Third Eye for the Blind

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ABSTRACT
Individuals with visual disabilities often rely on external assistance, be it from humans, trained dogs, or specialized electronic devices, to aid their decision-making and navigation. The challenge lies in finding a way for the blind to navigate independently. According to the WHO, 10% of visually impaired individuals lack functional eyesight, necessitating constant assistance for safe mobility. This project addresses this issue by leveraging other senses such as sound and touch. It utilizes the Atmega-328 microcontroller, an advanced 8-bit AVR RISC-based microcontroller, along with the HC-SR04 Ultrasonic Range Finder Distance Sensor Module to measure distances using ultrasonic waves. The system incorporates a buzzer for alarm sounds and a motor for vibration signals, notifying the user of obstacles. As proximity decreases, both audio and vibration frequency increase, facilitating navigation for the visually impaired. This low-cost, reliable, portable, low power-consuming system offers a robust solution with quick response times.

INTRODUCTION

The Third Eye is a wearable device aiding the visually impaired in indoor navigation. It reduces reliance on assistance and empowers independence. Using an Ultrasonic module and Microcontroller,[1] obstacle distances are measured and conveyed through a buzzer and vibrations, allowing users [2] to avoid collisions. The device's compact size and affordability result from employing only a microcontroller [3] instead of an entire Arduino board. By integrating all components onto a PCB-connected wearable band attached to gloves, accuracy and reliability are ensured. Previous attempts, like the Navbelt, had limitations, such as difficulty[4] [5] distinguishing audio cues and inability to track user position. This project builds upon existing designs, focusing on simplicity, affordability, and constructability. With a focus [6] on reducing complexity and cost, this device aims to provide visually impaired individuals with an efficient and affordable [7] means of obstacle detection, improving their daily lives.

LITERATURE REVIEW

People with visual disabilities often rely on external assistance, such as human [8] [9]guides, trained dogs, or specialized electronic devices, to navigate their surroundings. However, a significant challenge for the blind is to

independently find their way without constant assistance. According to the World Health

Organization (WHO), approximately 10% of visually impaired individuals have no functional eyesight, leaving them completely dependent on others for safe mobility. This project aims to address this issue by leveraging other senses, such as sound and touch, to compensate for the lack of visual perception.

The system utilizes an Atmega-328 microcontroller, which is a high-performance 8-bit AVR RISC-based microcontroller. To measure distances, it incorporates an HC-SR04 Ultrasonic Range Finder Distance Sensor Module. This module employs the principles of SONAR or RADAR by emitting ultrasonic waves to determine the distance of objects. In addition, the system includes a buzzer to generate alarm sounds and a motor to produce vibration signals. By utilizing audio and vibration cues, the system alerts the user about upcoming obstacles. As the distance between the user's glove and the obstacle decreases, the frequency of both the audio and vibration signals increases, providing timely and accurate feedback.

This innovative system offers a cost-effective, reliable, portable, low-power, and robust solution for navigation, with a short response time. It aims to empower visually impaired individuals to navigate their environment more easily and confidently.

Vision is a remarkable [10] [11] and crucial gift bestowed upon all creatures, particularly humans. Unfortunately, some people lack this beautiful ability, rendering them unable to experience the visual splendors of the world. The Third [12] [13]Eye for the blind project combines software engineering, hardware design, and scientific principles to enable visually impaired individuals to perceive and explore their surroundings confidently and independently. By utilizing [14] ultrasonic waves to detect nearby objects, the system provides auditory or tactile feedback through beeping sounds or vibrations.

According to the WHO, [15]around 2.2 billion people worldwide suffer from some form of vision impairment, significantly impacting their daily lives. The Third Eye device serves as an innovative solution for individuals with visual impairments, offering numerous advantages. Notably, it provides [16] an affordable solution within a limited budget, making it accessible to a wider population. The system incorporates an Arduino Pro Mini 328 board, integrated into a wearable band. The ultrasonic sensor module, mounted [17]on this band, enables users to perceive objects in close proximity and navigate effectively. Whenever the sensor detects an object, it alerts the user through beeping sounds or vibrations. This computerized gadget proves to be [18] immensely beneficial for visually impaired individuals, instilling them with confidence to move independently in any environment.

In conclusion, the Third Eye for the blind project utilizes ultrasonic technology and feedback mechanisms to facilitate independent navigation for visually impaired individuals. With its affordability, portability, and reliable performance, this innovative solution offers a significant improvement in the quality of life for individuals with visual disabilities, empowering them to move with confidence and freedom.

SYSTEM ARCHITECTURE

The system architecture for the Third Eye device consists of several key components. At the core is the Atmega-328 microcontroller, which serves as the main processing unit. It handles the data received from the sensor module and generates the appropriate output signals.

The distance sensing is accomplished using the HC-SR04 Ultrasonic Range Finder Distance Sensor Module. This module emits ultrasonic waves and measures the time it takes for the waves to bounce back after hitting an object. Based on this time measurement, the microcontroller calculates the distance to the obstacle.

To provide feedback to the user, the system includes a buzzer and a motor. The buzzer generates audible [19]alarm sounds, while the motor generates vibration signals. These feedback mechanisms help the visually impaired person detect obstacles and navigate safely. As the distance between the user's glove and an obstacle decreases, the frequency of both the audio and vibration signals increases, providing real-time feedback about the proximity of the obstacle.

The system architecture emphasizes simplicity, affordability, and robust performance. By using an Arduino Pro Mini 328 board and a minimalistic design [20]approach, the device achieves a low-cost solution without compromising on functionality. The microcontroller efficiently processes the sensor data, generating timely and accurate feedback signals to assist the visually impaired user in navigating their surroundings.

Overall, the system architecture of the Third Eye device combines hardware and software components to create an effective and accessible navigation aid for the visually impaired. It enables the detection of obstacles using ultrasonic waves, and provides feedback through audio and vibration signals, empowering individuals with visual disabilities to navigate indoor environments independently and with increased confidence.

Data Flow Diagram:

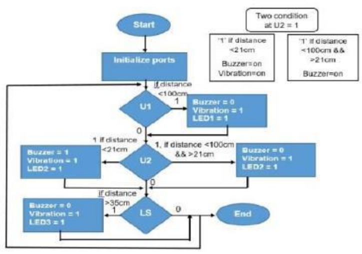

Fig 1. System Architecture

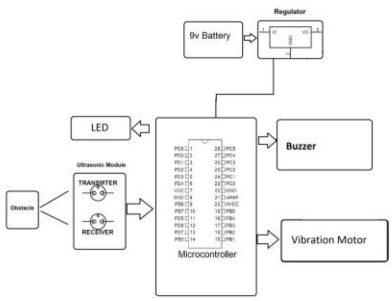

Fig 2. Data Flow Diagram

PROPOSED ALGORITHM

The primary goal of this project is to create a highly beneficial product for individuals with visual impairments, addressing their reliance on others for assistance. This innovative solution empowers visually impaired individuals to move with confidence and swiftness by providing them with the ability to detect nearby obstacles. This is achieved through a wearable band that emits ultrasonic waves, generating buzz sounds or vibrations as alerts. By wearing this device as a band or cloth, visually impaired users can freely navigate from one location to another. The project's main objective is to develop an affordable, efficient, and reliable solution that enhances the comfort, speed, and confidence of the visually impaired population.

Existing technologies intended for visually impaired navigation often come with complexities and require extensive training to utilize effectively. What sets this project apart is its emphasis on affordability, with a total cost of less than $70 or ~600 INR, while still delivering a simple and user-friendly design. Currently, no comparable devices exist in the market that offer such low-cost, wearable functionality. By implementing this improved device on a larger scale and refining the prototype, it has the potential to significantly benefit the visually impaired community.

Conventional walking canes are rudimentary mechanical devices that can only detect static obstacles, such as uneven surfaces, holes, and steps, through tactile feedback. However, they have limitations regarding size and their inability to detect dynamic obstacles. In contrast, this device operates similarly to radar, utilizing ultrasonic waves to ascertain the direction and speed of objects. By measuring the wave's travel time, the system determines the distance between the individual and the obstacle. Existing systems inform blind individuals about obstacles located at a fixed distance in front of or near them, enabling them to adjust their path accordingly.

IMPLEMENTATION

1. Open the Arduino IDE 2.0.

2. With the editor open, let's take a look at the navigation bar at the top. At the very left, there is a checkmark and an **a**rrow pointing right. The checkmark is used to verify, and the arrow is used to upload**.**

3. Click on the verify tool (checkmark). Since we are verifying an empty sketch, we can be sure it is going to compile. After a few seconds, we can see the result of the action in the console (black box in the bottom)

4. Now we know that our code is compiled, and that it is working. Now, before we can upload the code to our board, we will first need to select the board that we are using. We can do this by navigating to Tools > Port > {Board}. The board(s) that are connected to

your computer should appear here, and we need to select it by clicking it. In this case, our board is displayed as COM44 (Arduino UNO)

5. With the board selected, we are good to go! Click on the upload button, and it will start uploading the sketch to the board.

When it is finished, it will notify you in the console log. Of course, sometimes there are some complications when uploading, and these errors will be listed here as well.

SNAP SHOTS

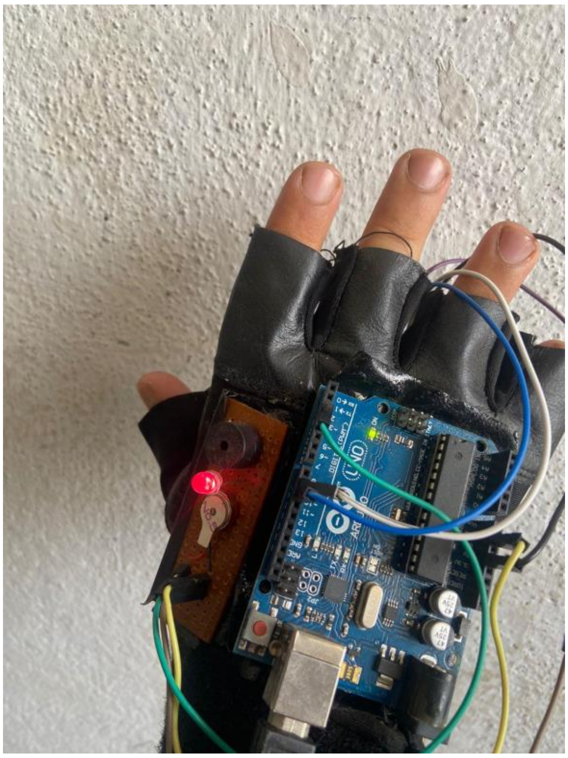

Fig 3. Glove indicating red light

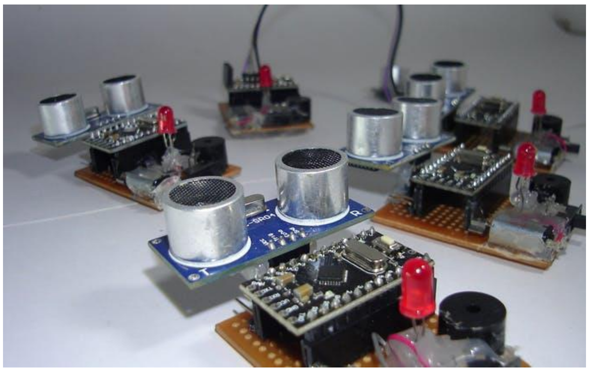

Fig 4. Device Pictures

CONCLUSION AND FUTURE ENHANCEMENT

Thus, the project, Third Eye for blind people is made sightless individuals to live independently, so as to perform their daily activities easily and more confidently with high level of safety. This Arduino based concept for the blind people is simple, cheap and can be easily carried and maintained. This system is able to scan and detect the hindrances in all directions irrespective of the height or depth The object lies at. With this project, if the construction is done properly, the blind can enjoy the taste of sight and can move freely from one place to another without assistance of the other individual. With the use of technology, anything is possible. I used it to serve disabled people because disabled people need more care than normal beings. Our inventions should be focused on them. With the help of a basic arduino board, buzzer and sensor, a cheap yet effective device was created. In future with the advancement of quicker response of sensors, like the usage of top notch sensors it can be made highly useful and also the modules that one needs to wear as a bracelet or on any other part of the body can be transformed into a wearable clothing like a coat, so that it can be made fit for working and there can be more advancement in this device for instance we can use piezeo electric plates in the shoes of the user which can generate sufficient electricity that the modules can run on.

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