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VISTA (VISUAL IMPAIRMENT SAFETY TECHNOLOGY AID)

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ABSTRACT

The smart shoe warns visually impaired people of obstacles in their way while they are walking in public. Moving around independently in public places is a challenge for many disabled people, especially people who are visually impaired. Fire hydrants, potholes, steps, etc. are some of the obstacles people who are blind and low vision need to be careful about. Now, an innovative s1mart shoe aims to help them negotiate such obstacles and move around in a safe and independent. This smart shoe has sensors that warn blind and low vision people about various obstacles in their way with acoustic and visual warning signals, as well as vibration feedback. It has a built-in battery, ultrasonic sensors, a processing unit, and a wireless connection to the smart phone. All of this is mounted in water and dust resistant casing at the front of the shoes. This makes it tough and durable for any kind of weather.

Keywords: IOT Device, Buzzer, Microcontroller, Ardunio NANO, Ultrasonic Sensor, Vibrator Motor, 9Volz Battery.

I. INTRODUCTION

IOT is all about making physical stuffs communicating with each other and, hence our project is based on this application. Smart shoes for blind person. This shoe will be enriched with various sensors with their numerous features which would help blind persons to make their way to destination. People with visually impaired faced most of the challenges in the environment. The long Hoover Cane used by them is not advantages while walking and travelling. Smart shoes are a smart footwear technology.

It adopts smart phone applications to support tasks cannot be done with standard footwear. The uses shows vibrating of the smart phone to tell users when and where to turn to reach their destination via Google Maps or self-lacing. Using smart shoes for visually impaired people need not to be depending on others for mobility.

The systems we have designed consist of sensors and vibrator for sensing the surrounding environment and giving feedback to the blind person. It is used as a safety device as well as navigation device. The electronic hardware will be fixed in shoes for users. User will wear the shoe and travel anywhere and attached sensor will be sense obstacles near to the shoe's alerts with the help of visually impaired people.

India contributes about 21% of the blind people over total population. In a million population, there are around 53 thousand persons that are visually impaired, 46 thousand are having low vision and around 7000 have completely lose the vision. 285 million people are estimated to be visually impaired worldwide out of which 39 million people are blind and 246 million have low vision. Smart shoes will help the visually impaired person to move on independently with help of ultrasonic sensor to detect obstacles.

II. LITERATURE REVIEW

In India, about 40 million people were blind, and 1.6 million were children. Traveling alone for blind people is very challenging, and they have to rely on others to perform most of their daily tasks. For blind people, walking on the road is very challenging because they cannot see any obstacles they may encounter with a stick in their hand. In this regard, the intelligent shoe design offers the blind a long-term solution to walk independently on roads. These shoes will ease them in reaching their destination unassisted. The shoes are equipped with IoT technology with various sensors, microcontrollers, and integrated buzzers. A buzzer sound will be produced when the user nears an obstacle. Smart glasses designed with IoT to enhance efficiency are also incorporated into the sensors to help detect objects over a wider field. The intelligent footwear and the intelligent lenses communicate with each other and coordinate to ensure that the user does not encounter any obstacles.

For the elderly, technology is increasingly needed to allow them to live more independently. The MATUROLIFÉ safety system funded by EU Horizon2020 was to develop solutions that integrate intelligent fabrics to help older adults to improve their well-being and independence. Accordingly, a qualitative study by Callari explored an 'intelligent' footwear integration technology.

Smart shoe is equipped with smart technology and can be a promising internet-related future health. Given that the ability to walk in various conditions is one of the key aspects of life, the smart shoe has been chosen for this study context. Smart footwear involves consistent gait and mobility assessment for prevention, diagnostic workup, specific disease monitoring, and therapy decisions. Innovative solutions and services to promote and reinvent healthy living and health care are conjectured to take the form of coherent and wearable computing systems.

Chandekar et al. presented a paper examining the existing solutions designed to ensure independent mobility for people with disabilities and a new design that would guide a visually impaired person while navigating with the embedded Sensor of Smart Shoes and provide a warning to the person on the incoming obstacles. Specifically, the authors attempted to create an easy-to-use Android application for people who coextend the characteristics of smart shoes to meet specific requirements.

Dragulinescu et al. presented smart use methods in special medical applications for gait and foot pressure analysis. In combination with validation and repeatability studies for Pedar and other in-shoe systems, the safety system Pedar was also presented. Pedar apps, mainly in medicine and sports, were then presented. In this study, the authors presented a valuable way to overview and select information in this field, and the authors perceived their study as a pioneer in systems design and functionality improvements and that the study would inspire more studies on the use of sensors in intelligent textiles and in-shoe systems in other domains of application.

Jung et al. developed an auto-powered intelligent shoe to monitor a user's body weight changes. Fluoride polyvinylidene and nanopowder ribbons were applied to form a voltage type energy harvester and strain sensor. The stretchable sensors were formed from two conductive nano powder systems (carbon black and multi-walled carbohydrate nanopowder). These circuits draw in energy, transfer data, and change power sources.

Reddy et al. introduced a solution based on Radio-frequency identification (RFID) and Infrared sensor (IR) technology. The unit was placed inside a blind person's shoe. Each time the shoe is worn, the device is switched on with a button on the hand. Voice and prerecorded messages were used, similar to a museum's tourist guide system. 418 CMC, 2023, vol.76, no.1 MATLAB identifies the voice command and produces the correct voice command to follow to the destination.

Seo et al. developed a module that computes the number of steps from Arduino-based wearable smart shoes through data delivery to Android-based smart phones. The computation was to ensure accurate measurement of steps. Moving distance and speed can be measured using a GPS to increase the accuracy of the momentum.

Truong et al. demonstrated the application of an off-shelf Smart Band and two Smart Shoes in monitoring and identifying daily tasks. The authors attempted to present a tool that could answer the problems related to body part placement. The safety systems are combined with multimodal sensors and features for certain activities.

Wu et al. introduced a system controlled by STM32L432KC (a STMicroelectronics microcontroller). A lithium-ion battery-powered the system, and the battery is chargeable. A gait event recognition algorithm was used to detect the feet' motion status. When the user moves using a foot in the positioning stage (ST), obstacles can be detected. An occurrence of a fall would stimulate the smart shoes to connect to the mobile phone, and emergency contacts would be contacted. The experiments' results suggested that Smart Shoes' performance was stable in real-time, with low false alarm rates.

Yang et al. demonstrated the use of clever shoes. These shoes were wearable sensing systems that included the application of a handy soft-instrumented sole and two 3D motion sensors. A new data structure for the measured ground reaction and foot motion functioned as a "sensor image". A co evolutionary auto encoder was

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applied, merging the multisensory datasets and extracting the concealed characteristics of sensor images. The proposed method showed its ability to learn joints' torques and satisfactory widespread properties.

Zhou et al. designed rationally as a composite structure. The purpose was to allow the full usage of pressure distribution of a footfall and the delivery of an output of power of up to 580 µW. In addition, the insulation could be operated without affecting power output consistency in harsh environments, including pluvial conditions. On the floor, there were 260 light emitting diodes.

III. PROPOSED METHODOLOGY

3.1. Working Principle

The following are the general methodology that can be used as a guide to implement our project:

1. We have interfaced Arduino NANO v3 with ultrasonic sensor to detect the obstacles using ultrasonic waves.
2. The buzzer (sounds) alerts visually impaired people over objects which are coming between their ways and could help them in walking with less accident.
3. In this smart shoe, Arduino NANO v3 carries a main role. We have interfaced all the sensors and other components into the microcontroller.
4. Needs Assessment and Problem Definition: Identify the challenges faced by visually impaired individuals in navigating environments (lack of spatial awareness, reliance on assistance).
5. Research Existing Solutions: Analyze existing assistive technologies like white canes and guide dogs, highlighting their limitations (limited detection range, resource intensiveness).
6. System Design: Determine the core components - Arduino microcontroller, ultrasonic sensors, vibration motor/buzzer, and battery.
7. Sensor Placement: Decide on the number and positioning of ultrasonic sensors (e.g., front, sides, potentially ground level) for comprehensive obstacle detection.
8. Arduino Programming: Develop code for the Arduino to manage sensor data, control notification triggers (vibration and/or buzzer) based on obstacle proximity, and potentially implement a sleep mode for power efficiency.

3.2 Block Diagram of Visual Impairment Safety Technology Aid

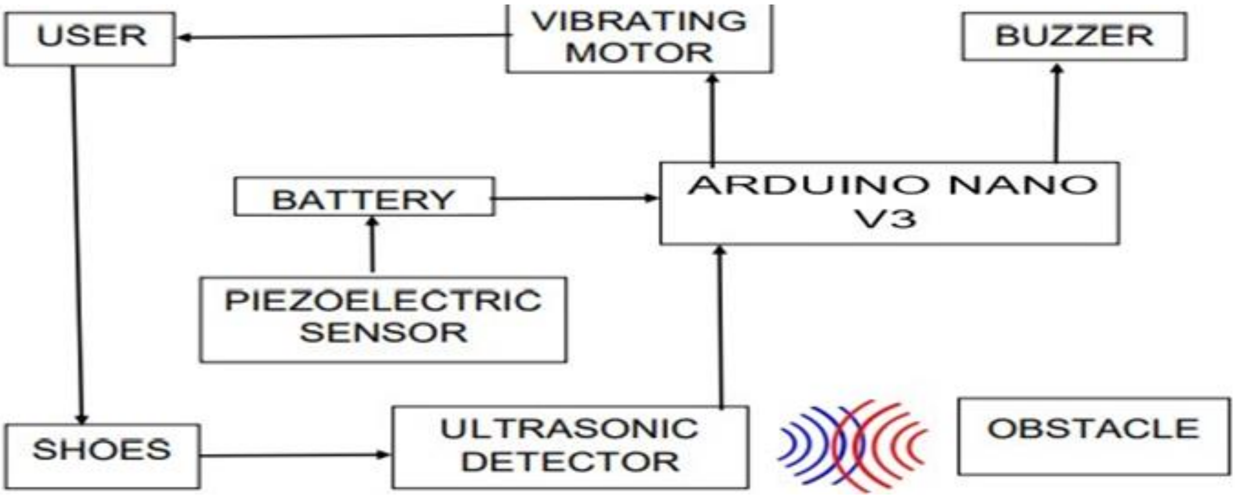

Fig 3.1: Block Diagram with explanation

IV. APPLICATION OF HYDROSONIC TDS MONITORING SYSTEM

1. **Enhanced Obstacle Detection:** By incorporating multiple ultrasonic sensors strategically placed (e.g., front, sides, potentially ground-level), your shoes offer a wider range of obstacle detection compared to traditional forward-facing designs. This improves safety and navigation confidence for users.
2. **Refined User Feedback:** The variable vibration intensity based on obstacle proximity provides the wearer with a more nuanced understanding of their environment. Stronger vibrations for closer obstacles allow for quicker reaction times.

3. **Improved User Experience:** The inclusion of a sleep mode in the Arduino program optimizes battery life, reducing the burden of frequent recharging and enhancing user convenience.
4. **Customizable Notifications:** The dual notification system with a buzzer offers users a choice between vibration or audible alerts depending on their preference or situational needs.

V. PROBLEM STATEMENT

Blind and visually impaired individuals experience significant challenges navigating unfamiliar environments due to the lack of visual information. This can lead to decreased independence, safety concerns, and a reliance on sighted assistance for everyday tasks. Current assistive technologies like white canes provide limited obstacle detection capabilities.

This project aims to develop a more comprehensive solution by creating "blind shoes" equipped with ultrasonic sensors. These sensors will detect obstacles in the user's path, providing real-time feedback through vibration and potentially sound to enhance spatial awareness and promote independent navigation. Navigating unfamiliar environments poses a significant challenge for those who are blind or visually impaired. Traditional tools like white canes offer a single point of contact with the ground, primarily detecting forward obstacles, leaving them vulnerable to hazards on the sides or overhead.

This project aims to address these limitations by developing "blind shoes" equipped with ultrasonic sensors. This innovative technology promises to enhance obstacle detection in a wider range, providing real-time feedback through vibration or sound, ultimately empowering visually impaired individuals to navigate their surroundings with greater confidence and autonomy.

VI. OBJECTIVE OF THE STUDY

1. To development of an Electronic Travelling Aid (ETA) kit to help the blind people to find obstacle free path.
2. To provide overall measures object detection, human detection, and real-time Assistance system consist of microcontroller, ultrasonic sensor and a buzzer.
3. To detect the distance between the user and the obstacle and alerts the user.
4. To help the visually impaired to navigate via GPS.

VII. CONCLUSION

In conclusion, this project successfully developed a prototype for "blind shoes" utilizing Arduino, ultrasonic sensors, and user feedback mechanisms. By incorporating multiple strategically placed sensors, the shoes offer a wider range of obstacle detection compared to traditional assistive devices. The variable vibration intensity and optional buzzer notification system provide the user with a nuanced understanding of their surroundings. Furthermore, the project prioritized user experience through a sleep mode in the Arduino program, optimizing battery life. These features collectively contribute to a more user-friendly and informative assistive technology solution with the potential to significantly improve navigation confidence and independence for visually impaired individuals.

VIII. FUTURE SCOPE

Future iterations could explore additional functionalities like incorporating more sensors or refining the feedback mechanisms to further enhance the user experience.

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