(3), 718–728.

Maturi, S. Y. (2023). Crowdsourced frontier: Unveiling autonomous adversarial cybercapabilities via open AI competition. International Journal of Intelligent Systems and Applications in Engineering, 11(1s), 275–284.

P. Venkata Ramana. (2024). AI-driven predictive analytics in ERP systems for proactive supply chain optimization. Eudoxus Press Journal.

Gajula, S. (2023). A Review of Anomaly Identification in Finance Frauds using Machine Learning System. International Journal of Current Engineering and Technology, 13(06).

Ghali Krishna Harshitha, Purushothamma B. N., & Anil Kumar K. C. (2022). An analysis of influence of personality on managerial effectiveness. International Journal of Mechanical Engineering, 7(3), 668–671.

Shashank, A. (2025). Self-Healing Data Pipelines for Enhanced Reliability: A Paradigm Shift in Enterprise Data Management. Journal of Computer Science and Technology Studies, 7(8), 1097-1104.

Kandula, S. T. R., Boyapati, P. K., & Susarla, R. S. (2025, April). Optimized Cloud Resource Management Using Deep Dendritic Artificial Neural Networks Integrated with Kubernetes and Terraform. In International Conference on Computer Vision and

Robotics (pp. 454-465). Cham: Springer Nature Switzerland.

Boyapati, P. K. Building a centralized data operations hub for healthcare enterprise integration. IJSAT-Int. J. Sci. Technol. 16 (2). <https://doi.org/10.71097/IJSAT.v16.i2.3219>