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Third Eye for the Blind

Siddhant Kushwaha[1], Prakalp Patil[2], Akanksha Agrawal[3], Prof. Santosh Kumar Jha[4]
[1,2,3]Student, Department of Electronics & Communication Engineering, LNCTE, Bhopal, India
[4]Guide, Department of Electronics & Communication Engineering, LNCTE, Bhopal, India

Abstract— **Third eye for the blind is an innovation with the help of the multidiscipline subjects like computer science, electronics engineering and health science which helps the blind people to navigate with speed and confidence by detecting the nearby obstacles using the help of ultrasonic waves and notify them with a buzzer sound or vibration. According to WHO 39 million people are estimated as blinds worldwide. They are suffering a lot of hardships in their daily life. The affected ones have been using the tradition white cane for many years which although being effective, still has a lot of disadvantages. This will be a wearable technology for the blinds. One of the main peculiarities of this device is that it will be affordable. The Arduino Pro Mini 328-15/16 MHz board is worn like a device. This will be equipped with ultrasonic sensors, consisting of module. Using the sensor, visually impaired can detect the objects around them and can travel easily. When the sensor detects any object, it will notify the user by beep or vibration. Thus, this is an automated device. Thus, this device will be of a great use for the blinds and help them travel different places.**

Keywords*— *Eye, Blind, Ardunio.

I. Introduction

"Third Eye for the Blind" is an innovative assistive technology designed to empower visually impaired individuals by enhancing their ability to navigate their surroundings independently and safely. Living with visual impairment poses numerous challenges, including difficulty in identifying obstacles, understanding spatial contexts, and recognizing objects in daily life. This device aims to mitigate these challenges by acting as a virtual "third eye," providing real-time sensory feedback through advanced technological integrations.

At its core, the Third Eye leverages a combination of cutting-edge technologies such as ultrasonic sensors, RFID (Radio Frequency Identification), camera modules, and feedback systems to detect obstacles, identify objects, and provide navigation assistance. By offering auditory and haptic feedback, the device enables users to interpret their environment more effectively, fostering independence and confidence in day-to-day activities.

The development of the Third Eye aligns with the broader goal of inclusive innovation, ensuring that technology serves as a bridge to accessibility rather than a barrier. With advancements in machine learning, wearable design, and miniaturization of electronic components, the Third Eye represents a step forward in creating practical and affordable solutions for the visually impaired community. This introduction sets the stage for understanding the device's purpose, working mechanisms, and its potential to transform the lives of its users.

The "Third Eye for the Blind" emerges as a solution to a persistent global challenge: empowering visually impaired individuals to navigate their surroundings safely and independently. According to the World Health Organization (WHO), over 2.2 billion people worldwide have vision impairment or blindness, with a significant portion facing difficulties in mobility and object recognition. These challenges can lead to reduced independence, safety concerns, and a diminished quality of life.

Historically, mobility aids for the visually impaired have included traditional tools like white canes and guide dogs. While effective to some extent, these solutions have limitations in terms of range, versatility, and affordability. The advent of modern technologies, including sensor- based systems, radio frequency identification (RFID), and artificial intelligence (AI), offers the potential to revolutionize assistive devices. These advancements enable real-time environmental analysis, object recognition, and intuitive feedback systems, paving the way for more sophisticated solutions.

The development of the Third Eye is rooted in the desire to bridge the gap between traditional aids and cutting-edge technology. Drawing inspiration from earlier systems like smart canes and wearable devices, the Third Eye integrates multiple technologies into a compact and user- friendly format. Its primary objective is to provide users with enhanced spatial awareness and object identification capabilities, fostering confidence and independence.

II. ARCHITECTURE

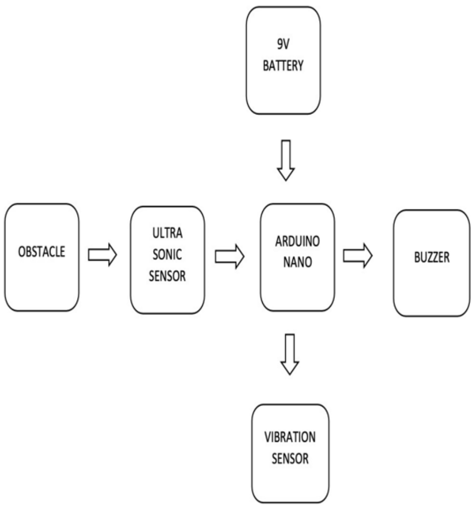

Figure 1: Project

The block diagram represents an obstacle detection and feedback system using an ultrasonic sensor, Arduino Nano, and peripheral devices such as a buzzer and a vibration sensor. Below is the description of each block and its role in the system:

Components:

1. Obstacle: Represents any object or barrier that the system needs to detect.

2.Ultrasonic Sensor: Measures the distance to the obstacle by emitting ultrasonic waves and detecting their reflection. It acts as the primary sensor for obstacle detection.

3.Arduino Nano: Serves as the central controller, processing the signals received from the ultrasonic sensor and triggering appropriate responses through connected peripherals.

4.9V Battery: Powers the Arduino Nano and connected components.

5.Buzzer: Emits an audible alert when an obstacle is detected within a certain range, notifying the user.

6.Vibration Sensor: Generates a tactile feedback (vibration) as an alert, providing an additional mode of notification.

Working Flow:

Obstacle Detection:

When an obstacle enters the detection range of the ultrasonic sensor, the sensor sends data to the Arduino Nano.

Processing:

The Arduino Nano processes the distance data from the sensor and checks whether the obstacle is within a predefined threshold.

Alert Activation:

If the obstacle is detected within range:

The buzzer is activated to provide an audible alert.

The vibration sensor is triggered to provide tactile feedback.

Power Supply:

The system components are powered by the 9V battery.

Applications:

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This system can be used in assistive devices for visually impaired individuals. It could be part of proximity alert systems for robotics or vehicles.

III. WORKING PRINCIPLE

The working principle of the "Third Eye for the Blind" concept refers to how blind individuals perceive their environment using alternative means in the absence of traditional sight. This "third eye" can manifest through enhanced sensory perception, assistive technologies, and neuroplasticity.

This proposed system consists the equipment like Arduino mini pro, ultrasonic sensor, pref board, vibrating motor, buzzers for detecting the obstacles and letting the user know about the obstacle, Red LEDs, Switches, Jumper cable, power bank, Male and female header pins, 3.3 volt old mobile battery which is unused or discarded, some elastic and stickers to make thedevice wearable as a band for wearing for the users. The wiring of the deviceis done in a following manner.

The Ground of LED, buzzer and vibration motor are connected to GND of the Arduino. The +ve of the LED and the middle leg of switch is connected to the Arduino pin 5. The +ve of the Buzzer is wired to the first leg of the switch and the +ve of the Vibration motor is wired to the third leg of the switch. The Ultrasonic sensor are wired accordingly. The Ultrasonic sensor pin VCC is connected to the Arduino pin VCC, Ultrasonic sensor pin GND is connected to the Arduino pin GND, Ultrasonic sensor pin Trig is attachedto the Arduino pin 12, Ultrasonic sensor pin Echo is connected to the Arduino PIN 12. The switch used here is for selecting the mode. (Buzzer orvibration mode.) We first cut the pref board in 5 X 3 cm dimension and solder the female headers for the arduino to the board. Then soldering of the buzzer is carried out.

Then using the glue connect the vibrating motor and solder the wires to it. Then connection of the LED is done. Then connect the switch. Connect the header pins for ultrasonic sensors and for the battery input. Then solder all the things and connect the arduino and ultrasonic sensor to the board. Also connect the elastic band to all the modules.

For making the module for the hand, connect the ultrasonic sensor to the board by using 4 jumper cables. Then connect a 3.7-volt mobile battery to this module. Then connect the elastic band. In the end after all the cnnections are done to the Arduino board, upload the code to each arduino board and power the 4 other modules using a power bank.

The US sensor is a transducer, and is used in pair as transreceiver. The transmitter emits the US waves and if obstacles are present in the path, the US waves hits the obstacles and gets reflected back, the reflected wave is received by the receiver. The US sensor is a combination of one transmitterand receiver. The time interval between sending and receiving of the US signal is calculated, this time interval is used to calculate the distance between sensor and the obstacle.

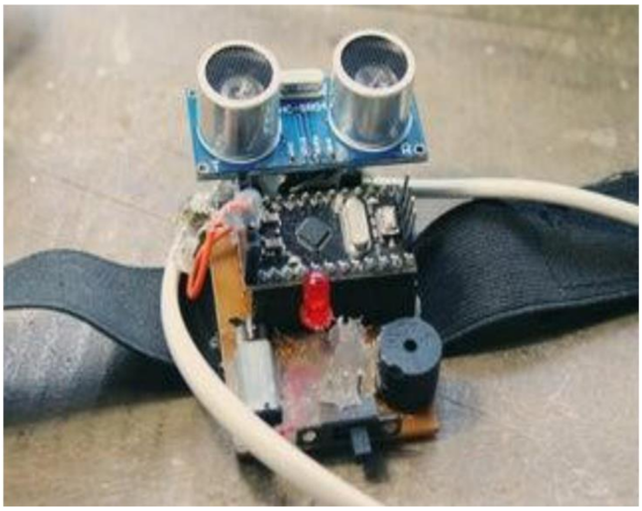

Figure 2: Project

The sensors which are placed in waist belt are in such a manner that the Ultrasonic pulses of sensors must not be overlapped one over the other. Sensors has a field of view (coverage) of about 60 degrees for 4 feet distance, as the distance from the sensor increases, the coverage angle decreases. Thus, the objective is to cover a wide angle to detect the obstacles with the help of the ultrasonic sensors to help the blind and make it easy forthem to move around easily without any hassle.

Hence, the distance calculation is calculated and the sensor detects and thefurther procedure of the buzz sound to the user is carried out. Thus, this way Third Eye for Blind will be designed for the visually impaired people and will make it

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very easy and convenient as it will be a wearable device and thus will help the user in travelling and detecting the obstacles while walking very easily.

IV. CONCLUSION

The concept of a "Third Eye for the Blind" represents a remarkable integration of neuroscience, technology, and sensory adaptation that allows individuals without sight to perceive and interact with their surroundings. Through the principles of sensory compensation, neuroplasticity, and the use of advanced assistive technologies, blind individuals can develop alternative means of spatial awareness and cognitive mapping, similar to "seeing" the world through heightened non-visual senses. Technologies such as echolocation, ultrasonic sensors, tactile feedback systems, and brain-computer interfaces are transforming the lives of blind individuals by providing them with real-time, navigational feedback. Devices like the Ultracane, BrainPort, and OrCam MyEye serve as tangible examples of how innovation can enhance mobility and independence for the visually impaired. These devices convert environmental data into auditory or tactile information, effectively enabling blind users to "visualize" their surroundings and make informed decisions. The integration of multi-sensor technologies—including ultrasonic, infrared, LiDAR, and camera-based systems—ensures that blind individuals can access a fuller understanding of their environment, from detecting obstacles to recognizing faces and reading text. Moreover, the development of artificial intelligence (AI) and machine learning in assistive technologies is paving the way for more intuitive, adaptive systems that continue to improve accuracy, usability, and accessibility. Ultimately, the "third eye" for the blind is not just a metaphor; it is a functional, evolving reality that blends human ability with technological advancements. It empowers blind individuals to navigate the world with greater confidence, independence, and dignity.

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