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A Smart Wearable Guiding Device for The Visually Impaired People

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Abstract— The "Smart Wearable Guiding Device for the Visually Impaired People" is designed to help blind individuals overcome their lack of vision by using other senses like sound and touch. It alerts the blind user of a major hurdle via audio and vibrating signals. According to the World Health Organization, 39 million individuals globally are considered to be blind. They have a lot of difficulties in their everyday routines. As a result, the project's goal is to provide a low-cost, high-efficiency method of assisting the visually handicapped in navigating with a little more ease, quickness, and assurance. This Arduino based gadget will assist the blind in navigating without the use of a stick, which might be inconvenient for them. They may just wear it as a wristband or fabric, and it will work quite precisely with little to no practice. A ringer is also included in the system, which emits a warning sound and generates vibration signals. The system uses sound and vibration signals to warn the user about impending dangers. The frequency of both sound and vibration signals increases as the range between elastic glove and obstacles decreases. The design incorporates a buzzer that emits an audible alarm and a motor that produces vibration signals, as well as the ability to transmit notifications to the appropriate person in the event of a crisis. As a result, the study objective is to provide a low-cost, high-efficiency method of assisting blind people to travel with more ease, pace, and assurance. This design provides a low-cost, robust, portable solution for routes with a self-evidently quick reaction time.

Keywords— Arduino, Visually Impaired People, Elastic Glove, Buzzer, Reaction Time

I. INTRODUCTION

Consider how a malfunction of the eyes, which are the primary sense organs, might have a negative impact on the capacity to adapt to the outside atmosphere's information. The issue of visual impairment is growing increasingly serious as the world's population ages. People with vision impairments rely on assistive technology to help them navigate their daily lives. In this technological age, where everyone aspires to be self-sufficient in order to compete in a world of competition, being self-sufficient is a top goal for practically everyone. Globally, 285 million individuals are affected by vision impairment, with approximately 39 million blind people and a growing prevalence rate [1]. Circumstances have improved so significantly in recent years that innovators are increasingly focusing on health-care innovations. The blind people have a difficult time navigating. They require assistance in moving from one location to another. There are several approaches to assisting the blind. Many clever alternatives have been created to enable the blind move freely as a consequence of technological advancements in hardware and software. The major issue for blind individuals is figuring out how to go where they want to go. Such individuals require the support of those who have a strong vision.

Existing solutions, such as white sticks, guided dogs, and human guides, have been ineffective due to their numerous restrictions. The white cane, for example, is the most commonly practiced mobility aid among blind and visually impaired individuals. However, the efficacy is far from adequate [2]. In recent years, assistive aids have been developed to assist the disabled. Poor handicapped people will have access to low-cost assistive devices if technology continues to advance in the near future. Although a number of frameworks have been developed to assist visually impaired persons, many of them are restricted in scope. The network of the visually impaired folks will undoubtedly benefit from the widespread use of this innovative device, as well as model improvements. So, our major goal is to deliver information to visually impaired individuals so that they may travel independently on the streets without being involved in accidents and can detect items so that they can make appropriate decisions and prevent accidents.

To show the evolution of such technology, we present a comparable guiding device for visually impaired persons in this article. As a result, an intelligent glove for visually handicapped persons has been built using Arduino in this project. The quality of life for the blind people is a pressing global concern that must be resolved. The suggested intelligent glove has the capacity to identify impediments and gives blind individuals more assurance when walking in social settings. Hurdle monitoring systems that utilize range sensor technology may monitor road conditions with a greater detecting range, alerting users to possible risks ahead of time. The Arduino microcontroller is employed to achieve the goal of producing flexible, lightweight, and economically accessible clothing. If an item is detected by the ultrasonic sensor. The vibrating motor would be activated,

alerting the blind to any obstructions along the way and also has the ability to transmit notifications to the appropriate person in the event of a crisis. There are no other electronics commercially available that can be worn like a cloth with such ease and low effort. The main goal is to obtain a device that is appropriate for the whole visually impaired population. One of the most important qualities of this device is that it will be cost-effective.

II. LITERATURE SURVEY

Over the last few decades, scientists have been working on new gadgets to create a good and dependable system for blind people to identify obstacles and notify them when they are in danger. Throughout the years, several initiatives to assist visually impaired persons have been developed. Object detection, GPS, the use of ultrasonic sensors, and audio conversion are among the most common methods used. There are several systems with restrictions and limits. Ultrasonic sensors are used as the principal sensor system in a number of existing ETAs. The marketplace for mobility aid tools for blind persons that use an ultrasonic sensor is classified into two categories: canes and Head Mounted Devices. As a result, it is critical to devise a more cost-effective and lucrative paradigm for the blind people to aid them in dealing with day-to-day challenges and to proceed with more trustworthiness.

Akhila S, et al. suggested a device that includes Raspberry Pi to recognize objects and give real-time help through GPS for navigation to a specified area. The ultimate goal of the system is to offer visually impaired persons low-cost, effective navigation and obstacle detection assistance that gives them a sensation of artificial vision [3].

We also went across an article titled Real-time Object Detection for 360-degree Panoramic Image using CNN [4]. This method uses a convolutional neural network to provide real-time feature recognition for 360-degree panoramic photographs (CNN). They've also used a CNN-based approach to detect objects, which includes a post-processing stage to determine the outcome.

D Sekar, et al. presented a device that works like an intelligent walking stick and warns visually impaired persons of problems in front of them [5]. This might assist them in traveling more safely. It comprises a basic walking stick with sensors that provide environmental information. The best path to take is determined by combining GPS technology with pre-programmed places.

Shoval et al. created the Navbelt, a wearable compact computer with collision avoidance that is only for indoor navigation [6]. Auditory signals, similar to the electronic signals supplied to the motor controllers of a mobile robot, can assist a blind traveller past obstacles or offer an "acoustic view" of the surroundings.

Partha: A Visually Impaired Assistance System [7] - This system consists of an intelligent glove and a mobile that will be used to identify items as well as avoid impediments in their path. The technology also provides protection to the blind in an outdoor setting by revealing their position in real time. The suggested system is dependable, cost-effective, practical, and implementable.

The Dijkstra method is used to identify the shortest distance accessible for visually impaired persons utilising smartphone devices for pathfinding and obstacle detection [8]. This gadget also employs an Ultrasonic sensor to detect impediments in front of the blind, and the Bluetooth module provides an immediate response to the user.

Benjamin et al. demonstrated an optical triangulation laser cane with three photodiodes and three laser diodes that serve as receivers. The barrier is detected by the laser cane in three distinct orientations. There is no mechanism in place to determine location and position with the laser cane [9].

Przemyslaw Baranski et al. outlined the principle of a remote guiding system for the blind. The system is divided into 2 parts: a remote operator's terminal and a mobile terminal for blind people. A mobile terminal is a compact electronic device with a digital camera, GPS receiver, and headphones. GSM and the Internet link the two terminals wirelessly [10].

The system suggested by V. Ramya et al supports the visually impaired in navigating via audio signals and haptic feedback, enabling them to locate where they are and improving their locomotion. The gadget also delivers audible feedback to the user, such as guidance, luminance, and temperature [11].

Anushree Harsur et al. suggested a system that uses Raspberry Pi to give pathway guidance to visually impaired persons. The user's navigating instructions were provided through the use of audio in this guidance system. The entire device is attached to a waist belt worn by the user [12].

Initial research on the system for blind remote navigation was addressed by M. Bujacz et al. [13]. The notion is that a blind person can be assisted by verbal directions from an administrator who gets a video feed from a camera worn by the visually impaired person.

Abhishek Choubey and Dattatray Patil suggested an easy and cost-effective solution that combines an embedded system with RFID, a sensor, and a cognitive device. The RFID tag should be permanently installed in pedestrian paths with unique identification, according to the proposal. When a blind person walks about, the implanted tags are energised and the tag ID is read by the sensor in the stick. The cognition device's cognitive algorithm decodes the address of the information message connected with it about the location [14].

Prashant Bhardwaj and Jaspal Singh have presented a system that uses an infrared-based detecting device to identify the barrier and then gives back vibrotactile or sound (buzzer) input to tell the user of its location. A sensor module is mounted on a lightweight hat, allowing the user to gather data about obstructions as well as the best way to follow [15].
Anush Goel and colleagues suggested a method that uses USB to connect to an ARM microprocessor. After pushing the button, OpenCV is used to process the acquired picture, and OCR is used to recognise the text. OCR technology allows pictures of printed text or symbols to be converted into text or information that can be read or altered by a computer software [16].

III.PROPOSED MODEL

It is difficult for visually impaired people to recognize barriers in their environment, causing them to fall behind in the increasingly complex urban world. This concept is created specifically for blind individuals to make day-to-day tasks simpler. This technology is created with the goal of preventing visually impaired people from getting into accidents when driving alone on the road and allowing them to distinguish objects in their environment.
We were continually thinking about eliminating the functionality of walking canes at the start of the design process in order to give a better walking experience for blind individuals. They can fully avoid the use of the white stick and other similar devices if they wear this device. They may wear the device as a band or even as a cloth, and it will operate correctly. They will need almost little preparation to use it because it is so simple. This proposed system includes components such as an Arduino UNO, ultrasonic sensor, pref board, vibrating motor, buzzers for obstacle detection and alerting the user, a GSM Module in the event of an emergency, Red LED, Jumper cables, mobile battery, and some elastic and stickers to make the device wearable.

The device includes the following components:

- Arduino UNO
- Ultrasonic Sensor
- Buzzer
- Mini vibration motor
- GSM Module
- 5mm Red LED
- Jumper wires
- Battery
- Wearable Gloves
- Arduino Software

A complete hardware model is a process of creating a model whose goal is to detect an obstacle or item within a given range, with the range value set in the application. Sensors are positioned along a route to detect obstacles or items. When they are discovered, the vibrating motor and buzzer switch on, allowing the individual to pursue a different course.
As human living conditions have improved, we have become so affluent that we have forgotten how tough it is for differently-abled people to survive. The proposed system is designed to provide a low-cost, high-performance obstruction detection system. As a consequence, because it will be a portable gadget, the Smart Wearable Guiding Device for the Visually Impaired People will make navigating and identifying obstructions while moving a lot easier and more pleasant for the user.
The Arduino is an open-source hardware and software platform that allows users to do useful tasks. This microcontroller gadget assists in the detection and control of objects in real-time scenarios and environments. The ultrasonic sensor is made up of three parts: a transmitter, a receiver, and a transceiver. Electrical signals are converted into sound waves by the transmitter. The sound waves are converted back into electrical signals by the receiver. The reception and transmitter functions are performed by the transceiver. It also has crystal oscillators. A beeper or buzzer is an auditory signalling device that can be electromechanical, piezoelectric, or mechanical. The main purpose of this is to transform an audio signal to a sound signal. Vibration motors are small coreless DC motors that vibrate to notify users that they have received a signal without making a sound. A GSM module is a device that connects to a network through a wireless data link using GSM mobile phone technology.

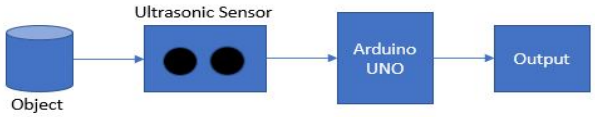

Figure 1: System Module

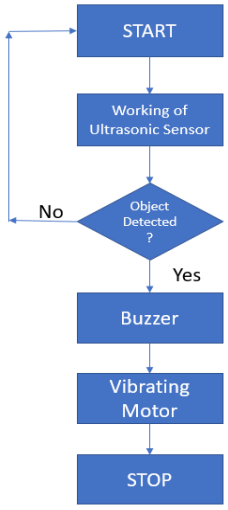

Figure 2: System Flow Chart of Smart Wearable Guiding Device

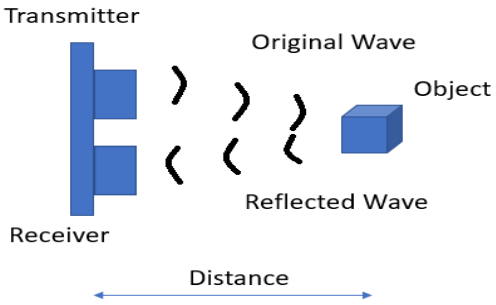

Figure 3: working of Ultrasonic Sensor

Figure 4: GSM Module

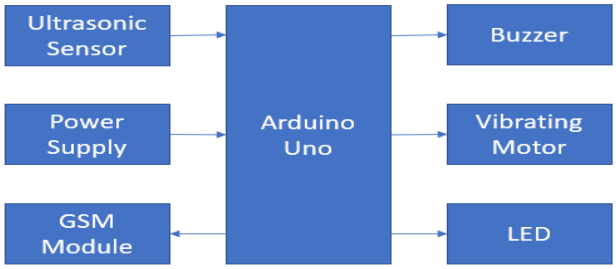

Figure 5: Block Diagram of Smart Wearable Guiding Device

IV. RESULTS

It's important to keep in mind at this juncture that the report's main goal, which was to build and create an ultrasonic vibrator glove for the blind, has been met. The suggested scheme is an assistive device for those who are visually impaired. It aids them in recognizing all types of impediments in their path, allowing them to move around freely. It's a great blind aid gadget that's

affordable to the middle class. Using a sensor module to identify obstacles is also restricted to recognizing immobile and slow-moving entities. As a result, it may be tweaked to recognize fast-moving entities with better precision, resulting in a far more user-friendly guidance system. As a result, the device's ultimate goal is to provide a safe and easy way for visually impaired people to handle their everyday problems without depending on someone else. It assisted the blind in navigating by detecting impediments in their pathway and identifying individuals approaching them in real-time. The visually challenged will be able to go from one area to the next without the assistance of others if the planned engineering is created with all things considered accurately.

V. CONCLUSION

Giving a blind person eyesight is really tough. In today's environment, any form of impairment, including blindness, may be difficult for anyone. Blind individuals are frequently marginalized. When accomplishing regular chores, the visually handicapped experience a variety of difficulties. These tasks might include distinguishing between things with similar forms or understanding the contents of a food label.

A novel Guidance System for the Blind has been presented and developed in this research. It is an Arduino-based initiative that will be cost-effective and accessible. This system provides a flexible and efficient artificial guided vision system. This is a simple and practical portable suit that can detect obstacles in any fashion, regardless of their height or depth. The technology enables blind and visually impaired persons to be highly self-sufficient by aiding their mobility, whether they are outside or indoors. This research entails the creation of a paradigm that may be described as a virtualized eye for patients who are unable to identify obstacles with their senses. This glove will serve as a foundation for a new generation of mobility aids that will allow vision-challenged individuals securely explore both indoors and outdoors. Currently, the entire concept of this initiative is implemented in a simple glove, which implies that there are fewer features accessible due to the fact that different other types of components cannot be loaded in such a small glove.

In the future, more updates can be produced, as well as software upgrades with better sensors. We'll also include a clever navigation system, which will allow blind individuals to travel simply and go wherever they want without having to rely on maps. In conclusion, we presented the Third Eye, a gadget that uses vibration to improve the capacity of vision impaired persons to explore space. Future improvement can be made to increase the performance of this project.

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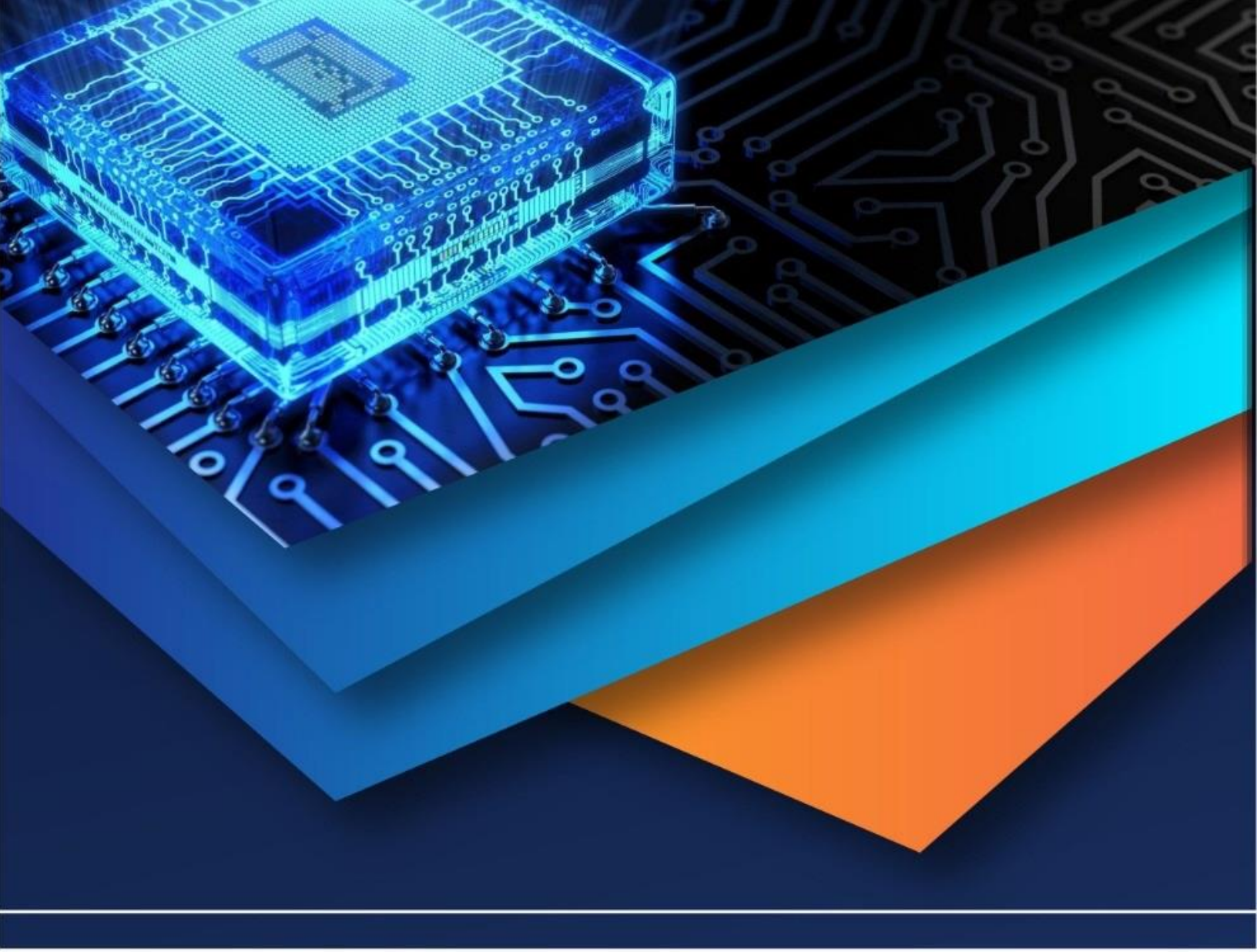

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