Smart Glass for Visually Impaired Using Mobile App

T. Anitha, V Rukkumani, M. Shuruthi, and A. K. Sharmi

Abstract Blind mobility is one of the most significant obstacles that visually impaired people face in their daily lives. The loss of their eyesight severely limits their lives and activities. In their long-term investigation, they usually navigate using a blind navigation system or their gathered memories. The creation of the work to develop a user-friendly, low-cost, low-power, dependable, portable, and built navigation solution. This paper (Smart Glasses for Blind People) is intended for people who are visually challenged. They encounter various threats in their everyday life, as current dependable gadgets fail to fulfil their expectations in terms of price. The major goal is to aid in a variety of daily tasks by utilizing the wearable design format. This project includes an ultrasonic sensor, a microcontroller, and a buzzer as far as hardware goes. Here, an ultrasonic sensor is used to identify obstacles ahead. When the obstacles are detected, the sensor sends the information to the microcontroller. The data is then processed by the microcontroller, which determines whether the barrier is within the range. The microcontroller delivers a signal to the buzzer if the obstacle is within the range. When an impediment is recognized within a certain range, a buzzer or beeper emits a buzzing sound. These data are saved in the cloud, and a mobile app is developed to keep track of the location and receive alarm notifications.

Keywords Microcontroller · Ultrasonic sensor · Buzzer · Cloud · Mobile App

1 Introduction

There are a variety of smart accessories available on the market, including smart glasses, smartwatches, and so on. But they're all designed with use in mind. Technology to assist the physically impaired is severely lacking. The proposed system that would help the people of sight-impaired. As a result, I created a low-cost smart glass that can assist the visually challenged. From the last few years the visually handicapped people has increased. According to the WHO, there are approximately

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285 million persons worldwide who are visually impaired [1]. People who are visually challenged encounter various threats in their daily lives, as current dependable gadgets frequently fall short of consumer expectations in terms of price and amount of aid. However, many institutions and jobs have been unable to accommodate them due to a lack of dependable technologies and a financial barrier. Subsequently, 90% of them continue to live in poverty [2].

Even when new technologies become available, they are either highly expensive ($3000 and more) or inexpensive ($200) but only perform a single or limited task function. Wearable gadgets are the most beneficial of all assistive devices because they do not require or require minimal hand use. Head-mounted devices are the most common. Their primary benefit is that, unlike other gadgets, the device naturally points in the direction of viewing, eliminating the need for extra direction instructions. The cloud, an ultrasonic sensor, and a mobile app are all incorporated into the design [1]. As a result, the solution presented in this paper is a cost-efficient, dependable, and portable technology that would enable a visually challenged people to walk on the public places in a manner similar to that of any other pedestrian [3]. Fortunately, for visually challenged people, there are various navigation devices or tools available [3]. The white cane has traditionally been used for local navigation, with most people swaying it in front of them to detect obstacles. ETA (Electronic Travel Aid) devices have proven to be effective in improving the daily lives of visually impaired people [4]. As it provides more information about the surroundings by combining multiple electronic sensors. The device presented in this paper falls into this category. After all, a disadvantage of the depth sensor is it has a restricted working range for determining obstacle distance and also does not perform well in the presence of transparent things like glass, French doors, and French windows [5]. This paper proposes a multisensory fusion-based obstacle avoidance algorithm that uses the depth sensor and the ultrasonic Sensor to solve this constraint. Auditory information can be provided to completely blind people. For visual improvements, the AR (Augmented Reality) technology is used for displaying the surroundings and seven possible directions on the glasses, are considered to obtain the people in attempting to avoid the obstacle [6].

2 Related Work

In the current technology, an infrared sensor attached to a blind person's stick is utilized to identify impediments. When the Sensor detects an obstruction, it simply emits a buzzer sound as a warning. However, this buzzer sound does not identify the actual location of the object. The Proposed system objective is to create the speech-based alerting system for blind persons that uses an ultrasonic distance sensor to identify obstacles and a voice circuit to make voice-based alerts. The advantage of this device is speech-based navigation, which means the user hears a voice that pronounces the directions he needs to take to arrive at his destination. By continually sending ultrasonic waves, the Ultrasonic Sensor detects obstructions in its path [7].

If any hindrance in the path, the ultrasonic waves are reflected back to the system. These ultrasonic waves are detected by the ultrasonic receiver, and the information is transmitted to the microcontroller [8]. The microcontroller sends out voice messages as alarms. When a blind person wears an ultrasonic glass with an ultrasonic distance sensor, the ultrasonic distance sensor, which can detect impediments in a blind person's path, detects the obstacles. This data is sent to the microcontroller, which informs the user by voice circuit if there are any obstructions in the road, allowing the user to avoid them [9]. In this paper an application is developed for monitoring the participant's activity and to display the participants faces using deep learning technique to improve the quality of the online classes and meetings [10]. This paper analyzes on network performance, Quality of Service (QoS) and user connection data are done for a year and conducted a video streaming experiment in different zones [11]. This research article provides solution for various handwriting recognition approaches by obtaining 91% accuracy to recognize the handwritten characters from the image document. Also with the machine learning approach statistical Support Vector Machine (SVM) provides good results [12]. The research paper aimed to offer analysis and discovery of complex non-linear environment using SVM-based learning technique and Dynamic Bayes network is used to predict words sequence with the help of phonetic unit recognition [13]. In supermarkets item recognition and billing takes lots of effort and time especially when it comes to fruits and vegetables [14]. In order to overcome this they proposed many convolutional neural networks based on image classification with start-of-art accuracy by providing quick billing technique [15].

3 Proposed Work

3.1 Software Description

The Arduino Integrated Development Environment (IDE) shown in Fig. 1 includes a text editor that allows you to create code and send messages, as well as a text and operator terminal, a toolbar with common buttons, and a menu system. It connects with Arduino and Genuino devices and uploads code to them. Searching, cutting, pasting, and replacing text are possible in the editor. Arduino sketches are programs produced with the Arduino software (IDE). Those sketches are saved as .ion documents. The message section helps by giving feedback and highlighting the mistakes while arranging and exporting. It prints texts, including detailed error messages and other information. The serial board is located in the bottom right corner of the window. We can check and send programs and also we can open, create, and save sketches, and view the serial monitor, using toolbar. The Arduino IDE has certain code structuring rules, especially to support languages like C, C++, etc. It has Arduino wire library that allows us to work on a variety of common input and output tasks. The GNU toolkit is included with the IDE which requires only 2 key functions to start

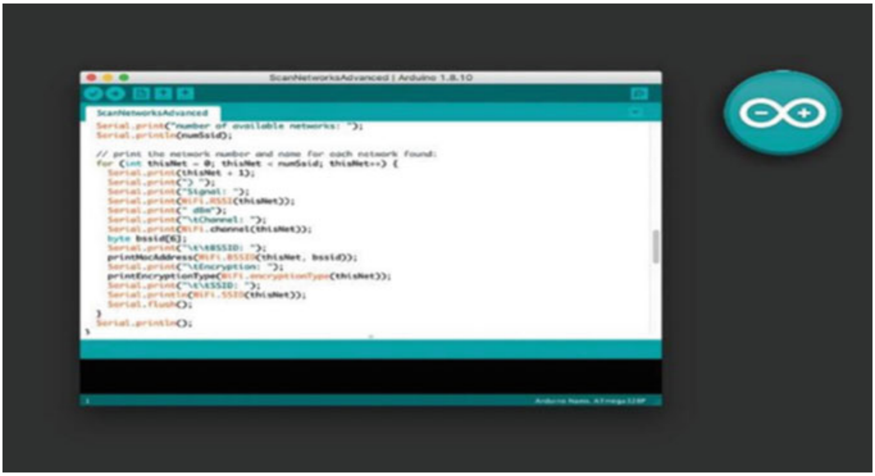


Fig. 1 Arduino IDE

the sketch and to program code loop and that are compiled and combined into an executable code.

3.2 *Circuit Diagram*

Circuit diagram for smart glass is shown in Fig. 2 in which Node MCU, buzzer and mobile app are connected through cloud.

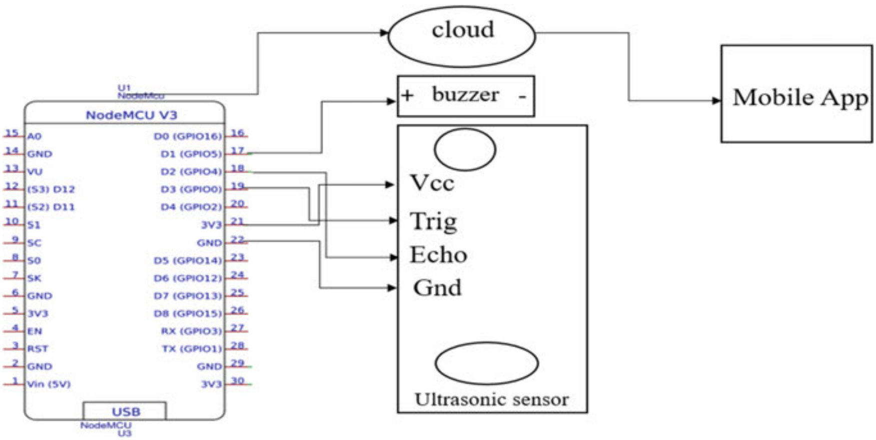


Fig. 2 Circuit diagram for Smart glass

Fig. 3 Ultrasonic sensor

3.3 Hardware Description

This project's hardware is both cost-effective and tiny in size. The hardware has been chosen in such a way that it may be utilized for prototyping and programming with ease. The following are the various components that were used in this project: Ultrasonic Sensor, Node MCU, Buzzer.

3.4 Ultrasonic Sensor

This technology is capable to detect and track the approaching objects. It is used to measure pinpoint ranges by sending and gathering different pulses of ultrasound transducer shown in Fig. 3. Sonomicrometry is a technique in which the ultrasonic signal's transit time is recorded digitally and mathematically converted as the distance between transducers, assuming the speed of sound, the medium betwixt the transducers is known. The time of flight measurement is calculated by base value or zero crossing, the equivalent incident (received) waveform, and this method is quite accurate in terms of physical and spatial precision.

3.5 Node MCU

Node MCU is an open-source firmware shown in Fig. 4, that can also be used with open-source prototype boards. The Espressif Systems ESP8266 is an economical Wi-Fi chip that uses the TCP/IP (Transmission Control Protocol/Internet Protocol). There are 13 GPIO pins, 10 PWM channels, I2C, SPI, ADC, UART, and 1-Wire connections on this board. The Node MCU Development Board v1.0 (Version2) is a black-colored PCB. The Node MCU Development Board is easily programmed with Arduino IDE, as it is simple to use.

Fig. 4 Node MCU

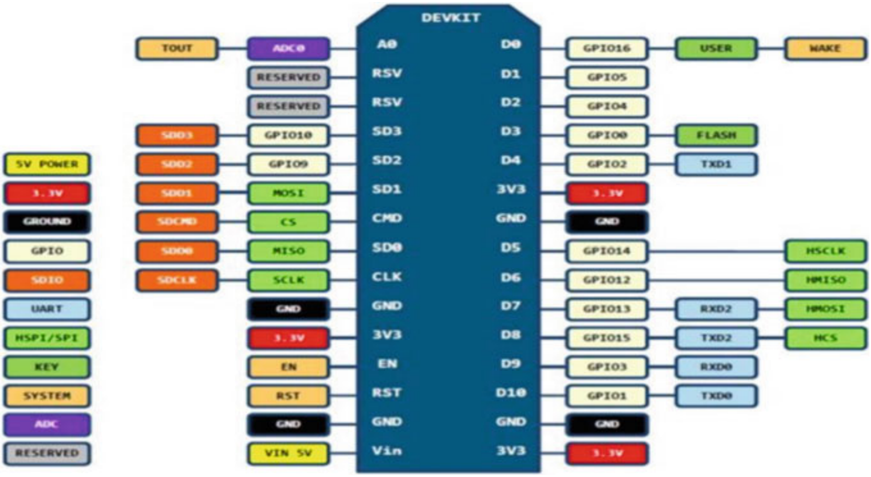


Fig. 5 Pin configuration of Node MCU

3.6 ESP8266 Arduino Core

Espressif System created a microcontroller named ESP8266 shown in Fig. 5. It is an autonomous Wi-Fi networking device that can be used as a link between current microcontrollers and Wi-Fi, along with executing self-contained applications. We can connect the Node MCU devkit to our laptop through a USB cable.

3.7 Buzzer

A buzzer creates the audio sound, it could be mechanical, electromechanical, or piezoelectric. Alarm clocks, timers, and other devices commonly use buzzers and beepers.

Fig. 6 Experimental setup of smart glass

3.8 Working

- The Node MCU and ultrasonic Sensor are installed on the eyewear.
- The ultrasonic Sensor's trigger and echo pins are connected to the Node MCU.
- The Node MCU was also connected to the buzzer.
- When the ultrasonic Sensor detects an obstruction, a warning message is transmitted to the mobile application.
- The buzzer sounds a warning tone shown in Fig. 6.
- The ultrasonic sensor collects the data and transfers it to Node MCU via serial communication. The Node MCU sends the data to the cloud server account called Thingspeak via Wi-Fi network.

4 Results

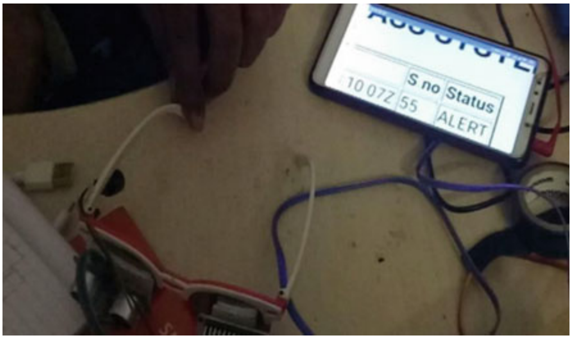
- The Node MCU's ESP8266 Wi-Fi chip communicates with the phone to transmit an alert message.
- The application for the smart glass system has been deployed.
- When the ultrasonic Sensor finds an impediment, an alarm message will appear in this application in Fig. 8.
- Finally, the data, including latitude and longitude, is stored in the Thingspeak cloud platform. When the data can be accessed and verified in Fig. 7.

5 Conclusion

Since most blind people use glasses and it inspires us for installing the device on glasses. People with visual disabilities are finding difficulty to communicate with their environment. It is difficult for them to go out on their own, nor to find lavatories, metro stops, restaurants, and other necessities. The objective of the smart glass system is providing convenience to their environment. The target of the proposed system is to develop an economical, user-friendly, reliable and portable, low power, and efficient

Fig. 7 Mobile application of smart glass

Fig. 8 Alert message in mobile app



solution for better navigation. This smart glass application will help the blind people gain strength in the busy world.

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