Implementation of Smart Shoe Using Arduino Uno

Anupama Rani N[1], Pranaya Rani Kota[2], Srilaxmi Gunji[3], Vennela Kethavath[4]
[1]*Assistant Professor, Department of ECE Sreenidhi Institute of Science and Technology, Ghatkesar, Medchal, District, Telangana*
[2,3,4]*Students, III Year II Sem, Department of ECE Sreenidhi Institute of Science and Technology, Ghatkesar, Medchal District, Telangana*

***Abstract*—One Good vision is one of God's gifts, as it helps a person to be aware of their surroundings. Unfortunately, this blessing is denied to millions of people. In visually impaired persons, lack of vision adds to low self-esteem, making them conservative since they are unable to interact with the world in the same way that others do. Taking all of these issues into account, a low-cost, user-friendly wearable shoe is developed that supports blind people in doing everyday tasks and enables them to become self-sufficient. This shoe enables both partially and completely blind people to traverse an unfamiliar area on their own. The trainer in question has features such as an obstruction-detecting sensor. This article discusses how to deal with the challenges that visually impaired people have by using assistive technology in the shape of shoes. INDIA accounts for 21% of the overall blind population, hence the majority of blind people rely on others for assistance. The smart shoes will identify adjacent objects or impediments and send the receiver an audio/vibration notification. As a result, it enables the visually impaired person to get additional knowledge about the difficulties around them without the need for assistance or advice. It will make kids more self-sufficient because there should be an "EYE" for every "I".**

Keywords: Arduino Uno, Ultrasonic Sensor, Obstacle Detection, Piezo Buzzer.

I. INTRODUCTION

The significance of the eyes is that they're frequently appertained to as the" window of the soul." The eye is a pivotal organ of the mortal body that gives a person mindfulness of his surroundings. Blindness limits a person's capacity to carry out everyday tasks and support their Survivor financially. According to a recent World Health Organisation(WHO) report, India is home to roughly 30 of all eyeless people worldwide. The number of visually hindered people in India has now reached 12 million, and this figure is anticipated to rise in the unborn times. The figures show how serious the problem of blindness is in India.

Numerous people suffer from severe visual impairment, which causes them to come trapped in their familiar surroundings. People who are fully eyeless are unfit to perform indeed simple tasks like turning on an addict, chancing their diurnal things, or going for a walk. The biggest issue with eyeless people is a loss of tone- regard and physical integrity, which causes them to lose confidence. When they enter a new area, they must memorize the position of every object of necessity and handicap.

As a result, individuals wear some outfit or fashion to help them in their mobility and everyday conditioning. One of the systems is the use of trained canines which can help visually disabled persons to move by navigating around the handicapped. still, this system isn't relatively effective as it requires a lot of trouble and time in training a canine and it's also veritably delicate for the eyeless person to take care of other living critter. Another system is the use of a club which is again unpractical because of its limited range.

So, we developed a smart shoe. Smart shoes are a type of smart footwear technology. Eyeless people can profit from smart footwear. This shoe will be accoutred with a multitude of detectors, each with a unique set of capabilities to help eyeless individuals navigate their surroundings. When walking and traveling, they don't profit from utilizing the long Hoover Club. It makes use of smartphone apps to help with tasks that are insolvable to do in traditional footwear. The composition's purpose is to develop an intelligent assistive shoe for eyeless people so they can quit demanding nightsticks and come more independent. likewise, in the moment's fast- zonked world, this will allow us to live singly.

While walking in public, the smart shoe cautions visually challenged people to implicit hazards.

numerous impaired people, particularly those who are visually bloodied, find it delicate to move around singly in public areas. A revolutionary smart shoe intends to help people in navigating similar walls and moving around in a safe and independent manner. With advising signs, as well as vibration feedback, these smart shoes advise eyeless and low-vision people of multitudinous impediments in their path.

The design of the suggested eyeless shoe is divided into three stages

• Primary stage-

It's made up of two hc- sr04 ultrasonic detectors, which are used to identify obstacles in the way of an eyeless person. A detector is installed on the top and side of the shoe to descry the presence of inhibition in the eyeless person's path

• Control Phase

It's made up of a microcontroller, in this case, an Arduino Uno, which receives the handicap distance via an ultrasonic detector. The microcontroller includes an inbuilt comparator, which compares the handicap distance to the reference distance and generates an error consequently. When an error exceeds the forbearance range, the microcontroller is configured to transmit a needed detector signal to the two wobbling motors and a piezo buzzer.

• Stage of an affair

It employs a two-coin wobbling motor that reacts to signals entered by the microcontroller. A piezo buzzer is also present, which sounds when the detector senses the presence of a manacle.

II. LITERATURE SURVEY

Ariba Khanam et al., in their research work they had introduced smart assistive shoes for blind individuals to aid them in their daily tasks. This study offers a solution for the issues experienced by people who are blind or visually impaired—a pair of shoes. The shoes will continuously deliver an audio and vibration notification to the receiver after sensing any surrounding impediments. Arduino is being used by them to test sensors. Future work will be focused on employing web cameras and NI cameras to gather focussed images that aid in item recognition and scan large environments for the existence of numerous objects in the route of the blind person. [1].

S.D. Asha Maheshetal., in their disquisition composition they designed to enable comprehensive object discovery and shoot information about visionless persons. This design intends to produce an Electronic Travel Aid(AID) to help visionless persons in chancing a handicap-free path. This schedule is tied to the shoe. When an object is linked close to the shoe, it informs them using a vibratory circuit and, in the future, using speakers or headphones that voice command with the help of an Android operation. IR sensor that detects the actuality of walls in the direction and delivers a command to the controller when an object is detected in the direction. Smart shoes that caution visually impaired people over obstacles coming between their ways could help them in walking with lower collision. When the object is detected near the shoe cautions them with the help of a vibratory circuit and also in advancement with the help of speakers or headphones that are voice commands with the help of android operation. After entering the input from the shoe module via Bluetooth module, the arduinolily receives the input, decodes it, and handpick the applicable saved voice communication and commands to the speaker which give suggestion to the user of the obstacles in the separate direction. In the future, longitudinal disquisition would be demanded to determine whether the smart shoes will be suitable to emulsion their traditional mode of mobility, thereby making them independent after prolonged use[2].

M. Madhu Meena et al., This article published a smart shoe that aids blind people in navigating by transmitting voice commands through light sources (Li-Fi) in their path. Data is transmitted to the shoe module by LED created by the Li-Fi module. When this signal is picked up by the shoe's Li-Fi receiver, the controller plays the data through the speaker. they are employing radio frequency identification tags. The most trustworthy source for data transmission to the blind is light, which is used by smart shoes. All system components were subjected to a normal bench test to assess their operability, correctness, and dependability[3].

Saloni Mohanty et al., in their research article, the authors use an ultrasonic sensor system to locate the closest barrier and then give back input to a blind individual. Android system being utilized by the user will notify the user when sensors identify any impediments. Obstacles will be detected by the sensor, and the vibrator will vibrate in that direction. The shortest path algorithm proposed by Dijkstra is employed. Mobile devices and electronic components

can be connected via the Bluetooth connection. By incorporating the camera guide, future work will be concentrated on improving the system's performance and lessening the user's workload[4].

Shubham Rastogi et al., in this journal proposed with the use of smart shoes, those who are blind or visually handicapped could avoid colliding with more objects as they walk. a pair of shoes featuring voice alarms and prerecorded message capabilities for user interaction. Radio Frequency Identification (RFID) is the technique they are utilizing. Two sensors attached to each shoe to identify items on the ground have been used to collect data by the system. The microcontroller then gives audio feedback to the user in accordance with the data it has received. Future long-term studies will be necessary to determine whether smart shoes can improve users' current modes of mobility and eventually lead to their independence following repeated use. [5].

Saylee Begampure et al., in their research work, introduced a wearable technology that will be created to assist in navigating with the aid of an Android application. The IR sensor is used to identify obstacles in the project, and once an obstruction is seen, the buzzer will activate. The shoes communicate with a smartphone app that uses maps and vibration to direct users to their destination by letting them know when and where to turn. Future attention will be on Bluetooth speakers, which are utilized to leverage GPS to retrieve location coordinates from mobile phones[6].

Ziad O. Abu Faraj et al., in this research article, introduced each shoe has three pairs of ultrasonic transducers fitted on the toe cap of each pair of shoes to let them identify ground-level obstructions of various heights as well as ground pits and holes. undertook an extensive training session while wearing the smart shoe, during which each sensor's associated tactile output was independently enabled. The topic of wayfinding or navigation is covered. Customer service and aesthetics are addressed [7].

Vikram Singh Parmar et al., the research work discussed examines the possibilities of tapping into warning users of impending challenges using a creative approach for providing feedback. It uses an ultrasonic sensor to identify obstructions within a configurable range of up to 2 meters, and a tapping mechanism at the foot arch gives the user feedback. For these sophisticated sneakers, there are two buttons accessible. The system is powered on and off using the power button. Mode Button: When the mode button is pressed, the system's built-in buzzer signals the current mode allowing the footwear to be used in either of its two configurations. Future development will concentrate on improving system speed and decreasing user burden by using a camera to guide[8].

Shlesha Khursade et al., in this research work, had one such wearable device intended to give blind people directional information. Everyone uses Android smartphones these days. Wearable technology will be created to assist with path navigation with the aid of an Android application. Vibrators that are attached to the hardware will vibrate when a left or right turn through path is detected by sensors that are attached to it. The user will be warned by a buzzer when an obstacle is about to blindside them. All people frequently use Android smartphones. Wearable technology will be created with the aid of an Android application to assist with path navigation. The sensors measure the distance between themselves and any barriers that come into contact with them. If obstacles are found within the predefined range of 15 to 20 cm, the buzzer starts to beep[9].

III. DESIGN AND IMPLEMENTATION OF SMART SHOE

To identify impediments using ultrasonic waves, we have integrated an Arduino microcontroller with an ultrasonic sensor in our design. The buzzer (sounds) warns visually impaired people about obstacles in their path and may enable them to move less recklessly. The piezo buzzer we used also transforms mechanical energy into electrical energy. The user's shoes will be put on when fixing hardware. When a user wears the shoes and moves, hardware sensors identify obstacles, and buzzers vibrate and buzz to signal a change in direction. Additionally, a vibrator will be used to alert the user when the impediment is nearby.

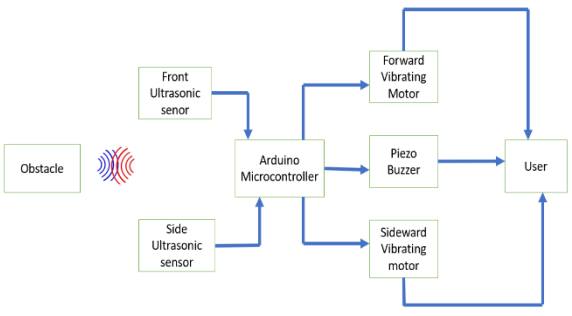

Fig 1 Block Diagram of Smart Shoe

When wearing the smart shoe, the user can travel without worrying about depending on others. The system is intended to be a user-friendly, low-cost replacement for a smart blind guide system. It is being created to boost the independence of people who are blind or visually impaired while simultaneously improving their ability to avoid dangers that could be fatal in several circumstances. Sensors will identify obstacles, and vibrators will buzz in the right direction (ahead and sideward) as a result. The front vibrator will buzz when an obstruction is nearby, and the sideward vibrator will buzz when an obstruction is farther away. To enable visually impaired people to travel anywhere they want, independently, and safely, our strategy is to develop a straightforward, hands-free application that is simple and easy to use.

IV. RESULT ANALYSIS

We used the Arduino IDE program and Tinkercad software to implement the commands in this project.

A. Implementation of Smart Shoe on the Tinkercad:

We created a software circuit-like prototype model with the same hardware requirements using Tinkercad Software. Here, two ultrasonic sensors are kept within a certain range to detect any obstructions.

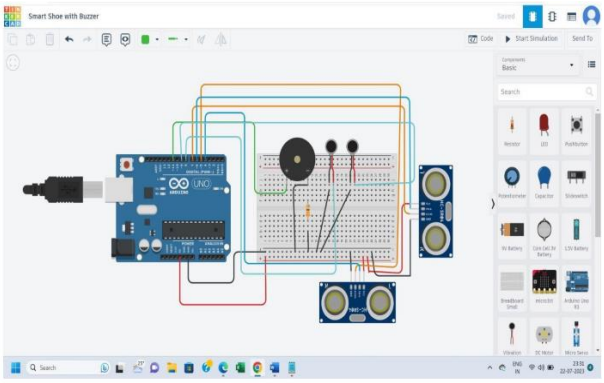

Fig 2. Smart Shoe Circuit Implemented in Tinkercad

When the ultrasonic sensor identifies an obstruction, it sends a signal to the vibrator and buzzer, which alerts the user.

B. Implementation of Smart Shoe Using Arduino IDE:

We created a prototype that is used in real-time with the aid of the Arduino IDE. When an individual walks out, the ultrasonic sensor detects an impediment and sends a signal to the vibrator and buzzer to notify the user. To detect a person before they approach a danger zone, we deployed two sensors with differing ranges.

Fig 3. Prototype of Smart Shoe

Here, we're using two ultrasonic sensors that are attached to the front and sides of the shoe, along with two vibrators that are attached to various sides. When an obstacle is close by, the buzzer sound and vibrator will be loud, while when it's farther away, the sensor detects it and alerts the wearer with a low buzzer sound and minimal vibration. So that individuals can stroll with confidence anywhere they desire. This aids people with visual impairment.

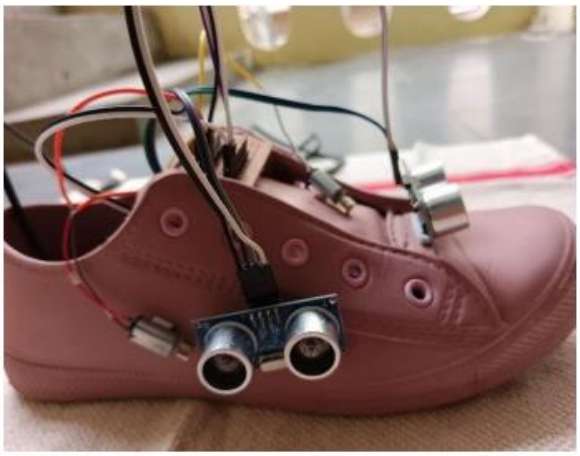

Fig 4. Different Cross-Sectional View of the Smart Shoe Prototype Model

This section provides an overview of the sensors and systems used in this project. Following the successful installation and testing of coding, the following results were obtained. The ultrasonic sensor, vibrator motor, and buzzer are connected to the Arduino microcontroller. The screenshot of the setup is shown above the Figure 3.

V. CONCLUSION AND FUTURE SCOPE

To identify obstacles in the way of those who are blind, we are utilizing an ultrasonic sensor. The entire procedure is carried out automatically. The primary goal of this article is to incorporate numerous technologies into smart shoes for visually impaired persons. A designed support system is accurate in identifying barriers and informing the visually impaired person to find their path, skipping any obstacle that comes in the way of the destination.

We intend to incorporate GPS into our system in the future to assist blind individuals in obtaining source and destination route information as well as in determining the shortest and optimal path with real-time coordinates and precise location. We also concentrated on enhancing the system's performance by keeping voice assistance and cameras linked to the shoes that can detect objects and identify impediments.

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