

Review on Real Time Multi-Utility Shoe for Visually Impaired Persons using Internet of Things

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Abstract—Making physical objects talk to one other or to people is the core idea behind the internet of things. It is an information technology that is expanding and developing quickly. The creation of assistive equipment is necessary due to the rise in the population of persons who are blind. This issue can be resolved by using a tool that acts as an intelligent guide for blind individuals. Our idea is to help blind people carry out their daily tasks, especially navigation. It is constructed utilising Internet of Things technology, and the shoe will have several sensors, a microcontroller, and a panic button incorporated in it. When the wearer steps in front of an obstacle, the shoe alerts them by sounding the panic button. Ultrasonic sensors are used for obstacle detection, and Bluetooth sends a voice command when an obstruction is found. Moisture sensor warns of slick surface. In order to locate the blind for simple tracking and to send an SMS to the guardian in case of emergency, the system uses GPS and GSM modules. To prevent the user from running into any obstacles in his path, the smart shoe collaborates and interacts with one another. It will also be helpful to use GPS to locate the person in real time and measure their temperature and heart rate. The device's main objective is to give blind people a simple and practical navigational tool that enables artificial vision by providing information about the environment and the static and moving objects nearby.

Index Terms— Smart shoe, Ultrasonic sensor, Water sensor, GPS-GSM tracking, piezo-electric plates, Bluetooth, Arduino uno, IOT (Internet of Things).

I. INTRODUCTION

An eye is a vital part of the human body that allows a person to see his surroundings. According to a recent World Health Organization (WHO) report, India is home to nearly 30% of all blind people worldwide. The number of visually impaired people in India has now reached 12 million, and this figure is expected to rise in the coming years. The data show how serious the problem of blindness is in India. Blindness can be classified into two types: partially blindness and completely blindness. Partially blindness is a condition in which a person can only perceive a portion of visual light and is completely blind. Blindness is defined as the total absence of visual light interception. Many people suffer from severe visual impairment, which causes them to become trapped in their familiar surroundings. People who are completely blind are unable to perform even simple tasks such as turning on a fan, finding their daily belongings, or going for a walk. The main issue with blind people is a loss of self-esteem and physical integrity, which causes them to lose confidence. When they enter a new environment,

they must memorise the location of every object of their need and every obstacle. As a result, they require some tool or technique to assist them in their mobility and daily activities. One method is to use a trained dog to assist a visually impaired person in moving by navigating around an obstacle. However, this method is inefficient because training a dog takes a lot of effort and time, and it is also difficult for a blind person to care for other living creatures. Another method is to use a cane, which is inconvenient due to its limited range. Smart shoes allow visually impaired people to move around without relying on others. Three categories of smart footwear exist: electro-mechanical, mechanical, and electronic smart footwear. The three categories of mechanical smart shoes include spring-levered pedometer-based smart shoes, actuator-based smart shoes, and passive pump-based smart shoes. Electromechanical smart shoes come in two different variations. The smart shoes have a generator built into them like the first. Generators based on solar panels, piezoelectric, or electromagnetic technology could be applied. The second kind of electromechanical smart shoe vibrates mechanically by use of embedded motors. The vibrating motors in such shoes are connected to the smart shoes. The two primary methods of connectivity for electrical sensor-based smart shoes are wired and wireless. Wireless Bluetooth connectivity is always preferred over conventional cable connectivity. The solutions we created have sensors and a vibrator for detecting the surroundings and giving the blind individual input. It functions as a navigational and safety tool. Electronic hardware will be installed in the users' shoes. Wearing the shoe allows the user to go around anywhere, and the sensor linked to it allows it to provide notifications to persons who are blind about potential hazards. A wearable gadget with the idea of safety and tracking is incorporated into smart sneakers. The suggested system's intelligence comprises functions including walking electricity generation, blind person obstacle detection, and user position monitoring. This multifunctional sneaker aims to serve a unique function as a sensory tool for blind persons. It is frequently used to find path holes and find things with an ultrasonic sensor. The ultrasonic sensor sends data to the Arduino after determining whether an object is there. The distance of an object and the distance between transmitting the signal and receiving it back are both objectives of this effort. A voice command is sent by Bluetooth when it discovers an obstruction. The moisture sensor delivers a surface-slip warning. GPS and GSM are used to pinpoint the location. Buzzers are used in this project to inform the user of where the nearest obstacles are. Using a MEMS sensor and a heartbeat sensor, respectively, we also calculate calories and a person's heart rate in this research. The user is intended to become independent and to be shielded from dangers that could be fatal.

II. REVIEW OF PREVIOUS WORK

Many methodologies have been proposed by many authors, including Smart stick for blind, Smart stick using LASER sensors, electronic cane for blind, Electronic Path Guidance for Visually Impaired People, Review on Obstacle Detection and Vision, and A Smart Infrared Microcontroller Based Blind Guidance System has been proposed by many authors and the detailed explanation about these methods is as follows:

Internet of Things - Enabled Smart Shoes for Blind People were created by Pratik Bhongade [2022][1] to make these people's lives easier, safer, and more self-sufficient while also monitoring their fitness and health. This shoe makes daily tasks easier for blind individuals, especially navigating. Additionally, the project offers GPS-GSM navigation, position monitoring, and an emergency SOS service to assist blind persons in any emergency. "Smart Shoe Gadget for Visually Impaired People" was created by Ravish Javed [2022][2]. The idea behind the smart shoe prototype is to help visually impaired people walk independently indoors and outdoors by alerting them to objects and wet surfaces in their path. Low-Cost Smart Shoe for Visually Impaired was created by M. Anisha [2021][4]. When an object or barrier is detected up to a specified distance, the designed shoe will inform the receiver via audio or vibrator. By employing an alert to signal items in their way, this enables blind persons to avoid several hassles. Teja Chava [2021][5] designed an IoT-powered Smart Shoe for the Blind. This shoe contains sensors, a microcontroller, and buzzers. When the user walks in front of an obstacle, the shoe warns him or her by making a buzzing noise with the buzzer. Pradeep Kumar created the "Real Time Assistive Shoe for Visually Impaired People" [2021][6]. A lightweight controller and sensors are included in the shoe module, while a GPS system is included in the phone module. The shoe module's controller is connected to a Bluetooth transceiver, which in turn communicates with a smartphone app that directs the user using Google Maps. Manali Tayade [2021][8] designed smart shoes for visually impaired people using IOT. These shoes include sensors, microcontrollers, a buzzer, a speaker, and a vibration motor. When the wearer walks in front of an obstacle, the shoe alerts him or her. It also detects wet floors and water bodies and issues an alert. Qianli Xu[2020][9] "Design and assessment of vibrating footwear for the navigation help of visually impaired people." created using a haptic shoe and cell phones By integrating the user's walking state with transmitting the corrective direction to visually impaired persons, it gives information to blind people.

A. Obstacle Detection

There are three ultrasonic sensors, one IR sensor, one buzzer, one vibrator motor, one speaker and power supply are linked together using an Arduino Uno, the ultrasonic sensor operates on the principle that it consists of two parts: a sender and a recipient. Sound waves are continuously emitted by the ultrasonic sensor. These move at the speed of sound through the atmosphere. The waves' pulses are returned to the receiver as echoes if they hit an object. The ultrasonic sensors are interacted with using an Arduino Uno. Arduino sends trigger signals to the ultrasonic sensor, which has a duty cycle of 10 microseconds for the specific sensor being used, in order to measure the distance between the object and the sensor. The timer begins and 8 acoustic wave bursts are produced by the ultrasonic sensor when it is activated. The sensors generate a strong pulse that is precisely timed to correspond to the interval between the transmitted and received ultrasonic bursts. Arduino converts the time signal into the distance measurement. To improve system efficiency, three ultrasonic sensors are deployed. If the object is in different directions, the use of a single ultrasonic sensor does not reflect the pulse. As a result, combining three ultrasonic sensors with the Arduino yields the best results. The three sensors operate in a linear fashion but not simultaneously. The first ultrasonic sensor will look for any objects, and if none are found, the second ultrasonic sensor will take over, and so on. The assigned distance is 50cm, so if an object is detected within this range, the buzzer will begin buzzing, vibrator motor vibrates. They operate on the fundamental principle of light reflection. The IR light is emitted by the IR transmitter, and when it hits a surface and bounces back, the photodiode detects the IR Light, letting sensors know there is an object in front of them. Whenever an object appears in front of the sensor, a corresponding voice command is played through the Bluetooth.

B. Water Detection

The presence of water can be detected using the water sensor. Sensor consists of a sequence of ten exposed copper traces, where five of the traces are power traces, while the other five are sense traces. These traces are placed in parallel so that every two power traces have a sense trace in between them. These traces are not connected until they are underwater and until they are united by water. The traces serve as variable resistance, with resistance that fluctuates with water level. whenever the water is detected by the water sensor, the analogy data from the sensor is translated into digital data with the help of Arduino nano microcontroller. The alert is given to the blind people with the help of Bluetooth. A preinstalled audio message will be played through the speakers.

C. Fall Detection

This sensor is used to detect the fall. A combination of an accelerometer and gyroscope are included within MPU6050 sensor module. The accelerometer provides information about the angular parameters of data, while the gyroscope determines the orientation. The comparison between the acceleration magnitude and the threshold value is done to detect a fall. When a fall is detected by the model an alert message is sent to the concerned person with the help of microcontroller.

D. Power Generation

A piezoelectric sensor is a device that converts and changes in pressure, acceleration, temperature, strain, or force into an electrical charge in order to measure them. It is employed to determine how many steps a user took at a particular time.

E. Health Monitoring

Temperature sensor is mostly used to measure the body temperature and sometimes it can also measure the atmospheric temperature. The heart beat sensor Is used to determine the heart rate of the person. In case of any emergency situation if person press panic button the alert message is send to guardian.

F. GPS and GSM Tracking

The shoes have a GPS tracking gadget built into them. The shoes, as well as the person wearing them, can always be promptly located via a Web-based monitoring dashboard because the device constantly communicates location coordinates to a central monitoring system.

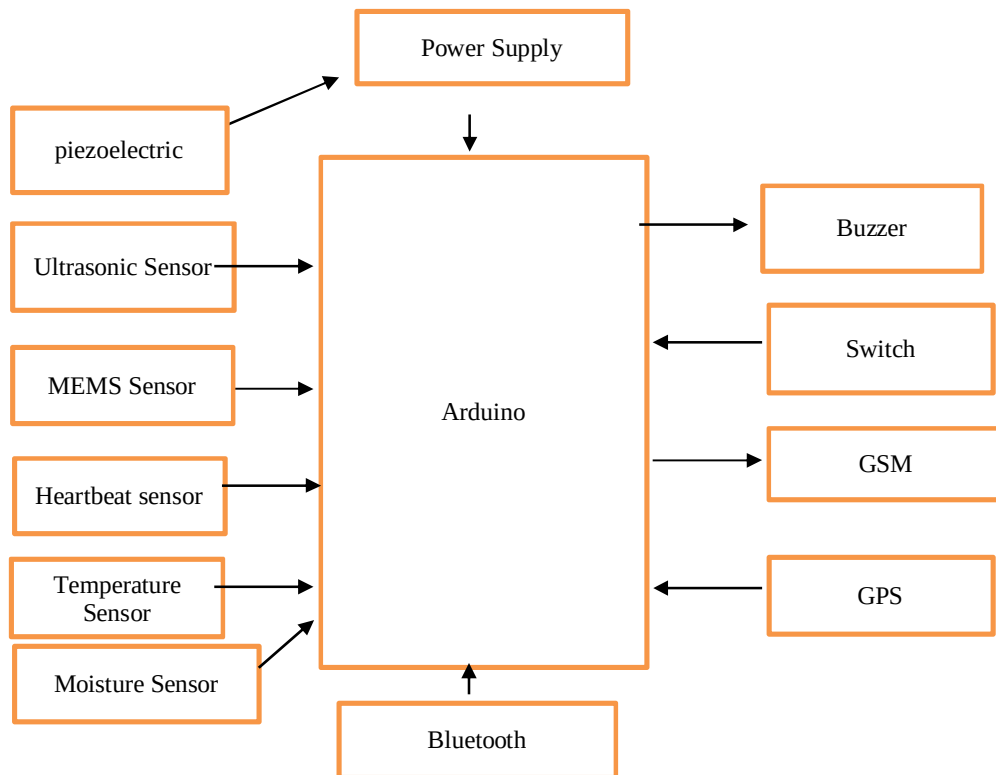
global system for mobile communication (GSM). This design will continuously track the whereabouts and update their guardian on the situation. In order to do this, a GSM modem and a GPS receiver are connected serially to a microcontroller. The latitude and longitude of a person are sent from a distant place using a GSM modem. The GPS modem will continuously transmit information about the person's location, such as latitude and longitude. The position of the person is requested using the same data that is sent to the mobile phone at the

other end. The system automatically sends a back response to that mobile when a user sends a request to the number at the GSM modem, showing the person's location in terms of latitude and longitude in real time. Almost all Arduino Modules may be programmed, compiled, and uploaded to using the **Arduino IDE**, an open-source programme created by Arduino.cc. Even a layperson with no prior technical expertise can begin learning to compile code thanks to official Arduino software. The Arduino Uno, Arduino Mega, Arduino Leonardo, and many other models are examples of Arduino modules. A microcontroller that has been programmed and can accept data in the form of code is located on the board of each of them. A Hex File is eventually produced by the primary code, often referred to as a sketch, written on the IDE platform and transmitted and uploaded into the board's controller. Two fundamental elements make up the majority of the IDE environment: the Compiler, which is used to compile and upload the code into the provided Arduino Module, and the Editor, which is used to write the necessary code.

III. PROPOSED SYSTEM

The system used in this work detects the obstacles which makes the buzzer to alert to assist the visually impaired people thereby will help to navigate while travelling. To measure the obstacles distance ultrasonic sensor was used.

- i. Input Stage: - It consist of two HC-SR04 ultrasonic sensor, the sensor is uses to detect obstacle in the path of blind person. A water sensor is also used which is mounted on bottom of shoe which will detect presence of water in the blind person path.
- ii. Control Stage: - It consists of a microcontroller here we used Arduino Uno; the microcontroller receives the obstacle distance via ultrasonic sensor, microcontroller has inbuilt comparator which will compare obstacle distance and reference distance and then generate an error as according. The microcontroller also receives the signal from water sensor. The microcontroller is programmed in such a way that it will sends a required trigger signal to the two vibrating motor and a piezo buzzer whenever error is found to be beyond tolerance range.
- iii. Output Stage: - It involves two-coin vibrating motor which will act according to signal receive by microcontroller. A piezo buzzer is also there that sound when water sensor detects presence of water.



IV. CONCLUSION

The creation of an IoT-based Smart shoe is discussed, which is particularly helpful for blind people as it would allow them to go from one location to another without the help of others, increasing their autonomy. The created smart sneakers will help with navigation while walking and inform the user if any danger or discomfort is identified. They are fitted with several sensors. The created prototype accurately detects impediments in front of the user at a distance. For the blind, it will be a wonderful blessing. The Smart Shoe can also be used to navigate by connecting to a GPS at the same time. By generating electricity while moving and storing it in a piezoelectric sensor for later use, this work can be improved. You could save electricity by doing this. In order to simultaneously charge the battery and power the circuit, the LTC3588 module can be utilised to capture the energy offered by piezoelectric transducers.

REFERENCES

- [1] Pratik Bondage, Sanyukta Girhay; Abdul Moeid Sheikh; Rahul Ghata; Chitra Dusane "Internet of Things - Enabled Smart Shoes for Blind People" , IEEE Delhi Section Conference,2022.
- [2] Ravish Javeed; M. Saleh Alghannam; M. Fahad; Mahdi Al Qahtani; "Smart Shoe Gadget for Visually Impaired People", European Journal of Applied Sciences, Vol. 10 No.2, 2022.
- [3] P. Ebby Darney; A. Essaki Muthu; K. Jeyakumar; R. Santhana Krishnan; Y. Harold Robinson "IoT based Smart Shoes for Blind people" 3rd International Conference on Electronics and Communication Systems (ICESC),2022.
- [4] M,Anisha; S. Kirthika; D.Jemimah Harline; P. Thenmozhi; R Rubala.; T. Girija Pragathi; M. Benisha;"Low-Cost Smart Shoe for Visually Impaired" , IEEE Section Conference,2021.
- [5] Tejachava, A.Tarak Srinivas ,Lohith Sai,Venubabu Rachapudi, 2021 "IoT based Smart Shoe for the Blind" 2021 6th (International Conference on Inventive Computation Technologies), IEEE ,26 February 2021, Coimbatore, India.
- [6] Sulaiman khan, Shan nazeer, Habbib ullah khan, "Analysis of navigation assistance blind and visually impaired people" IEEE Section Conference, Jan 2021.
- [7] Pradeep Kumar M; Inchara K M; Lekhashree S; Likhith C N; Pavan U "Real Time Assistive Shoe for Visually Impaired People" , 6th International Conference for Convergence in Technology (I2CT) IEEE, April 2021.
- [8] V Nandalal; V Anand Kumar; Sujitha A; Sumitha G; Sureka A S "Intelligent Multi-Utility Shoe for Visually Impaired Persons" ,2nd International Conference on Smart Electronics and Communication (ICOSEC),2021.
- [9] Manali Tayade¹, Serena Matla², Raghuvveer Deepala³, Yash Dekate⁴, Harsh Kadam," smart shoes for visually impaired using iot", International Research Journal of Engineering and Technology (IRJET),2021.
- [10] Xu, Qianli, Tian Gan, Shue Ching Chia, Liyuan Li, Joo-Hwee Lim, and Phyo Kyaw Kyaw. "Design and evaluation of vibrating footwear for navigation assistance to visually impaired people", In IEEE International Conference on Internet of Things (iThings) and IEEE Green Computing and Communications (GreenCom) and IEEE Cyber,2021.
- [11] Roy abi zeid daou; Jeffrey chehade; Georgio abou haydar; Ali hayek; Josef boercsoek "Design and implementation of smart shoes for blind and visually impaired people for more secure movements" 32nd international conference on microelectronics (icm),IEEE,2020.
- [12] Divya V Chandran¹ , Aswathy N² , Parvathy S Kumar³ , Neelima Sunil⁴ , Nikhil Krishnan⁵ , Parvathy Krishnan" Smart Shoes – An Aid To Blind People", International Journal of Advanced Research in Computer and Communication Engineering Vol. 9, Issue 12, December 2020 .
- [13] Niveditha k, Anitha K, Jayaprakash K, Sathish Kumar" Smart shoe for alzheimer patients", European Journal of molecular and clinical medicine Vol.07, Issue 09, 2020.
- [14] N.Loganathan,K.Lakshmi, N.Chandrasekaran, S.R.Cibisakaravarthi; R.Priyanka, K.HarshaVarthini "Smart Stick for Blind People", 6th International Conference on Advanced Computing and Communication Systems (ICACCS), March 2020.
- [15] Varsha singh; Savita Sindhu; Romisha Arora "BUZZFEET: Blind Man Shoes", International Conference on Machine Learning, Big Data, Cloud and Parallel Computing IEEE, 16 February 2019.
- [16] H. Xia, J. Charlton, M. Hunt, P. Shull, "Preliminary test of a smart shoe for training foot progression angle during walking", Osteoarthritis and Cartilage 27, S64, research gate, (2019).
- [17] Akhlaqur Rahman; Kh. Fatema Nur Malia; Md. Milan Mia; A.S.M Mehedi Hasan Shuvo; Mahmudul Hasan Nahid;"An Efficient Smart Cane Based Navigation System for Visually Impaired People" , International Symposium on Advanced Electrical and Communication Technologies (ISAECT) IEEE , 29 November 2019.
- [18] Yi-Qing, Zhi-Kai Gao, Zhang-Jian Shao, and Gu-Yang Liu. "Intelligent ultrasonic detection of walking sticks for the blind." 9th International Conference on Electronics, Computers and Artificial Intelligence (ECAI), pp. 1-4. IEEE, 2019.