Ultrasonic Guide for Visually Impared

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Abstract: The main concept is to develop a device for the visually impaired people as an Assistance System in their day-to-day life. The device measures the distance of the obstacle approaching the person with the help of an ultrasonic sensor, placed in the goggles to detect the obstacle. In the detection of the obstacle an alert message is sent in the form of Voice message to the person by speaker embedded in ISD module. This system functions like an assistive guide to the visually impaired person for the safety purpose as well as help them continue their regular routine without any issues.

Keywords: ultrasonic sensor, goggles, Speaker.

1.INTRODUCTION

The detection of obstacles is one of the major problems that people with visual impairment frequently encounter. In this work, we are attempting to make it easier for them to quickly identify obstacles using sensors and transducers through non-contact method, thereby creating a better world for them.

Although vision loss can affect individuals of all ages, most people with vision impairment and blindness are over the age of 50. A variety of factors influence how a vision impairment affects a person. This covers, for instance, the accessibility of interventions for prevention and treatment, access to vision rehabilitation (including aids like eyeglasses or white canes), and whether the individual has issues with inaccessible structures, transportation, and information. Young children who experience early-onset severe vision impairment may experience long-term effects on their motor, verbal, emotional, social, and cognitive development Vision impairment has a profound impact on quality of life in adult populations. Adults with visual impairment frequently participate less actively in the labour force, produce less, and experience higher levels of worry and sadness.

Older adults who have vision problems run a higher risk of fractures from falling, social isolation, difficulty walking, and early admission into nursing or care facilities. Walking without sight carries a not insignificant danger of head-level and fall accidents. 13% of the respondents reported head-level mishaps at least once per month, and 7% reported walking-related crashes at least once per month. Medical care is frequently needed after these incidents. Many of the respondents claimed that these kinds of mishaps altered their walking patterns and diminished their confidence in their ability to journey independently.The kind of mobility aid utilised has little bearing on how frequently mishaps occur. The correct use of a long cane appears to offer greater protection against head-level or fall accidents than using a dog guide. People who venture outside more frequently do not appear to be more susceptible to head-level or fall mishaps than those who venture outside less frequently. The statistics of accidents encountered by blind people inside and outside of their own homes are shown in Figs. 1 and 2.

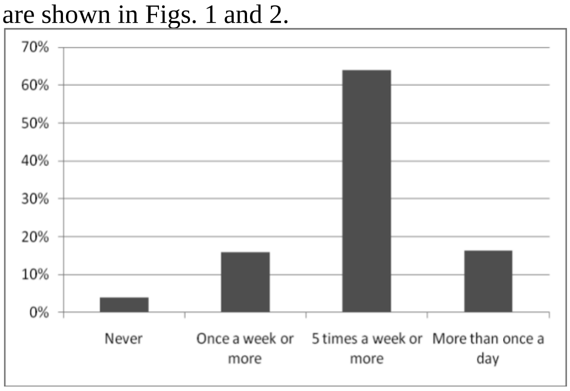

Fig 1Distribution of frequencies of travel outside one's ownresidence

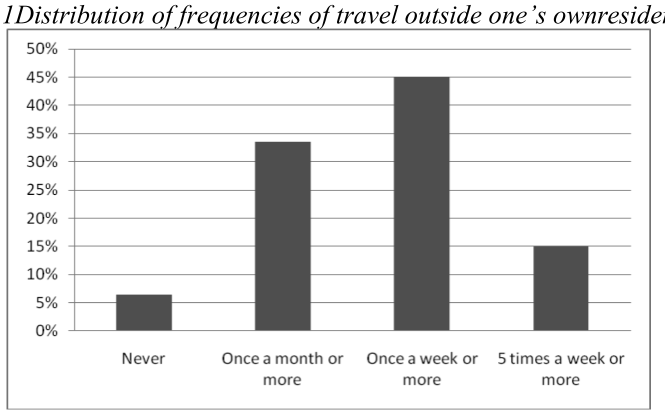

Fig 2 Distribution of frequencies of travel outside of familiar routes

Anang Tadar, the oldest child of a socioeconomically disadvantaged family whose parents are farmers, has always struggled to succeed because of a lack of resources. He does, however, point out that all innovators, inventors, and developers experience money difficulties. Particularly for a guy like him, whose folks barely make $1,000 per month. The AnangTadar smart goggle's first version can be seen in Fig. 3

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Fig 3 AnangTadar's first prototype of smart goggles

The tech whiz remembers how he would rather play with mechanical toys than participate in athletics with his friends. He asserts that nothing in particular led him to develop a passion for mechanics and automation. He has always been interested in science, particularly physics, and since he didn't have access to television, mobile devices, or the internet, he learned by disassembling remote-controlled cars and malfunctioning technology. The system was developed using two ultrasonic sensors, an Arduino mini, a battery, transparent glasses, and rudimentary electronic parts. The blind individual can now use the glasses to identify obstacles and transmit this information. To serve as eyes, the ultrasonic sensors are affixed on the sides of glasses. To gather information about obstacles, the sensors continuously send and receive ultrasonic waves. The Arduino is constantly getting this data from the sensors. The Fig 4 shows the recent updated smart goggle for visually challenged people

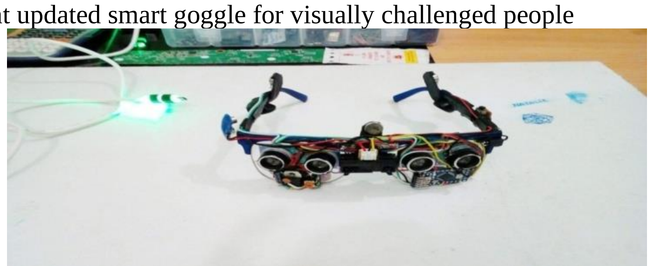

Fig 4 Existing module

The Arduino then uses this information to control a vibrator motor that is placed on the corresponding side of the glasses. In order to better grasp the distance, the microcontroller scans the sensor data and then controls the vibrator motor in accordance with the information received. Thus, using vibrations, this method enables blind people to gain a more precise understanding of the objects and obstacles in front of each eye. Although there are many ways to build a gadget and make it very efficient, the cost of the device plays a significant role. The main goal of this project is to assist the visually impaired people by using evolving and developing technologies. The cost of the device is determined by the materials used in its construction. Maintaining or striking a balance between the device's affordability and excellence is generally impossible. This project offers a solution to those equilibrium problems, making it applicable to all blind people who require an efficient assistive device of the highest calibre at a reasonable cost. In order to navigate their homes and the outside world, visually impaired individuals frequently require assistance. Since having human assistance is not always feasible, researchers have been looking for a solution to this issue for a long time. So, using ultrasonic spectacles, we create a clever fix for this issue.

2.THEORY OF OPERATION

The entire system is based on the ESP-NOW concept which enable the interaction between two microcontrollers wirelessly without the help of internet or any connection medium, the ESP-NOW protocol can be implemented only on the microcontrollers introduced by the Expressif , Thereby the microcontrollers that we use in our proposed system is ESP32, in order to make a two way communication in ESP-NOW we will be needing two ESP32 ,one will be acting as a master which will be sending the signal to the other ESP32 which will receive that signal thereby this microcontroller is called slave

In this proposed system we will be making use of two ESP32 one of them will be situated in the goggles and the other will be located in the shoes, the microcontroller in the shoe will act as the master since it will receive the signal from ultrasonic sensor and transmit it wirelessly to the slave ESP32 situated in the goggles which already has another set of ultrasonic and ISD1820 Voice record and play module which act as the output of the entire project giving details that whether the obstacle we face is situated in the lower or upper level, The ESP-NOW wireless connection can extend upto 722 feet distance thereby if we are about to make a a efficient wireless transmission it is the most reliable protocol, The ISD1820 module has the ability to store anything to store in it within 10000 bytes, It has the non-volatile memory therefore even if the device is turned off the voice message which is stored in the module will not be deleted this makes the proposed system language independent as the user can decide what their message should be and in which language it should deliver the message

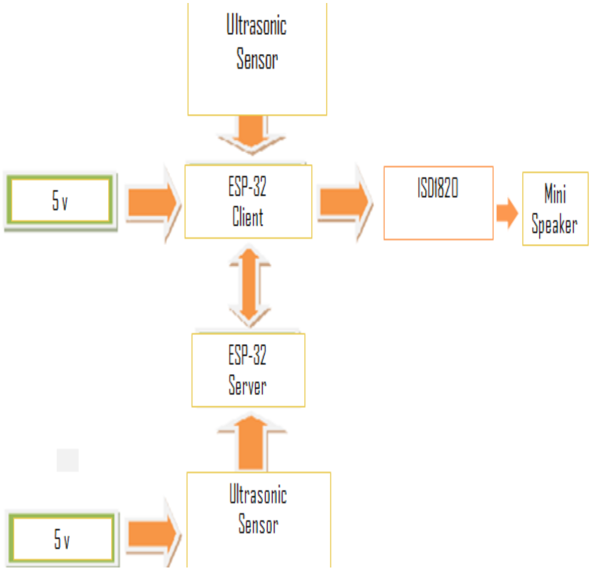

Fig 5 Block diagram

3..PROPOSED SYSTEM

This project is proposed as a solution to most of the previously existing systems which were introduced with a pure motive of absolute obstacle detection specially for visually impaired people. This project makes use of the ESP NOW concept for effective wireless transmission of signals.

A.Hardware Componennts

1)ESP Board

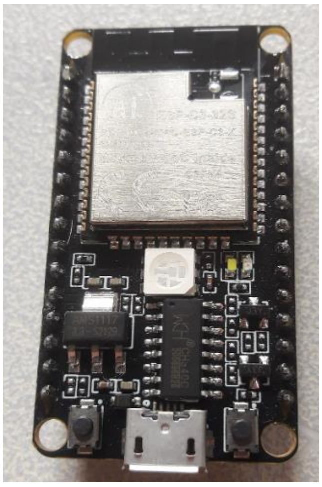
Fig 6 ESP board

ESP is a line of inexpensive, Microcontrollers that are low-power SoCs with integrated dual-mode Bluetooth and Wi-Fi. The ESP32 series includes integrated antenna switches, RF baluns, power amplifiers, low-noise receive amplifiers, filters, and power-management modules in addition to the TensilicaXtensa LX6 dual-core or single-core microprocessor, TensilicaXtensa LX7 dual-core, or a single-core RISC-V microprocessor.

The ESP32 was designed and built by a Shanghai-based Chinese company, Espressif Systems, and is manufactured by TSMC using their 40 nm technology. It is a substitute for the ESP8266 microcontroller.

Features:

- Processors include an ultra-low power (ULP) co-processor and a dual-core (or single-core) 32-bit Xtensa LX6 microprocessor. Memory includes 320 KiB RAM and 448 KiB ROM.
- Wi-Fi: 802.11 b/g/n; Bluetooth: v4.2 BR/EDR and BLE; wireless communication (shares the radio with Wi-Fi)
- Interfaces at the periphery
- 34 configurable GPIOs and an 18-channel, 12-bit SAR ADC
- Eight-bit DACs and ten contact sensors (capacitive sensing GPIOs)
- SD/SDIO/CE-ATA/MMC/eMMC host controller; SDIO/SPI slave controller; Ethernet MAC interface with specialised DMA and planned IEEE 1588 Precision Time Protocol support[4]; I2S interfaces; I2C interfaces; UART;
- Pulse counter with complete quadrature decoding, CAN bus 2.0, Infrared remote controller (TX/RX, up to 8 channels), Motor PWM, and LED PWM (up to 16 channels)
- Infrared Hall Effect Sensor
- A deep slumber current, an internal low-dropout regulator, a separate power domain for the RTC, and wake-up signals from the timer, the ADC measurements, and the capacitive touch sensor

  Pin Diagram

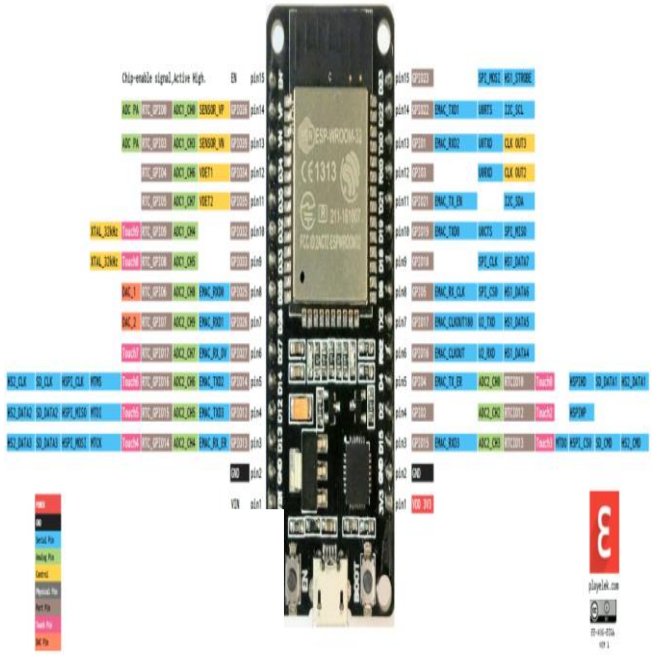

Fig7 ESP32 pin diagram

2) ISD 1820 Voice record and play module

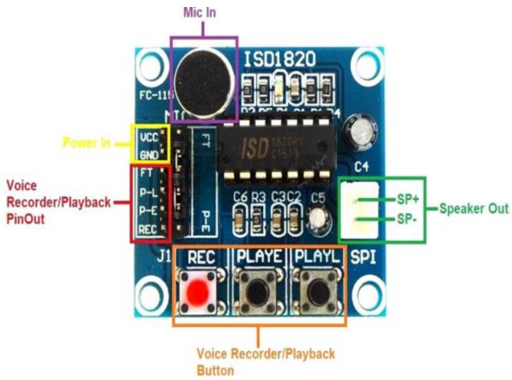

Fig8 ISD 1820 Voice record and play module

ISD1820 is a compact Voice Recorder and Playback module with the ability to capture in multiple segments. With the on-board resistor adjusted, the user can obtain good quality recording (for 8 to 20 seconds) for each application. This Voice Recorder/Playback module is built with integrated Flash memory, which has a record/erase life cycle of 100,000 and can store data for up to 100 years. Because of this, the device has the capacity to retain information for a brief period of time without it being erased from memory, even after the whole thing has been turned off.

ROSC	Duration	Sample Rate	Bandwidth
80K Ω	8 secs	8. 0KHz	3. 4KHz
100K Ω	10 secs	6. 4KHz	2. 6KHz
120K Ω	12 secs	5. 3KHz	2. 3KHz
160K Ω	16 secs	4. 0KHz	1. 7KHz
200K Ω	20 secs	3. 2KHz	1. 3KHz

Features:

- Wide power source ranges from 2.4V to 5.5V DC are available for use as operating voltage.
- This board's internal audio amplifier allows it to directly operate 8 Ohm, 0.5 W speakers.
- A built-in microphone.
- With two working modes
- Independent mode
- The Microcontroller Driven state
- Record up to 20 seconds of audio with a push of a button; playback can be edge or level enabled; automatic power-down mode (standby state); and dimensions (LxWxH) in cm of 8 x 6 x 3

This ISD1820 speech Recorder/Playback Module reproduces natural speech and audio in high-quality from audio that has been recorded by a microphone or driven by a microcontroller. We can easily use this in accordance with our needs thanks to its dual operation modes (Standalone and Microcontroller driven), and with a small adjustment to the onboard resistor, we can get flexibility in the sampling frequency and recording length.

Pin Description

Pin Name	*Description*
VCC	DC 2.4-5.5V
GND	Ground
FeedThrough: VCC DC 2.4	5.5V In this mode, the microphone can immediately drive the speaker.
REC	It is an indication. REC/REC (Button). When REC is HIGH, the gadget begins recording. This pin needs to stay HIGH throughout the video. Either replay (PLAYL or PLAYE) signal is overridden by REC.
P-E/PLAY-E (Button)	Playback is edge-activated when a HIGH-going transition is found, and it continues until an End-of-Message (EOM) marker is reached or the memory is used up.
P-L/PLAY-L (Button)	When the level of this input pin changes from LOW to HIGH, the playback feature is enabled.
SPI	Direct drives for loudspeakers with impedances as low as 8 are available from the SP+ and SP ports.
MIC	Microphone In: The on-chip pre-amplifier receives sounds from the microphone input.

Voice signals can be transmitted into this module through the differential onboard microphone input.
The module offers an 8 0.5W speaker out straight from the board as an output.
The voice chip has two ways of playing the audio:

- *Playback with Edge activation:*

If the module detects the HIGH signal on the pin, the gadget starts the playing loop. The playback cycle continues up until an End-of-Message (EOM) marker is located or the memory space is used up. After the playback cycle, the gadget immediately turns off and enters standby mode.

- *Level-activated Playback:*

If the module detects the LOW to HIGH signal on this pin, a playback loop is initiated. Playback continues up until PLAYL is pulled LOW, an End-of-Message (EOM) marker is located, or the memory space is used up. The device enters standby mode shortly after the playing is ended. If the module detects the LOW to HIGH signal on this pin, a playback loop is initiated. Playback continues up until PLAYL is pulled LOW, an End-of-Message (EOM) marker is located, or the memory space is used up. A playing loop is completed, and then the gadget immediately enters standby mode.

Interfacing Diagram

Three digital I/O communication pins on the ISD1820 voice recorder and playback module make it simple to operate the device with any microcontroller, including the PIC, Arduino, etc.

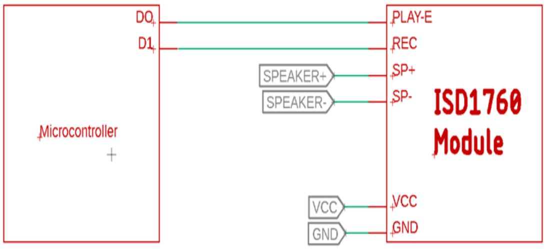

Fig 9 Interface diagram

Applications

- ➢ Voice Recording purpose
- ➢ Audio playback using microcontroller
- ➢ Sound recording purpose

3)Speaker 8 Ohm / 0.5W

Fig10Speaker 8 Ohm / 0.5W

This 8 oms speaker performs admirably and is frequently used for all kinds of audio tasks. The speaker has an RMS power of 0.5W and an 8 ohm impedance.

Features:

- ➢ 8 ohm resistance, 0.5 W RMS power, and a size of Diameter: 1"/approximately 25.4mm; Size: Height: 7mm (approx)
- ➢ Form: Round
- ➢ Terminal: 2

Applications

- ➢ Simple amplifier projects, general alert alarms, and compatibility with robots projects

4)Ultrasonic Sensor

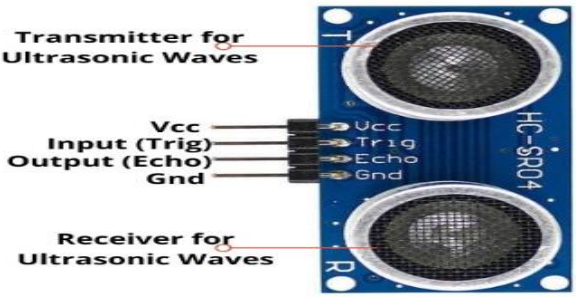

Fig 11 Ultrasonic sensor

Ultrasonic sensors, which are also referred to as transceivers when they send and receive data, operate on a similar premise to radar and sonar, which determine a target's characteristics by deciphering the echoes of radio or sound waves, respectively. High frequency sound waves are produced by ultrasonic instruments, which then analyse the echo they hear back. Sensors calculate the elapsed time between transmitting a signal and getting an echo to estimate the object's distance. This device can be used to measure things like tank capacity, air or water speed, and wind speed and direction (anemometer). A device uses multiple detectors to measure direction and speed, and it determines speed based on the distances between particles in the air or water.

The sensor detects the distance to the fluid's surface to calculate the volume of liquid in a tank. Sonar, medical ultrasonography, burglar alarms, humidifiers, sonar, and non-destructive testing are additional uses.
Most systems make use of a transducer, which converts electrical energy into sound waves in the ultrasonic range, above 18,000 hertz, and then back into electrical energy after getting the echo, allowing for measurement and display.
The technology is constrained by the surface shapes and substance density or consistency. For instance, foam on a liquid's surface in a tank could affect a measurement.
Eye Telemeter Module with Ultrasonic Electronic ultrasound electric telemeter module can measure a distance using non-contact ultrasound measurement technology within 0.03-3m effectively.

Feature:

- Narrow dimming zone; high sensitivity.
- Rapid reaction.
- Supply power of 5V DC.
- Small-footprint SMD architecture.
- 40 kHz modulation.
- 9600 bps TTL serial data output for simple interaction with any microcontroller.
- +-1 centimetre accuracy.
- Intelligence processing device using ultrasound.

An apparatus called an ultrasonic transducer converts energy into ultrasound, or sound waves that are louder than those that are ordinarily audible to human ears. Dog whistles technically produce ultrasonic sound waves from mechanical energy in the form of air pressure, but the term is more usually used to refer to piezoelectric transducers, which create sound from electrical energy.
Piezoelectric crystals, which may change size when a voltage is applied, vibrate at extremely high frequencies and generate extremely high frequency sound waves when an alternating current (AC) is placed across them.
The active transducer's area, shape, ultrasound frequency, and sound velocity can all be used to identify where a transducer directs its sound.

Features:

- 5 VDC Supply Voltage
- Range: 2 cm to 3 m; Supply Current: 30 mA typical; 35 mA maximum (0.8 in to 3.3 yrds)
- Positive TTL pulse, 2 uS min, 5 s type, input trigger
- Positive TTL pulse, 115 uS to 18.5 ms for the echo pulse and 750 ms for the echo hold-off after the decline of the trigger pulse
- Burst Indicator LED displays sensor action and has a burst frequency of 40 kHz for 200 s.
- Size: 22 mm H x 46 mm W x 16 mm D. Delay before next measurement: 200 s (0.84 in x 1.8 in x 0.6 in)

5)Power Supply :

Fig 12 Lithium ion battery

The ESP32 can only be operated in 3.3 v power supply if any deviation in this supply voltage will lead to the damage of the microcontroller therefore in order to power up the ESP32 we are making use of 3.3v power battery which is the one used in the earphones charger the maximum voltage provided by these rechargeable battery is 3.7 volt

6)Booster board

Fig 13 XL6009 Booster

A non-isolated step-up boost voltage converter with adjustable output voltage and good efficiency is the XL6009 module. It changes a 5-32V DC incoming voltage into a 4-38V DC output voltage.

7)Charging Board

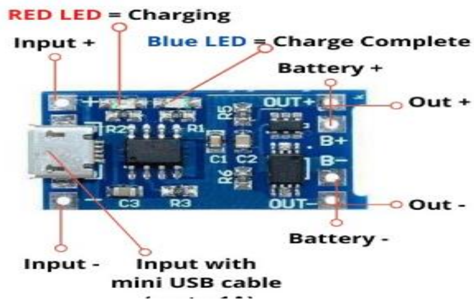

Fig 14 TP4056 1a li-ion lithium battery charging module

The TP4056 Micro USB 5V 1A Lithium Battery Charger Board Protection Module is a full constant-current/constant-voltage linear charger for single cell lithium-ion batteries. Because of its SOP packaging and few external components, the TP4056 is ideal for portable applications. The TP4056 module comes with a widely used micro USB port and a led indication for state sensing.

Features:

- Voltage input: 4.5 to 5.5 volts
- Voltage at complete charge: 4.2V; power output: 4.2 w
- Charging precision: 1.5%
- Micro LED charging sign
- Interface for Input: Micro USB connection
- Charge in a continuous fashion
- Thermostat operating range: -10 to +85 °C

7)Mini ON/OFFPush button switch

Fig 15 Mini ON/OFFPush button switch

One push turns it on, two pushes turns it off, a third push turns the other side on, and one final push turns it off once more! It functions essentially as a connect/disconnect toggle device. This clicky Mini On/Off Button switch works well as a mode or power control. Because you see them in tiny flashlights, they are frequently called "flashlight" switches. capable of safely handling 500mA at 12VDC.This switch has big, flat contacts that are simple to solder or clip onto, making it really gratifying to use. The two contacts have holes, which is the best part, allowing you to use it in a wearable craft where the switch is sewn on with conductive thread.

B.Software Components

1)Arduino IDE

To upload programmes and interact with the Arduino boards, a connection is made using the Arduino Integrated Development Environment, or Arduino Software (IDE). Sketches are computer programmes created using the Arduino Software (IDE). These drawings are created using a text editor and stored as files with the extension.ino.

4.RESULT AND ANALYSIS

The initiative "Ultrasonic Guide for Visually Impaired People" will now be briefly described. With the aid of the speaker, the master microcontroller in the shoes transmits a signal to the subordinate microcontroller using the ESP-NOW protocol.

The ESP-NOW protocol can only be implemented on the microcontrollers introduced by the Expressif, so the microcontrollers that we use in our proposed system are ESP32. In order to make a two-way communication in ESP-NOW, we will need two ESP32, one will be acting as a master which will be syncing data to the other microcontroller, and will be syncing data to the master to the other ESP32 which will receive that signal thereby this microcontroller is called slave.

Fig 16 Shoe fitting Kit (Master ESP)

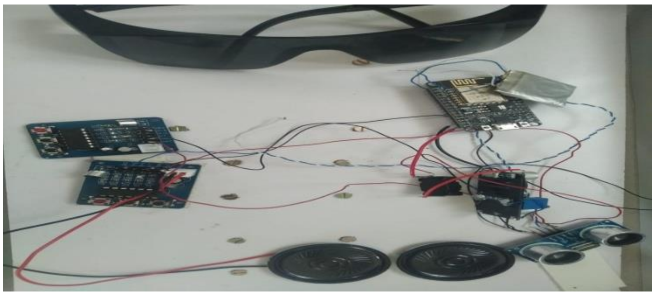

Fig 17 Goggles fitting Kit (Slave ESP)

In this proposed system we will be making use of two ESP32 one of them will be situated in the goggles and the other will be located in the shoes, the microcontroller in the shoe will act as the master since it will receive the signal from ultrasonic sensor and transmit it wirelessly to the slave ESP32 situated in the goggles which already has another set of ultrasonic and ISD1820 Voice record and play module which act as the output of the entire project giving details that whether the obstacle we face is situated in the lower or upper level, The ESP-NOW wireless connection can extend up to 722 feet distance thereby if we are about to make a a efficient wireless transmission it is the most reliable protocol, The ISD1820 module has the ability to store anything to store in it within 10000 bytes, It has the non-volatile memory therefore even if the device is turned off the voice message which is stored in the module will not be deleted this makes the proposed system language independent as the user can decide what their message should be and in which language it should deliver the message.

5.CONCLUSIONS

Under the name "Ultrasonic Guide for Visually Impaired," the work suggested the design and architecture of a brand-new concept of smart shoe and goggles for blind people. The system's advantage is that it may prove to be a very affordable solution for millions of blind people around the globe. The planned model satisfies every conceptual criteria. The smart shoe and goggles' final output could easily notify the user with the help of the ISD1820 module. The results match the expected results. For autonomous and secure road walking, smart shoes and goggles are helpful. A blind person who hears the voice guidance and receives the obstacle signal falls through. The Ultrasonic Guide for the Visually Impaired would provide low-cost assistance to the blind. The superior module can then utilise this. By using a variety of sensor types, It may be improved further to have better decision-making abilities and applied in a variety of ways. It makes an effort to deal with the problems that blind people experience every day. Furthermore, the system has safeguards for their protection.

A processing unit, an output device, an ISD1820 voice over module, a power supply, and a set of glasses and shoes with an obstacle detection module mounted in the middle make up this device. The processing unit is linked to the output device and the obstacle detection module. The power source provides energy to the central processor unit. The ultrasonic sensor, the control module for processing, and the speaker for output make up the majority of the obstacle detection module's parts. The ultrasonic sensors are operated by the control device, which also collects information about the barrier in front of the user, analyses that information, and broadcasts the necessary information through the speaker. These affordable, user-friendly, portable, and lightweight ultrasonic guides are made for blind or visually impaired individuals. These devices could easily guide the blind and help them avoid dangers.

6.FUTURE SCOPE

For blind people who are unable to see any objects, this Ultrasonic Guide for the Visually Impairedsystem is used, so they are conscious of accidents. In the future, it might be used as an image recognition system where a sensor informs the user about an item.

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