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Review Paper on Smart Guidance Belt For Blinds

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Abstract: This project seeks to create a simplified version of a smart wearable belt that can assist blind people with navigation, using a sensible and compact design for the electronic equipment. The design includes an embedded system, and could potentially incorporate machine learning algorithms to detect potholes and other irregularities on the road. The goal is to develop a smart belt that can help blind people travel independently without the use of a cane.

The Electronic Blind Mobility Aid is a technology that uses sensors put on a belt worn around the waist to allow blind persons to travel independently. This advanced technology can help many people with visual impairments to travel independently. Blind people often face obstacles that can make it difficult for them to travel alone, but a blind belt can extend their range of perception by serving as an obstacle detector. Visually impaired people often use their hearing to compensate for their reduced eyesight, and can recognize sound sources.

This technology enables blind persons to travel independently and receive obstacle alerts via headphones and speakers using sensors installed on a belt that is worn around the waist. Blind people can utilise this approach every day to find potential hazards, roadblocks, and pathways. In the end, this technology will serve to increase the independence of blind individuals and give them more confidence when they travel.

To notify users of potential dangers, the device has a buzzer that produces vibration signals and emits a warning sound. Both the sound frequency and the vibration frequency rise as the space between the elastic gloves and the barriers gets smaller. The design incorporates a buzzer and motor in addition to the capability to notify the proper person in case of an emergency..

The goal of this study is to provide a low-cost, effective means of helping blind individuals travel more easily, quickly, and confidently. This design provides a quick-response, cost-effective, and portable solution. This device can let blind persons traverse their environment more safely and confidently by employing sound and vibration cues to notify the user of impediments.

I. INTRODUCTION

Visual impairment can significantly impact an individual's ability to adapt to their environment. As the world population ages, the problem of visual impairment is becoming increasingly severe. Assistive technology is crucial for people with vision impairments to navigate their daily lives. In today's technology-driven world, self-sufficiency is a top priority for most individuals. The prevalence of visual impairment is rising globally, with 285 million people affected, including approximately 39 million blind individuals [1]. In recent years, innovators have focused more on healthcare innovations. The visually impaired have difficulty navigating, and they require assistance to move from one place to another. Technological advancements in hardware and software have enabled many clever solutions that allow the blind to move freely.

However, the primary issue for blind individuals is to know how to reach their desired destination, and they require the support of those who can see. White canes, guiding dogs, and human guides are only a few of the limitations of current options. White canes are the most popular mobility aid among visually impaired people, yet they are not very useful. To aid those with disabilities, assistive technology has been developed recently. Low-cost assistive devices will be easier for the underprivileged to access as technology develops. Although various frameworks have been created to aid people with visual impairments, many of them have a narrow range of application.

Widespread use the visually impaired community and enhance their quality of life. One such example is the smart gloves for the blind that we discuss in this post. Blind people can walk more confidently in social settings thanks to the smart glove's ability to identify obstructions. Distance sensor technology-based obstacle tracking systems can monitor traffic conditions with a wider detection field and warn users of impending dangers.

We created smart gloves for the blind using an Arduino microcontroller in order to provide flexible, lightweight, and economical clothing. When an obstacle is detected, the ultrasonic sensor turns on, turning on the vibration motor and alerting the blind to potential problems ahead. The gadget can also send notifications to

II. LITERATURE REVIEW

In recent years, several initiatives have emerged to help visually impaired individuals by developing aids that identify obstacles and alert them when they are in danger. However, many of these systems have limitations and restrictions. Ultrasonic sensors are a popular sensor system used in many existing devices such as canes and head-mounted devices. Still, there is a need to develop a more cost-effective and reliable paradigm for helping the blind to solve everyday problems.

In 2011, S.Gangwar created a smart stick for the visually impaired that uses infrared (IR) sensors to provide early warning of any sensed obstacles and alerts the user through vibration signals.

Benjamin et al. in 2019, it developed a smart stick that uses laser sensors to detect objectsand emits a high-pitched "beep" tone through headphones to alert users to obstacles in the way.

Amirul A. Talibetal and Mohd Helmyabd Wahab in 2019 created a cane that alerts the user through vibrations and a voice via earphones.

A. Sakhare and Shruti Dambhare designed a system that uses object detection and machine vision to provide real-time assistance via GPS. This system offers a low-budget and efficient navigation system by providing the user with information about objects around them through vibrations.

A practical solution created by Abhishek Choubey and Dattatray Patil integrates an embedded system with RFID, a sensor, and a cognitive device. The implanted tags are activated when a blind person passes by, and a sensor in the stick reads the tag's ID. The address of the information message connected with the location is decoded by a cognitive algorithm in the recognition device.

A system proposed by Prashant Bhardwaj and Jaspal Singh employs infrared detection tools to locate barriers and gives vibrotactile or aural (buzzer) information to the user to let them know where it is. The sensor module is fixed to a thin headgear, which enables the user to gather information on potential hazards and the best course of action.

III. PROPOSED MODEL

The visually impaired face challenges in recognizing obstacles in their environment, which can cause them to struggle in navigating complex urban spaces. To assist with daily tasks and prevent accidents while traveling alone, various technologies have been developed specifically for the visually impaired. In the design process, we aimed to create a device that would provide a better walking experience for blind individuals, potentially eliminating the need for a white cane or similar device. The device can be worn as a band or cloth, requiring minimal preparation. Components of the proposed system include an Arduino UNO, ultrasonic sensor, PCB board, voice playback modules, buzzers for obstacle detection, GSM module for emergencies, jumper cables, power bank, and elastic and stickers for wearability.

The hardware model aims to detect obstacles or items within a specified range, with sensors placed along the path. Upon detection, the vibrating motor and buzzer activate, signaling the user to adjust their route accordingly.

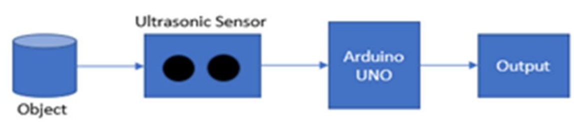

Fig.1: System Module

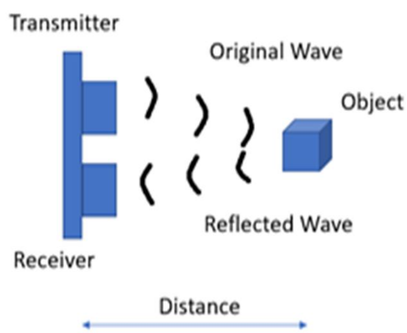

Fig.2 : Working of Ultrasonic Sensors

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IV. METHODOLOGY

The wearable belt was tested in a closed environment with reduced sunlight. The testing process was divided into two parts: obstacle detection and distance measurement. To pass the obstacle detection test, the belt had to perform successfully under the test conditions. The first test involved placing the prototype 30cm away from an obstacle, and the sensor successfully detected the presence of the object. The second test was to check the boundary conditions by placing the prototype 5m and 10m away from the obstacle, and the sensor was able to detect objects at both distances. The final test was to place the prototype 20m away from the obstacle, where detection is not possible, and the prototype did not detect any object. Therefore, the range testing phase was successful.

The second phase involved testing the distance measurement capability of the wearable belt. The test was successful up to a certain range. For pothole detection, the Right Angle Triangle Algorithm was introduced, which involves calculating the sum of the square of the length of the object and the distance from the feet to the belt. If the theoretical hypotenuse length is less than the practical length, then the buzzer will alert the user. This tilted-ultrasonic sensor works differently from other sensors.

A. Block Diagram

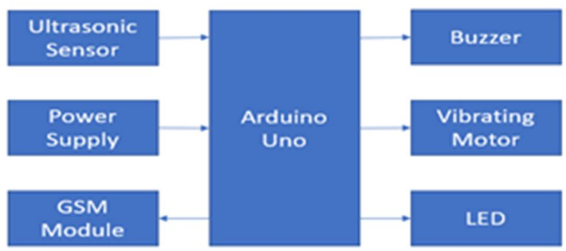

Fig. 3: Block diagram of Smart Guidance Belt

Fig. 4: GSM Module

B. Flow Chart

Fig.5 :System Flow chart of Obstacle Detection

The Ultrasonic Sensor checks whether an object is in range of the sensor or not. If the object is in range, it will make the buzzer to vibrate so that the blind man gets to know whether to stop or not.

V. CONCLUSION

Assisting people with visual impairments can be a challenging task, as they often face difficulties in completing everyday tasks and may experience marginalization. To address these challenges, a new Guidance assistance for the Blind has been developed using Arduino technology that is both affordable and accessible. This flexible system acts as an artificial guided vision system, providing a practical and portable solution to detect obstacles of any size or height. By enabling visually impaired individuals to move freely both indoors and outdoors, this system enhances their self-sufficiency and serves as a virtualized eye for those who cannot detect obstacles with their senses. The current prototype is a simple glove that has limited features due to its small size, but future upgrades will include better sensors and a smart navigation system that allows individuals to navigate easily without relying on maps. The Third Eye is a vibration-based gadget that can significantly enhance the mobility of visually impaired individuals, and further improvements can be made to enhance its performance.

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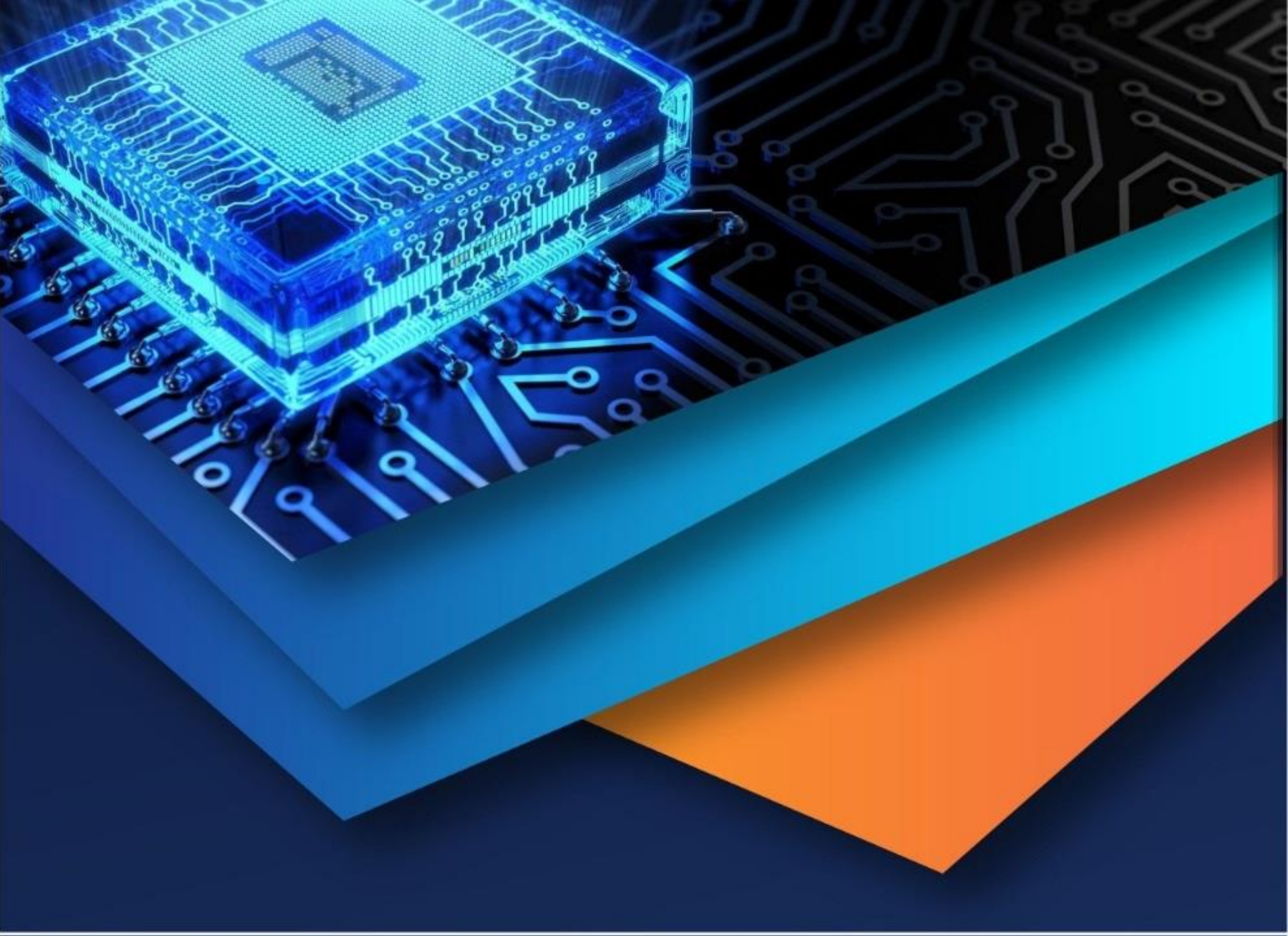

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