

Sole mate-Electronic Shoes to Assist Visually Challenged

Rashmi R., Swathi S., Murari Hanisha, S. Rahul, Rashmi S.

Abstract

Making daily living easier has always been a goal of technological development. Everyone in today's fast-paced world uses technology to their advantage, except for some regions. Society. One of them is visually impaired and must contend with many difficulties on a regular basis. One of their biggest issues is getting around, such as crossing roads, taking trains, or going to public places, all of which frequently require human help. Occasionally, if support is not provided, they are left defenseless, resulting in the visually impaired being dependent on other kinds of assistance such as guide dogs and canes. These are undoubtedly the most conventional methods. But these methods are often not efficient and need a lot of training, without which it might be dangerous to themselves and others. Instead of a cane, a smart shoe is created in this instance because it is more effective and practical. This system includes an ultrasonic range finder circuit for obstacle detection, a Bluetooth module with GPS technology to provide voice guidance to the desired location, and in emergency situations, it will send an SMS alert to registered mobile numbers via the Android application. This system offers a user-friendly and accessible navigational aid for people who are blind or visually impaired, which is a wonderful help for artificial vision by giving details about the environment and the static and moving objects nearby.

Keywords: Smart shoe, ultrasonic sensor, renesas microcontroller, water sensor, LCD, bluetooth, android application.

INTRODUCTION

One of the most vital senses is sight because it provides us with most of the environmental information. The serious impairment of blindness affects millions of individuals worldwide. Blindness can significantly lower a person's ability to communicate, navigate their environment, and engage in everyday activities, all of which have a negative impact on their quality of life. Over 2.2 billion people worldwide have a near- or distance visual impairment, according to the WHO. At least 1 billion of these cases roughly 50 percent involved vision loss that could have been avoided or is now untreated. The main causes of vision impairment are cataracts, which can be surgically removed, and

refractive problems, which can be corrected with eyeglasses. Other reasons include glaucoma, diabetic retinopathy, and age-related macular degeneration. Although uncorrected refractive errors are the primary cause of moderate and severe vision impairment, cataracts are the major cause of blindness in middle- and low-income nations. According to estimates, the frequency of viral diseases that cause vision impairment has decreased 20-fold globally. Eighty percent of vision problems can be avoided or treated. Every person who is blind or visually impaired initially has trouble getting around and using public transit. The blind stick continues to be the most often utilized device. Its shortcomings include the need

*Author for Correspondence

Murari Hanisha
E-mail: hanishagupta01@gmail.com

¹Student, Department of Information Science and Engineering, Vidyavardhaka College of Engineering, Mysuru, Karnataka, India

²Assistant Professor, Department of Information Science and Engineering, Vidyavardhaka College of Engineering, Mysuru, Karnataka, India

Received Date: July 29, 2023

Accepted Date: September 12, 2023

Published Date: September 20, 2023

Citation: Murari Hanisha, Rashmi R., Rashmi S, Swathi S, S Rahul. Sole mate- Electronic Shoes to Assist Visually Challenged. International Journal of Optical Innovations & Research. 2023; 1(1): 1–7p.

for extensive practice, the large range of motion, the unreliability regarding dynamic impediments, and range detection.

We propose to add electronic parts and detectors to this cane. Technology is always evolving, and recent advancements can aid in precise artificial navigation. Our model connects to Google Maps for navigation using Bluetooth and GPS technology, which also starts an Android operation. Also, we have employed ultrasonic technology to aid with obstacle detection and hurdle identification. The speaker will ring using this technology for varying durations of time to indicate different distances. We propose to demonstrate a useful, lightweight, and realistic model that makes it easy for people with visual impairments to navigate.

LITERATURE SURVEY

[1] "Smart Stick for the Blind and Visually Impaired People" by Mukesh Prasad Agrawal, Atma Ram Gupta. This paper says that the "Smart Stick" is a device designed to help those who are blind or visually challenged navigate their daily lives. It uses an ultrasonic sensor, water sensor, RF module, GPS-GSM module, buzzer, and vibrator to detect obstructions in the user's line of sight. The microcontroller gathers data and communicates it as vibrations to alert the user of obstructions. An ultrasonic sensor uses sound waves to determine how far away an object is, while a water sensor detects the presence of water in the user's route. An RF module transmits and receives signals between two objects, and a GPS-GSM module is employed to navigate. A battery is used to recharge the device, and a buzzer and vibrator are used to alert the user when a barrier is about to cross their route.

[2] "A Smart Stick for Assisting Blind People" by Ashraf Anwar, Sultan Allandale. From this paper, Blind persons are guided by a smart stick device, which is made up of ultrasonic transducers, infrared sensors, water sensors, heat sensors, and LDR sensors. The Arduino Uno R3 receives sensor signals and analyses them, then outputs pulses to buzzers, vibrators, and voice alarms. The blind man wears earphones to listen to the GPS navigation instructions and a buzzer alarm serves as a warning. The device is reasonably priced, suited for most blind individuals, and effective at enabling independent mobility for blind people.

[3] "Raspberry Pi Based Smart Navigation System for Blind People" by Prof. H.S.Hemane, Arundhati Singh, Sneha Shree, Sagar Pandey. From this paper, The Raspberry Pi-based smart navigation system for the blind consists of a smart stick, a moisture sensor unit, a GPS module, a voice command module, an ultrasonic sensor unit, and a secure digital card. This system provides users with a sense of independence and a safer atmosphere, enabling them to live a regular life. The SD card is used to record distances between barriers and a blind person or to store the navigation path.

[4] "Smart Assistive Shoes and Cane: Sole mates for the Blind People" by S.D. Asha Mahesh, K.Raj Supriya, M.V.S.S.N.K.Pushpa Latha, P.Gowri, T.Sonia, B. Nani. The study focuses on creating a tool to enable visually impaired people to travel more safely and independently. The main purpose of the cane is to detect obstacles and transfer data to inform blind people with speech output. Arduino Lily controller receives information from sensors, processes, and the shoe module.

[5] "Low-cost ultrasonic smart glasses for the blind" by Rohit Agarwal, Nikhil Ladha, Mohit Agarwal, Kuntal Kr. Majee, Abhijit Das, Subham Kumar, Subham Kr. Rai, Anand Kr. Singh, Somen Nayak, Shopan Dey, Ratul Dey, Himadri Nath Saha. This paper says that Ultrasonic Smart Glasses for the Blind are portable, user-friendly, lightweight, and affordable equipment that includes a set of glasses, ultrasonic sensors, a buzzer, and an Arduino NANO central processing unit. The control unit activates the ultrasonic sensors and analyses the information to generate the desired output.

[6] "Design and Implementation of Voice Assisted Smart Glasses for Visually Impaired People Using Google Vision API" by P. Selvi Rajendran, Padmaveni Krishnan, D. John Aravindhar. This paper aims to create a guiding system that uses wearable smart glasses and a sensor to continuously

collect images from the surrounding area. The machine is composed of three components: speech announcement, scenario identification, and barrier identification. The machine was trained using the Context Common Objects (COCO) dataset and the You Just Look Once (YOLO) v3 tool. Two major hardware components of Computer Vision Glass are Raspberry Pi and a small HD sensor. Sensing and object identification, the two most crucial elements, were created using the YOLO philosophy.

[7] "Design of Ultrasonic sensors-based spectacles and waist belt for the blind using low-cost Arduino" by Mr. Yadla Arunabab, Mr. Raghu Ram. From this paper, Real-time obstacle detection and direction-based alerts for Blind People using Arduino are achieved by using sensor-based spectacles and waist belts with audible alerts. Ultrasonic sensors detect obstacles transmitting ultrasonic waves to the microcontroller, which then sends notifications via a buzzer alerting device. Voice command models help users understand and react.

[8] "Low-Cost Smart Shoe for Visually Impaired" by M. Anisha, S. Kirthika, D. Jemimah Harline, P. Thenmozhi, Rubala. R, T. Girija Pragathi, M. Benisha, C. Jim Elliot. This paper proposes an electronically aided shoe to help visually impaired individuals use an ultrasonic detector to locate obstacles. The shoe is designed at a low cost and is more useful and effective than a standard blind stick. Blind individuals can now use an alarm to recognize an obstruction and walk securely and independently on the road. The shoe's low-cost assistance also benefits the visually disabled.

METHODOLOGY

System Architecture

The proposed system design of the smart shoes is as shown in Figure 1 below.

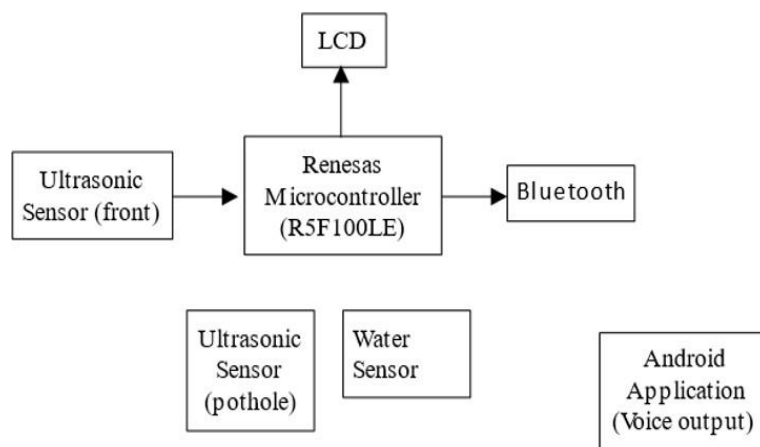


Figure 1. Proposed system design of smart shoes.

Microcontroller

Renesas Microcontrollers are compact electronic components that are utilized in a variety of applications to manage and control numerous operations as mentioned in figure 2. The Renesas microcontroller has three UART connections in addition to 58 input and output pins. Additionally, it features a dedicated power supply pin and LCD display slot.

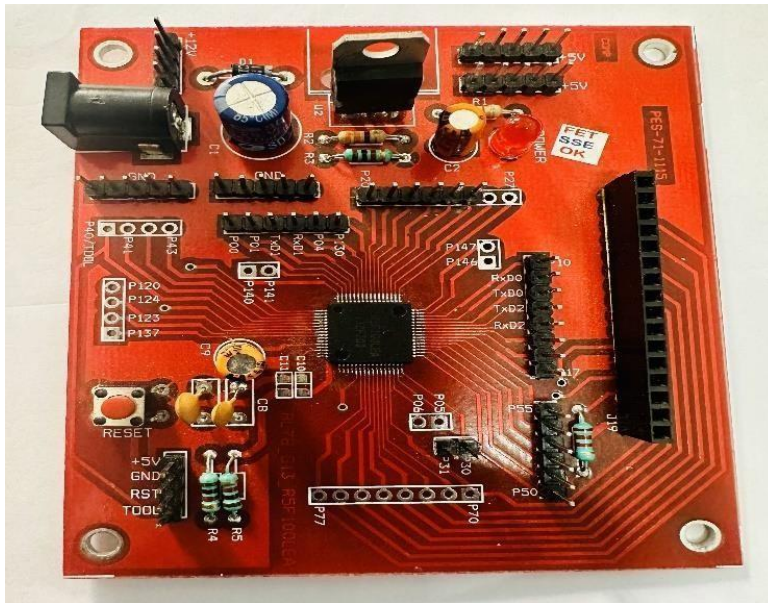


Figure 2. Renesas microcontroller.

Ultrasonic Sensors (HC-SR04)

Ultrasonic sensors are electrical devices that use high-frequency sound waves to measure object proximity, presence, and absence. Two ultrasonic sensors are being used; one is used to detect front obstacles and is situated on the right side of the shoes, while the other is used to detect potholes and is positioned obliquely on the shoes.

Specifications: The operating voltage is +5V and the practical measuring distance is 2cm to 80cm. The configuration pin is Vcc (powers the sensor with +5V) shown in figure 3, Trigger (input pin), Echo (output pin) and Ground (connects to ground of the system).



Figure 3. Ultrasonic sensor.

Water Sensor

A water sensor is placed at the bottom of the shoe as a safety measure against damp surfaces that might cause slipping and injury.

Specifications: The operating voltage is 3.3V to 5V DC shown in figure 4. The configuration pins are Vcc (powers the sensor with +5V), Gnd (power supply ground), DO (Digital out pin for digital output) and AO (Analog out pin for analog output).

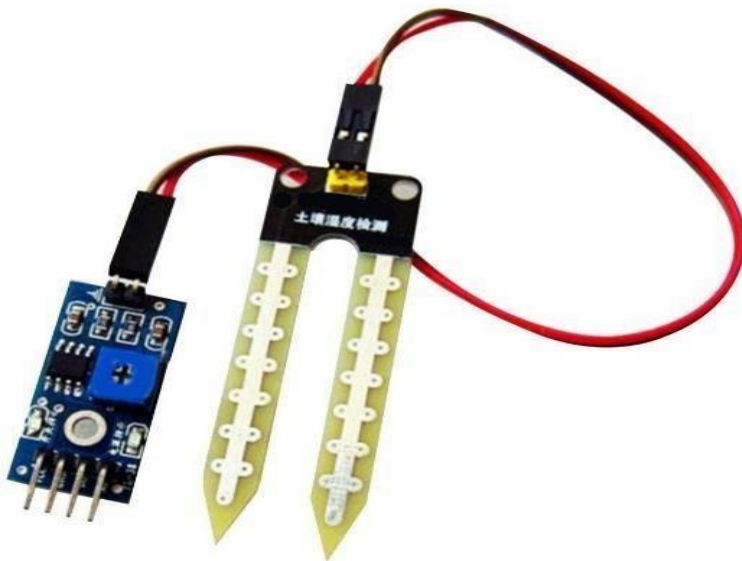


Figure 4. Water sensor.

LCD

In embedded systems, LCD screens are frequently used in conjunction with microcontrollers to show data or user interface components as shown in figure 5. There are many different sizes and resolutions of LCD displays that are compatible with microcontrollers, and they can be connected to the microcontroller using a variety of interfaces, including parallel or serial interfaces.



Figure 5. LCD display.

Bluetooth Module (HC05)

Bluetooth is a wireless technology that makes it possible for devices to communicate with one another nearby. It transmits data between devices via radio waves. The configuration pin is Enable, Vcc (3.3V to 5V), Gnd, Txd, Rxd and State as shown in figure 6.



Figure 6. Bluetooth.

Working

This project aims at providing a proper navigation for individuals suffering from blurred vision and blindness, which happens due to ageing factor and permanently disabled person. Many embedded systems have substantially different designs according to their functions and utilities. In this project design, structured modular design concept is adopted, and the system is mainly composed of a Renesas microcontroller, LCD, Bluetooth, Ultrasonic sensor (HCSR04), water sensor.

The microcontroller located at the center of the block diagram forms the control unit of the entire project. Once the entire unit (comprising of microcontroller and sensors) is worn by the blind person, the sensors begin to monitor the surrounding environmental conditions. The output of the sensors is a voltage which corresponds to the surrounding environmental conditions. This voltage generated by the sensors is fed to the inputs of the microcontroller. In this case ultrasonic sensor input to the microcontroller. Based upon the program embedded within the controller an output is generated and transmitted to the Android based Smartphone via Bluetooth module. An application created and stored in the Android based.

In embedded systems, LCD screens are frequently used in conjunction with microcontrollers to show data or user interface components. There are many different sizes and resolutions of LCD displays that are compatible with microcontrollers, and they can be connected to the microcontroller using a variety of interfaces, including parallel or serial interfaces.

Smartphone generates speech output depending upon the incoming messages transmitted via Bluetooth. Ultrasonic sensor is utilized to locate the distance of any object from the blind person. This can come in handy for individuals with poor sight due to the ageing factor. If any object is located within the range of 10m or 20m, the sensor on detecting the presence of the obstacle delivers an input voltage to the microcontroller which then alerts the person via Android Smartphone using Bluetooth module. In this project, LCD is also utilized to show the working of every unit. In case of an emergency, the blind person can press at the Centre of the phone which sends the current location to the guardian through SMS. Wireless connectivity can be achieved with the help of Bluetooth device to the android application. These things will be achieved with the help of the IOT.

FUTURE IMPACT

By significantly enhancing the lives of blind individuals, we hope to reassure the larger community of people with disabilities that, even if we are unable to fully cure them, we can nevertheless significantly enhance their quality of life. Using cutting-edge technology, they may go about their regular lives. This demonstrates a fresh approach to creating gadgets that can help regular people—as well as those with disabilities—in their day-to-day activities. enabling much increased levels of labour efficiency for humans.

CONCLUSION

Electronic shoes are designed to assist visually challenged individuals who have the potential to significantly improve their quality of life. These shoes can provide real-time feedback about the surrounding environment, such as obstacles or changes in terrain, which can help users navigate more safely and independently. The shoes can also provide haptic feedback, which can help the user better understand their surroundings and detect obstacles. We may anticipate seeing a greater acceptance of these shoes as technology advances and costs come down, which will enable many individuals all over the world to live better lives.

REFERENCES

1. Mukesh Prasad Agrawal, Atma Ram Gupta, “Smart Stick for the Blind and Visually Impaired People”, ICICCT 2018, dated-20-21, April, 2018, IEEE Xplore, <https://ieeexplore.ieee.org/document/8473344>.

2. Ashraf Anwar, Sultan Aljahdali, "A Smart Stick for Assisting Blind People," vol. 19, Issue 3, May-June 2017, page-86-90, IOSR Journal of Computer Engineering (IOSR-JCE), e-ISSN: 2278-0661,p-ISSN: 2278-8727, iosrjournals.org/iosr-jce/papers/Vol19-issue3/Version-2/O1903028690.pdf.
3. Prof. H.S.Hemane, Arundhati Singh, Sneha Shree, Sagar Pandey, "Raspberry Pi Based Smart Navigation System for Blind People", IRJET, vol.07, Issue 7, July 2019.
4. S.D. Asha Mahesh, K.Raj Supriya, M.V.S.S.N.K.Pushpa Latha, P.Gowri, T.Sonia, B. Nani, "Smart Assistive Shoes and Cane: Solemates for the Blind People", IJESC, vol. 8, Issue 4, 2018.
5. Rohit Agarwal, Nikhil Ladha, Mohit Agarwal, Kuntal Kr. Majee, Abhijit Das, Subham Kumar, Subham Kr. Rai, Anand Kr. Singh, Somen Nayak, Shopan Dey, Ratul Dey, Himadri Nath Saha," Low-cost ultrasonic smart glasses for the blind", IEMCON(IEEE), 03-05 october-2017, Vancouver, Canada, IEEE Xplore, <https://ieeexplore.ieee.org/abstract/document/8117194?signout=success>.
6. P. Selvi Rajendran, Padmaveni Krishnan, D. John Aravindhar," Design and Implementation of Voice Assisted Smart Glasses for Visually Impaired People Using Google Vision API", ICECA(IEEE), 05-07 November-2020, Coimbatore, India,IEEE Xplore, <https://ieeexplore.ieee.org/document/9297553>.
7. Mr.Yadla Arunababu, Mr. Raghu Ram, "Design of Ultrasonic sensors based spectacles and waist belt for the blind using low-cost Arduino", IJMETMR, vol. 1, Issue 10, 2014, page-226-231, <http://www.ijmetmr.com/olctober2014/YadlaArunababu-RaghuRam-a9.pdf>.
8. M. Anisha, S. Kirthika, D. Jemimah Harline, P. Thenmozhi, Rubala. R, T. Girija Pragathi, M.Benisha, C. Jim Elliot," Low- Cost Smart Shoe for Visually Impaired, "ICICV(IEEE), 04-06 february-2021, Tirunelveli, IEEE Xplore, <https://ieeexplore.ieee.org/document/9388432>.