SMART ASSISTIVE SHOE FOR BLIND PEOPLE

Under the guidance of Prof. Sujata Kullur

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INTRODUCTION

- Blind people face many problems in independent mobility and navigation. Daily activities are hampered by their inability to conceive their surroundings.
- In a world with 39 million people with visual disability, India itself accounts for 15 million of them.
- In India, we don't have much advanced technologies or equipments for the blind people. Currently, blind people use a white stick as a tool for directing themselves.
- In our project, we are presenting a smart assistive shoe enabling the visually impaired people to avoid obstacles.
- Our shoe will detect obstacles such as curbs, the staircases in the ground or even moving objects by transmitting obstacle information through haptic feedback such as vibrations and beeps.

OBJECTIVES

- The main objective of our project is to design algorithms that are reliable enough to detect and warn for any obstacles that can appear in the user's vicinity.
- To seize the psychological, social, and economic outcomes which impact the individuals with visual disability.
- To improve the most crucial activities for the blind people such as navigation and mobility.
- To provide reliable assistance technology with the ability of blending in along with the normal people.
- To provide the user with highly accurate and simple to use technology.

LITERATURE SURVEY

- SMART ASSISTIVE SHOES AND CANE:SOLEMATES FOR THE BLIND PEOPLE", Rastogi, S., Sharma, P., Dhall, P., Thakur, S. and Agarwal, R. (2017) This paper focuses on designing a device for visual impaired (or blind) people that would help them to travel independently and also with more ease. It also offers a numerous applications in the medical field to provide a better responsive mate to the visually impaired.

- SMART ASSISTIVE DEVICE FOR VISUALLY IMPAIRED PEOPLE ", Tehzeeb Alam, Sonal Shrivastava, and Tanzim Alam,(2015). The paper is based upon the survey about the existing solutions meant for autonomous mobility for the visually impaired people. In our paper, they have proposed a novel design, Smart Shoes with sensors embedded in them to guide a person who is blind and to alert him/her about the obstacles which is laying ahead of him in his path.

PROBLEM STATEMENT

- To design The " Smart Assistive Shoe " for visually impaired people which will detect and notify the obstacles in a way, using embedded systems technology.
- To provide intelligent navigation capabilities in the Integrated Smart Shoe with the rapidly advancing modern technology.
- To introduce high end technological solutions for helping the blind people navigate independently.

SOLUTION

- We are designing a smart shoe for the blind people that will detect the obstacles coming in the user's vicinity while performing any daily activities such as walking or climbing the stairs.
- We are using the Blynk application that will alert the user about the direction of the obstacles so they can walk with ease.
- It consists of sensors that receives signals and then sends a command to the controller which executes it further about the direction.

HARDWARE COMPONENTS

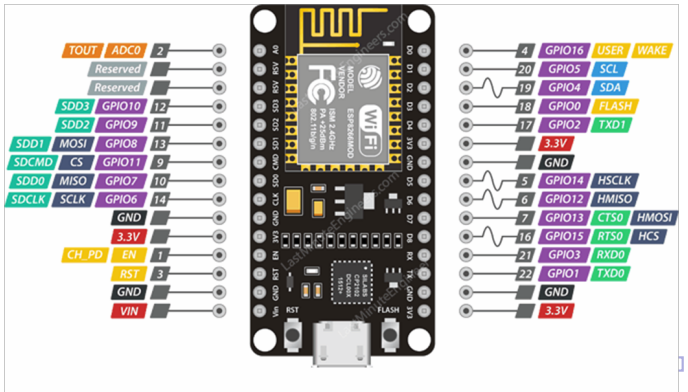
1. Arduino Nano
2. NodeMCU (Controller)
3. Ultrasonic sensors
4. Power Supply(Transformer,Diode,capacitor,resistors,LED)
5. PCB
6. Nylon cable ties to attach all the components on the shoe

SOFTWARE COMPONENTS

1. Kikad Software(PCB designing)
2. Arduino IDE Software (Controller Programming inculding IOT program ming)
3. Blynk Software (IOT Mobile application)

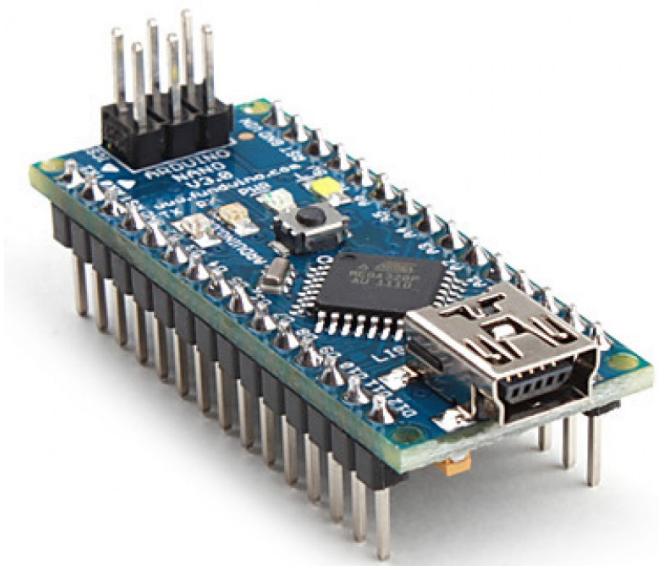
ESP - 12E MODULE

- ESP - 12E is a miniature Wi-Fi module
- It is used for establishing a wireless network connection for microcontroller or processor.
- It features ability to embed Wi-Fi capabilities to systems or to function as a standalone application
- It consist of 128 KB RAM and 4MB of Flash memory for program and data Storage
- The ESP8266 Integrates Wi-Fi transceiver, so it can set up a network of its own, allowing other devices to connect directly to it.
- This makes the ESP8266 NodeMCU even more versatile.



ARDUINO NANO

- The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328P; offers the same connectivity and specs of the UNO board in a smaller form factor.
- The Arduino Nano is programmed using the Arduino Software (IDE), our Integrated Development Environment common to all our boards and running both online and offline.

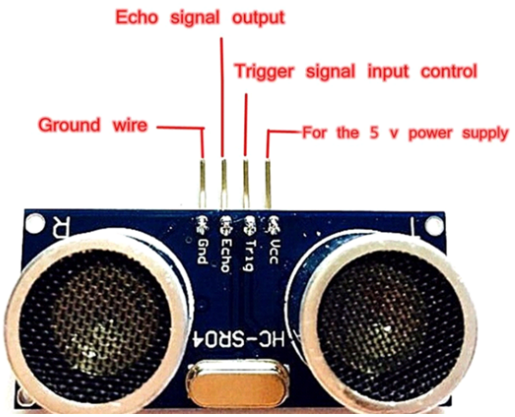


ULTRASONIC SENSOR

1. The Ultrasonic Sensors belongs to a category of sensors that emits ultrasound
2. Initially, a trigger pulse is given as an input.
3. The ultrasonic sensor will emit a short ultrasonic burst signal.
4. This burst signal will travel will hit an object and then it bounces back to the sensor resulting in an output pulse .

ULTRASONIC SENSOR

- It consist of 4 pins:
  (1) VCC : The Vcc pin powers the sensor, typically with +5V.
  (2) Trigger :- Trigger pin is an Input pin. This pin has to be kept high for 10us to initialize measurement by sending US wave.
  (3) Echo :Echo pin is an Output pin. This pin goes high for a period of time which will be equal to the time taken for the US wave to return back to the sensor.
  (4) Ground :This pin is connected to the Ground of the system..

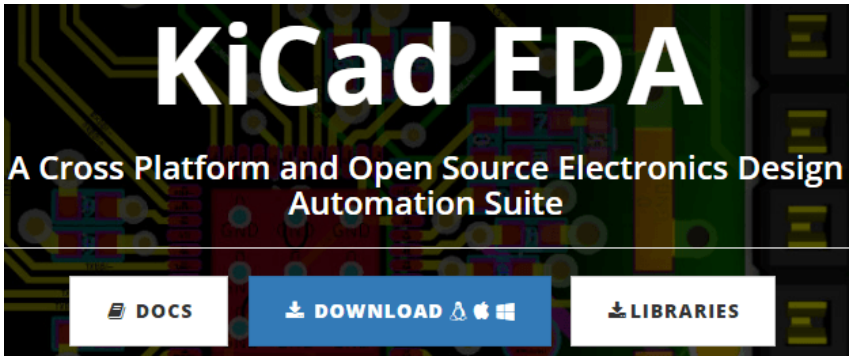


IOT Software : Blynk

- Blynk is a Platform with IOS and Android apps to control Arduino, Raspberry Pi and the likes over the Internet.
- It's a digital dashboard where you can build a graphic interface for your project by simply dragging and dropping widgets.

PCB Designing Software : KiCad Software

- KiCad is a free software suite for electronic design automation.
- It facilitates the design of schematics for electronic circuits and their conversion to PCB designs.
- KiCad was originally developed by Jean-Pierre Charras.
- It features an integrated environment for schematic capture and PCB layout design.



ARDUINO SOFTWARE

- The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board.
- It runs on Windows, Mac OS X, and Linux.
- The environment is written in Java and based on Processing and other open-source software.
- Language : C

CONCEPT OF WORKING

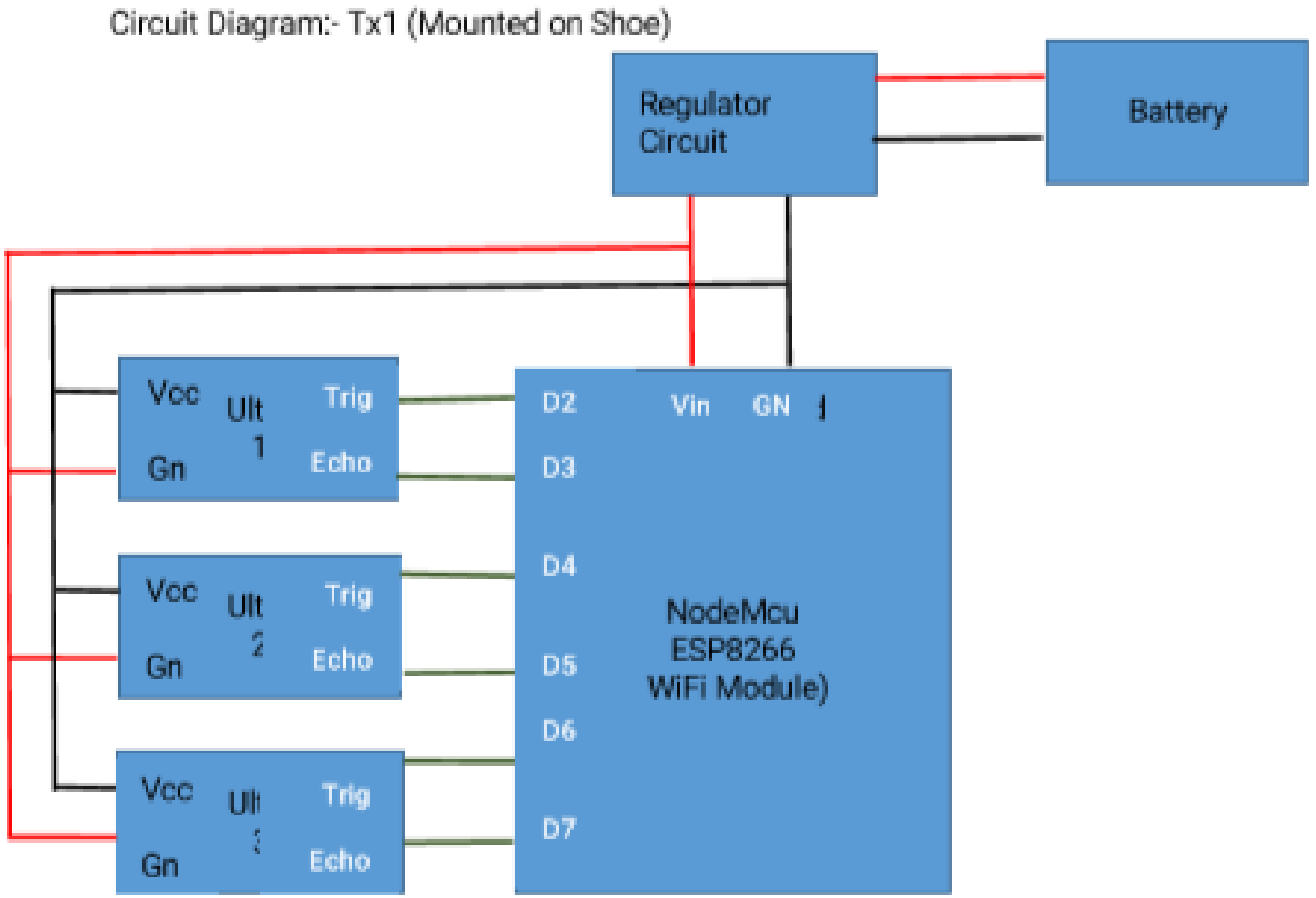
T1X (Transmitter section 1):

- In this part, the components used are ultrasonic sensors , Controller, Node Mcu , GPS module and Battery
- In this circuit we have used three ultrasonic sensor as ultra 1,ultra 2 and ultra 3 shown in the figure above.
- Ultra1 will be used for detecting the obstacle in left /Right of the blind person
- Ultra 2 will be used for detecting the obstacle in the Front of the blind person

CONCEPT OF WORKING

- Ultra 3 will be used for detecting the Path ahead such as Hole,Pothole and deep Step in front of the blind person.
- These ultrasonic sensors has two pins as Trigger and Echo.
- Trigger pin is used to send the pulses to the sensor from the controller
- Echo pin is used to detect the obstacle and this distance will be measured by controller.
- GPS Module is connected to the controller which will give the location of the blind person.

CONCEPT OF WORKING



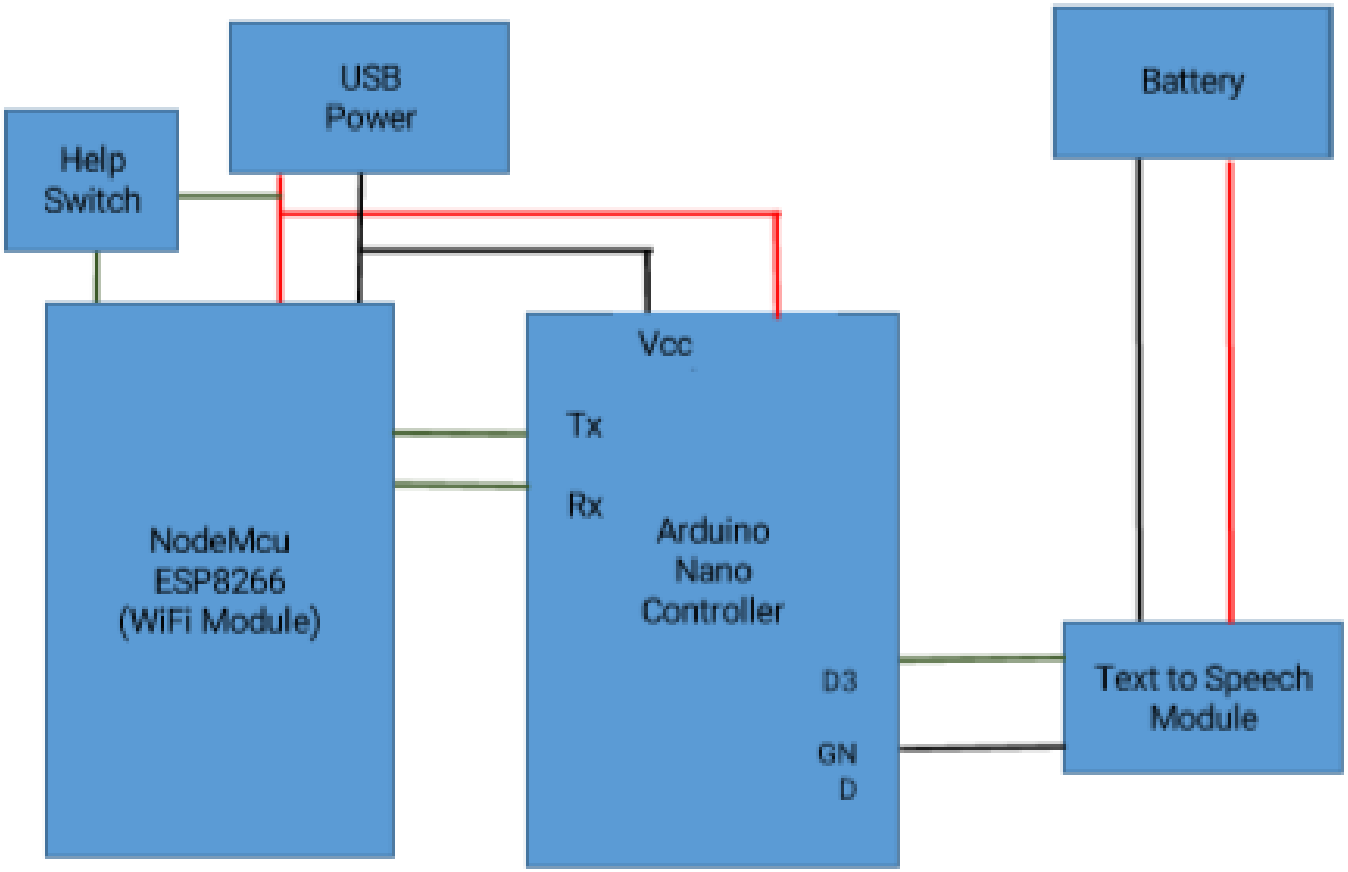
CONCEPT OF WORKING

Rx 1 / Tx 2 (Receiver Section for Section 1) and (Transmitter Section 2):

- This part will receive the details from the Transmitter Section for further processing and the data will transmitted wireless / via internet.
- If any one of the ultrasonic sensors comes across an obstacle, it will be detected by the controller and the controller will give commands to text to speech module as turn right/ turn left and Stop Go back if all the sensors detects obstacles.
- We also have one Help switch which, if pressed by the blind person, will send a mail to the users family members with his/her location specifications (via Blynk app).

CONCEPT OF WORKING

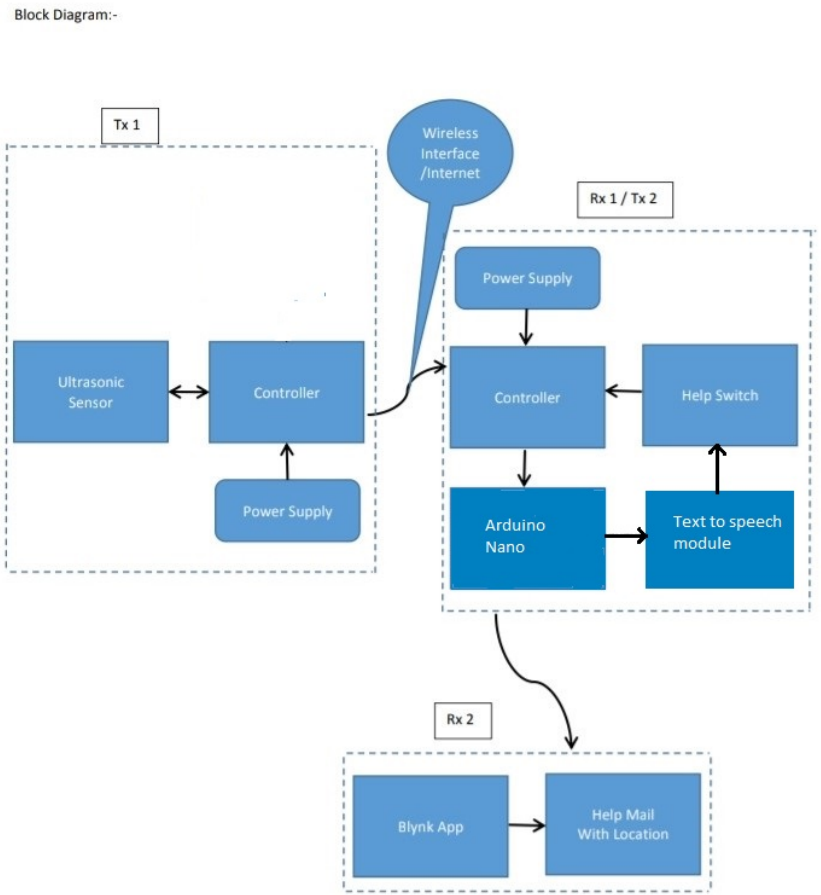
Circuit Diagram:- Rx1 (Remote Section)



CONCEPT OF WORKING

Rx 2 (Receiver 2):

- This section is a moblie app Blynk used to support the IOT For sending data form one section to other and the help Mail



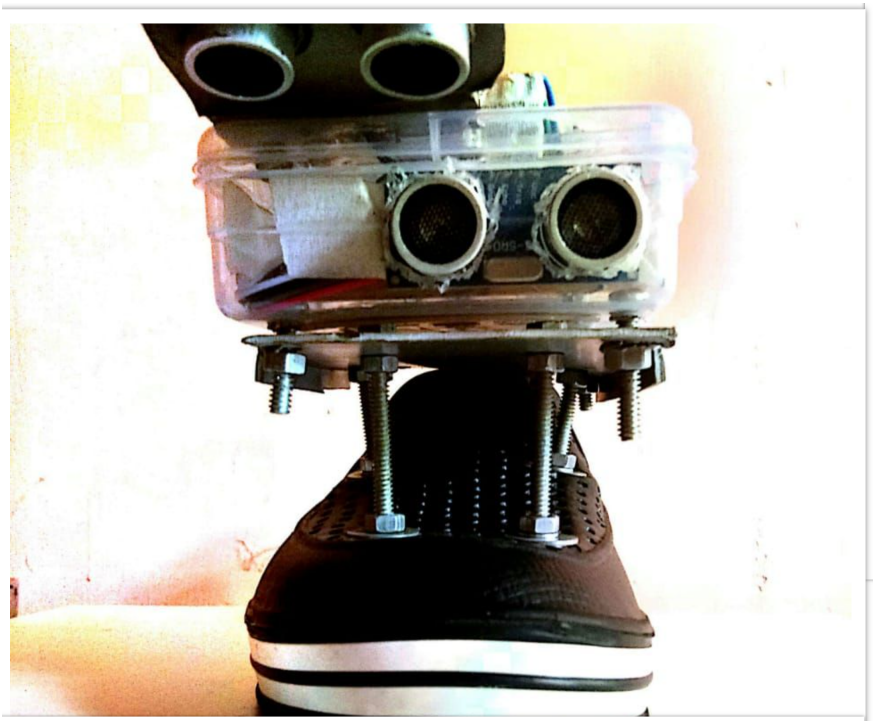
IMPLEMENTATION : Shoe : Tx 1 (Transmitter Section1):

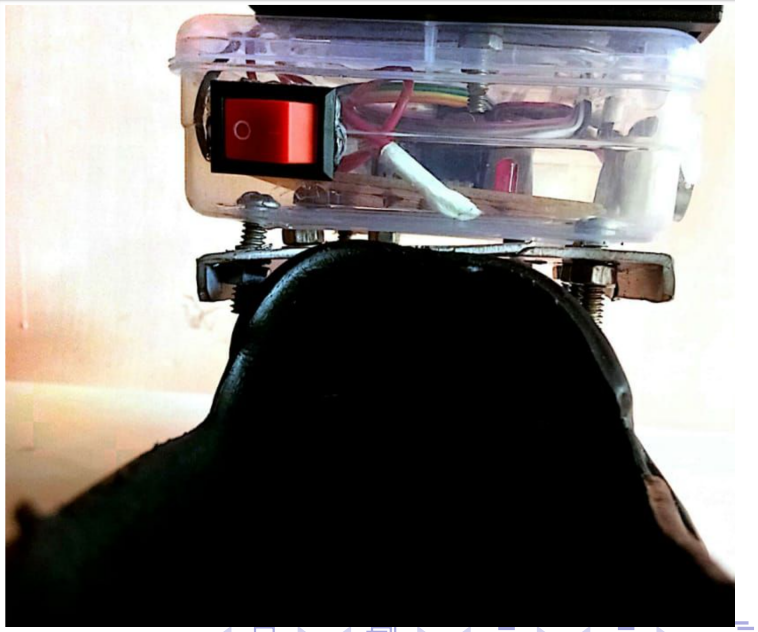
- This section consists of 3 ultrasonic sensors,Node MCU and Battery.
- One sensor is used to detect the obstacles on the left side and the other sensor to detect the obstacle on the front side and the third sensor is used for pothole direction and it will also alert the blind person about the same.
- In this circuit, we have used a Micro-Controller named as Node MCU ESP8266 which will calculate the distance between the obstacle and the shoe detected by the ultra sonic sensor and it works as a transmitter to send these data to the Remote which acts as a receiver in our system.
- In this circuit, the Components used are as follows:
  1. Node MCU
  2. Capacitor
  3. Regulator IC
  4. Register
  5. Power LED

Shoe : Tx 1 (Transmitter Section 1) :

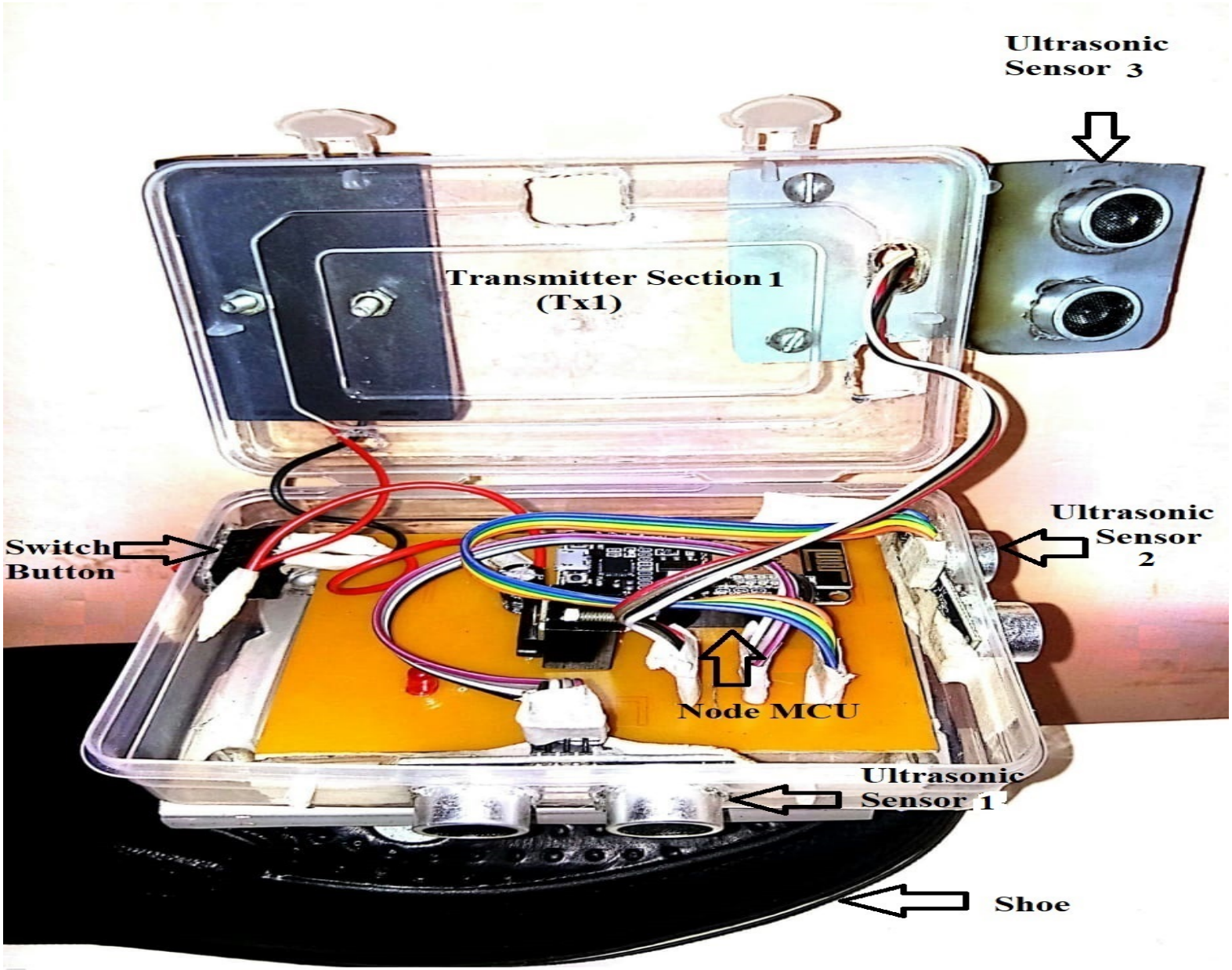
- We are using lithium batteries which are rechargeable and it posseses of 8 volts.
- The controller requires 5 Volts to perform its operation.
- since the controller runs on 5 volt , the above components are used for the regulation of the voltage i.e it converts the voltage from 8 to 5 volts.
- The circuit also consists of power switch which is used to turn on or turn off the circuit.
- THE ABOVE MENTIONED ENTIRE CIRCUIT WILL BE MOUNTED ON THE SHOE.
- The connection part of the kit is done according to the pcb design which is designed in the Kicad software.

Shoe : Tx 1 (Transmitter Section 1) :





Shoe : Tx 1 (Transmitter Section 1) :



PCB DESIGN

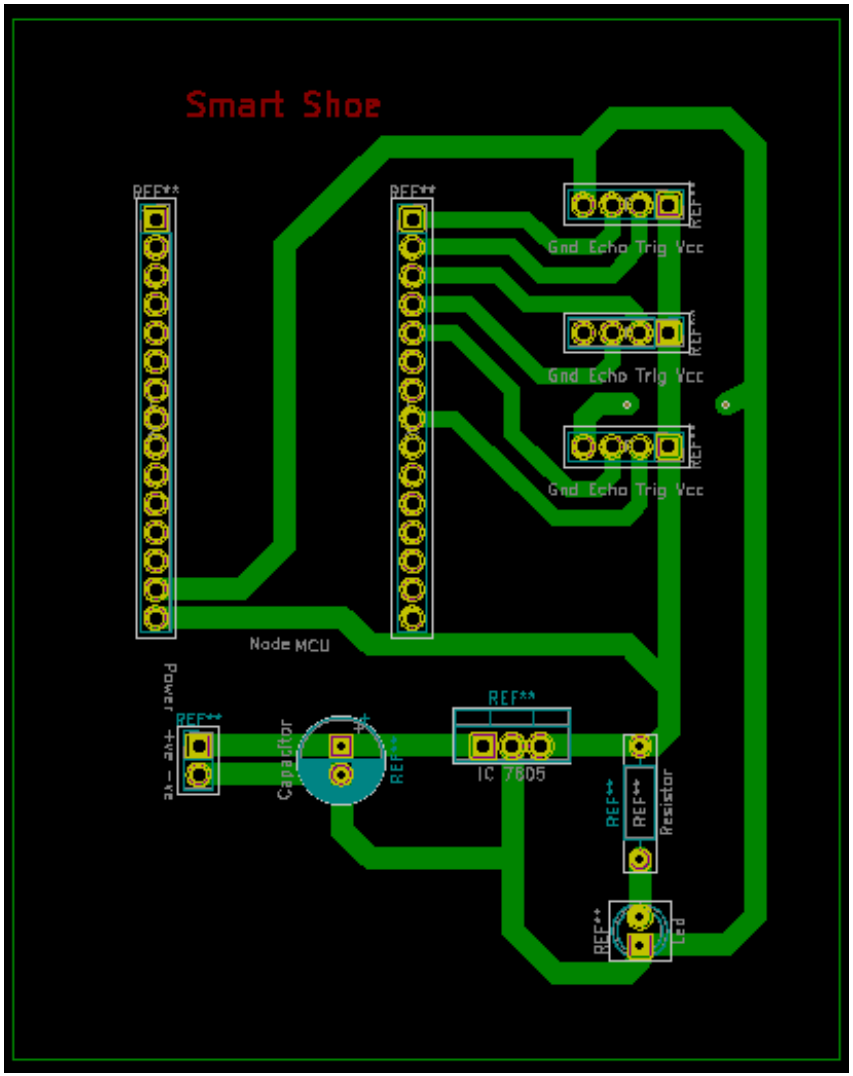


Figure: Pcb design

PCB DESIGN

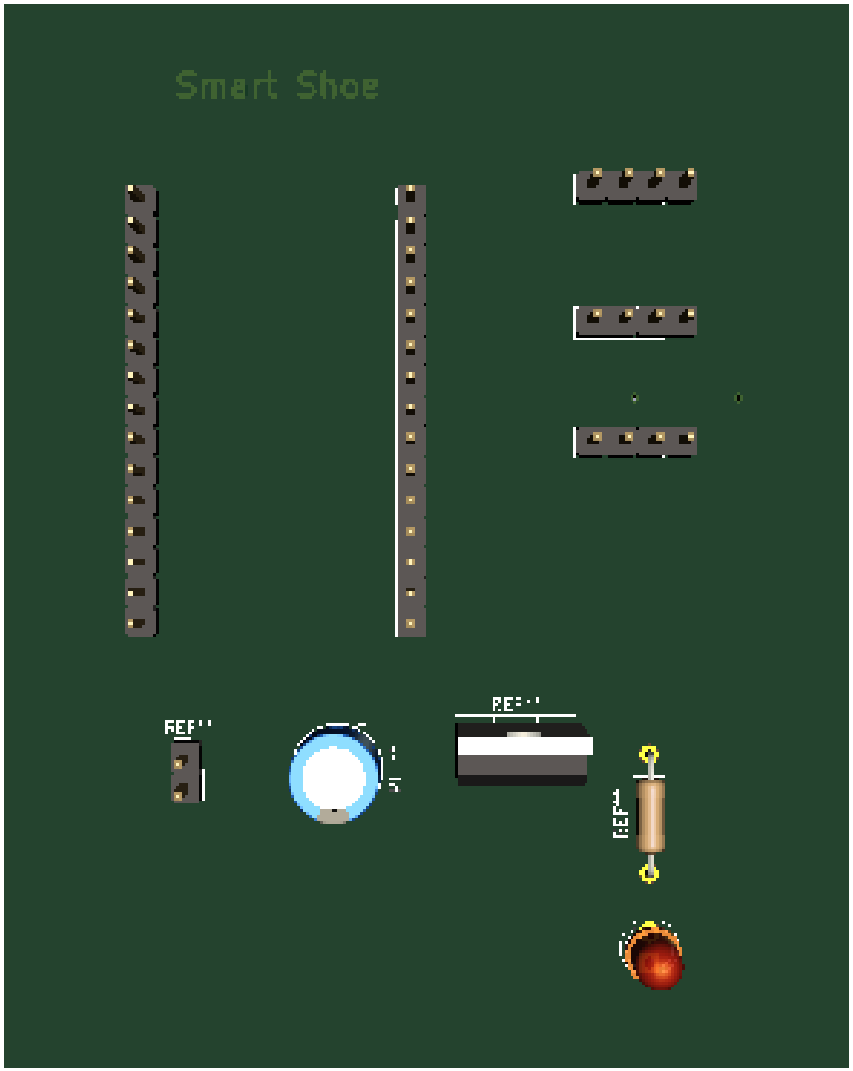


Figure: 2D view

PCB DESIGN

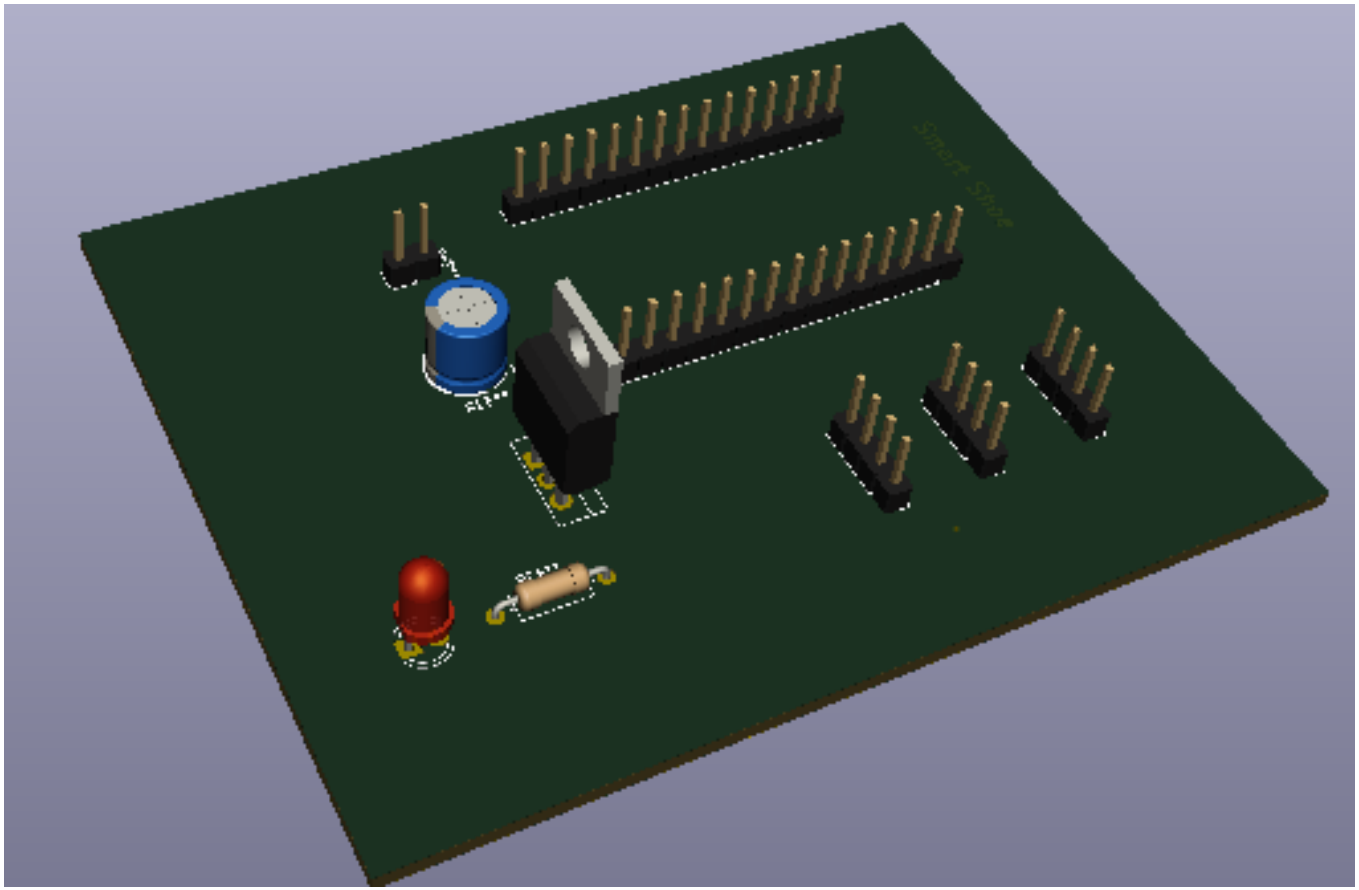


Figure: 3D view

REMOTE : Rx 1 / Tx 2 (Receiver Section for Section 1) and (Transmitter Section 2):

- This box is basically referring to remote control which will be held by the blind person.
- The remote will receive the signals from the transmitter i.e Shoe and it acts a receiver in our project.
- Through this remote, the visually impaired will access the smart shoe.
- In this circuit ,we are using Lithium Rechargeable Batteries.
- It consists of HELP SWITCH , RESET SWITCH and POWER SWITCH.
- The HELP switch is used to send the HELP MAIL with the location of the blind person to their family members whenever they need any sort of help and in case of any emergencies.
- The power switch is used to turn on and turn off the circuit. Similarly, the Reset switch is used to reset the circuit.

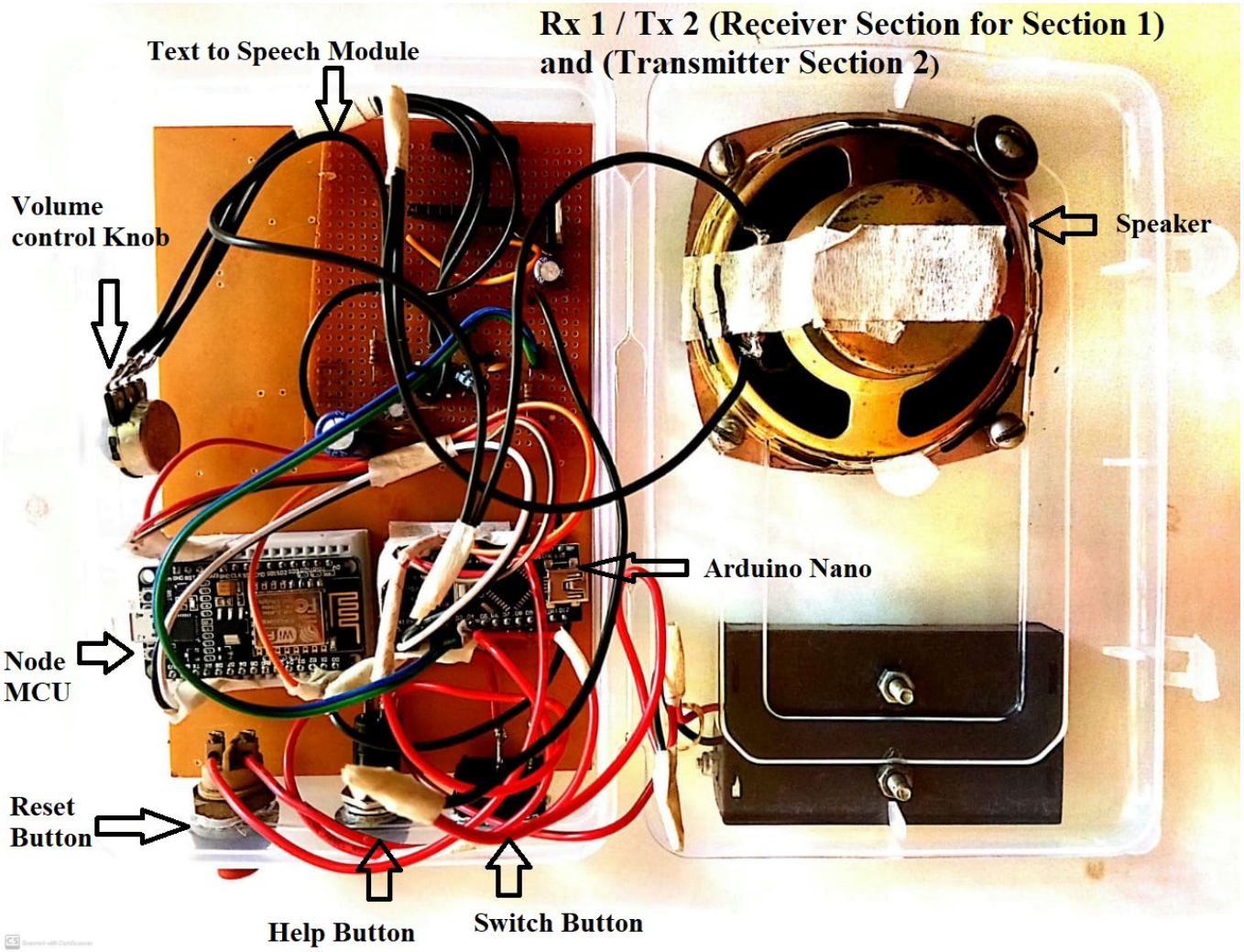
REMOTE : Rx 1 / Tx 2 (Receiver Section for Section 1) and (Transmitter Section 2):

- The Remote consists of Node MCU , Arduino Nano Controller, Help switch, Battery,Text-to-speech module, speaker.
- In this circuit, all the signals coming from the transmitter will be received by our Node MCU and it will be processed.
- After the signal is processed by Node MCU, it will send these signals to Arduino Nano Controller.
- Then Arduino Nano Controller processes it and transmits these signals to the text-to-speech module.This module will further make the text audible to the visually impaired with the help of speaker.

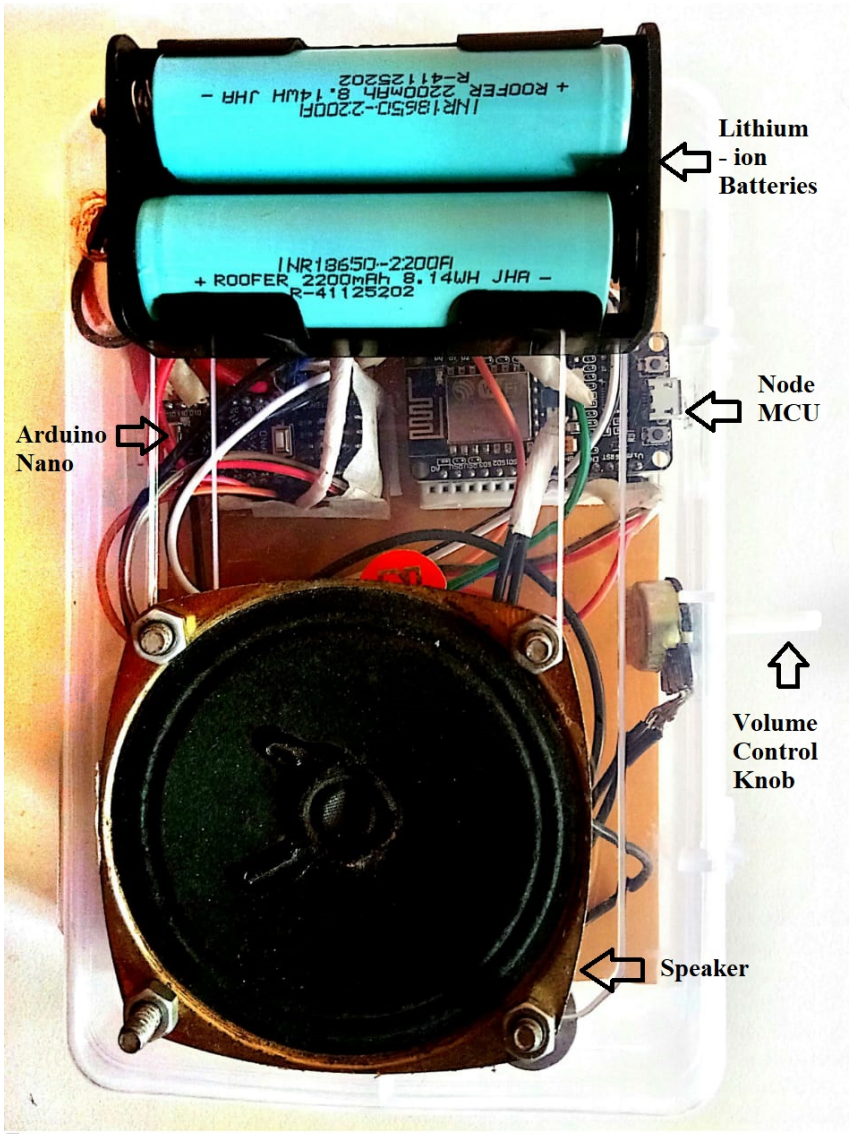
REMOTE : Rx 1 / Tx 2 (Receiver Section for Section 1) and (Transmitter Section 2):

- In case of any help , we need to press the help switch twice since it is a push up button.
- When we press the button, the help mail will be continuously sent to the family member of the blind person until you release the button.
- After this stage, it requires a reset because after sending the mail the controller drains more power and it can go into flash mode.
- Flash mode means that the code is not able to run , hence we need to reset the controller with the help of reset switch.

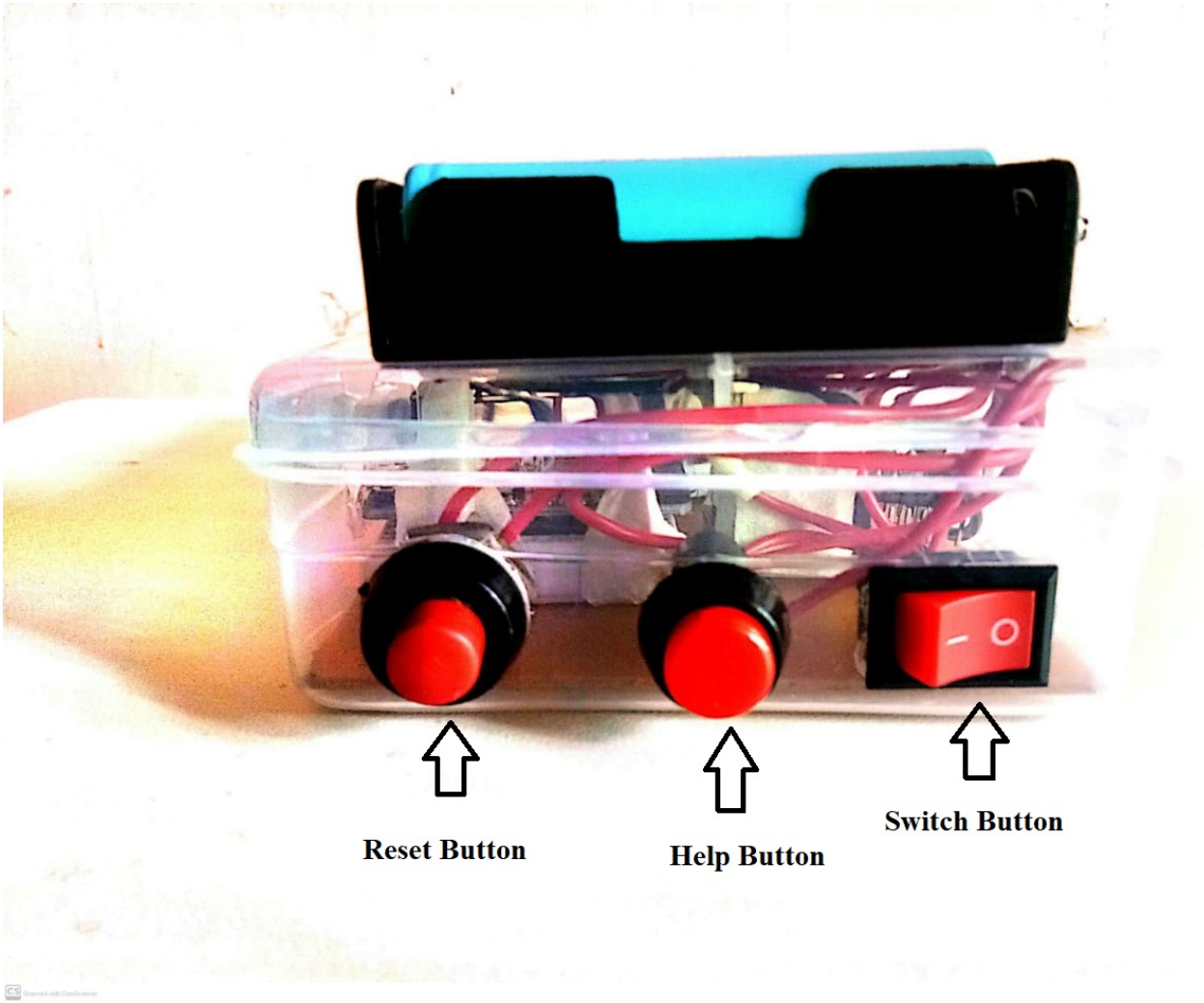
REMOTE : Rx 1 / Tx 2 (Receiver Section for Section 1) and (Transmitter Section 2):



REMOTE : Rx 1 / Tx 2 (Receiver Section for Section 1) and (Transmitter Section 2):



REMOTE : Rx 1 / Tx 2 (Receiver Section for Section 1) and (Transmitter Section 2):



Rx 2 (Receiver Section 2:)

- *widgetBridge bridge1(v2)* is the command we have used to connect two devices/controllers through which we are sending our data from one controller to another controller. *(v2)* is the virtual pin.
- After this command, we have to write *BLYNK CONNECTED() bridge1.setAuthToken("....")* to the code of transmitter section/shoe controller.
- This token is similar to the token of controller of the remote i.e. this token is for the controller to which we have to send the data.
- So we have connected the shoe controller and remote controller through Blynk application using the "authentication token".

Rx 2 (Receiver Section 2):

transmitter | Arduino 1.8.13

File Edit Sketch Tools Help

transmitter §

```
#define BLYNK_PRINT Serial
#include <BlynkSimpleEsp8266.h>
#include <Blynk.h>
#define trig1 D1
#define echo1 D0
#define trig2 D2
#define echo2 D3
#define trig3 D5
#define echo3 D4
float tim1=0;
float distance1=0;
float tim2=0;
float distance2=0;
float tim3=0;
float distance3=0;
char auth[] = "1swyZkxQfhM2AE6iU9jz5x0vU8_gA7ha";                    #Authentication token of the controller of the shoe
char ssid[] = "Blynk";
char pass[] = "12345678";
WidgetBridge bridge1(V2);
BlynkTimer timer;
BLYNK_CONNECTED()
{
bridge1.setAuthToken("MmLGdyarNDgtkLFkVsbKheZocXO3kH-l");              #Authentication token of the controller of the remote to connect the shoe controller and remote controller
}
```

Figure: code of the transmitter section

Rx 2 (Receiver Section 2):

receiver | Arduino 1.8.13

File Edit Sketch Tools Help

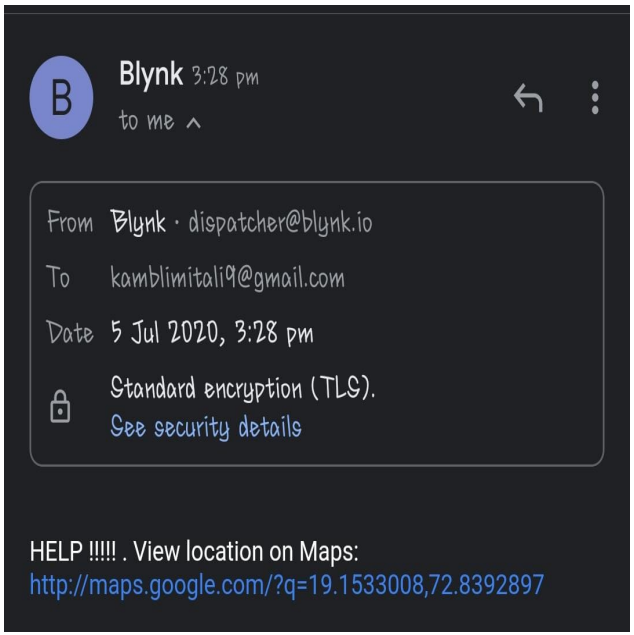
receiver

```
#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>
#define B D0 int val=0;
char auth[] = "MmLGdyarNDgtkLFkVsbKheZocXO3kH-l";                    #Authentication token of the controller of the remote
}
char ssid[] = "Blynk";
char pass[] = "12345678";
String latitude;
String longitude;
void setup()
{
```

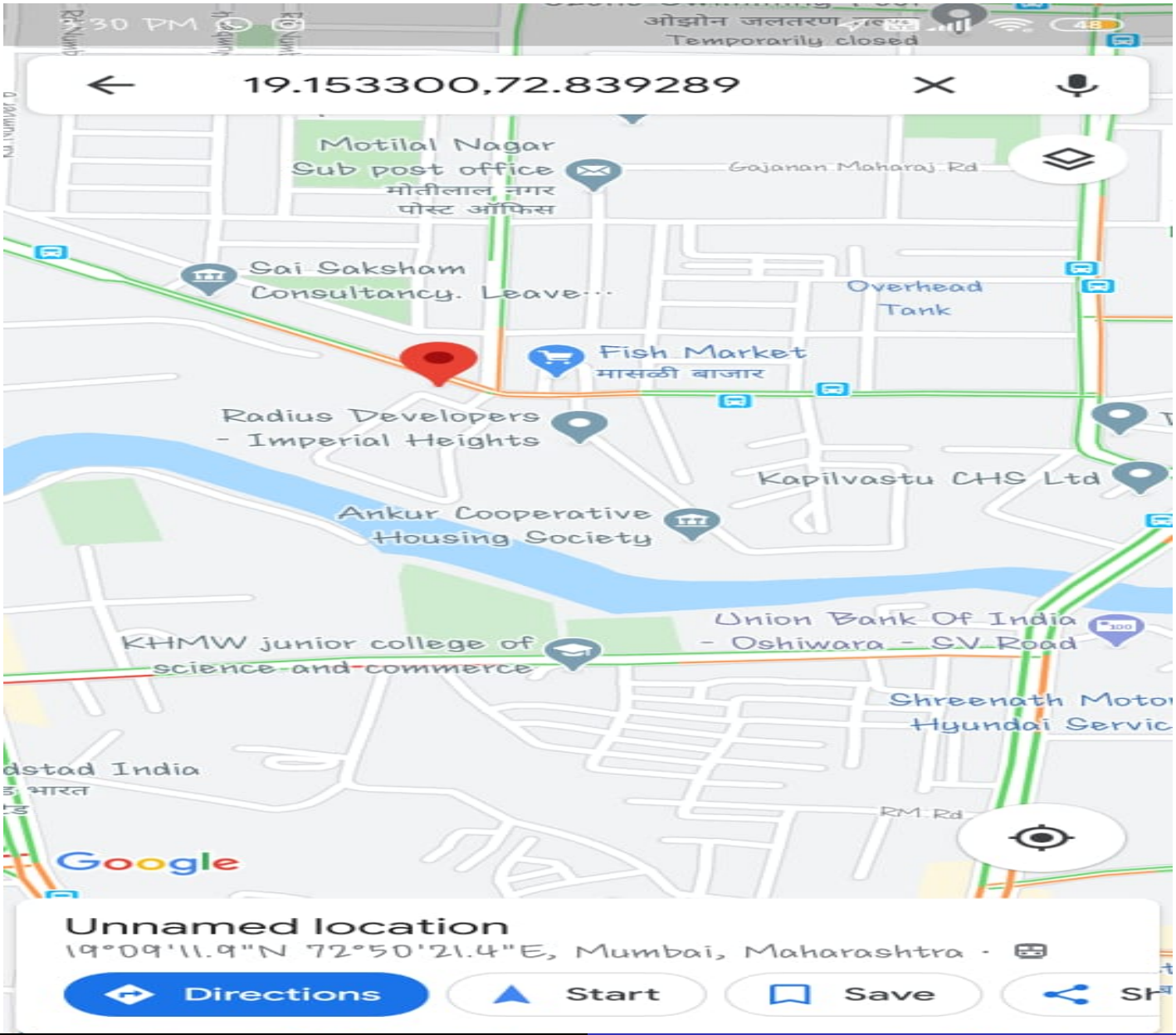
Figure: code of the receiver section

Rx 2 (Receiver Section 2):

- After pressing the help switch of the remote, the help mail will be send to the relative of the blind person through Blynk application.
- We have to provide the mail ID of the realtive of the blind person in the code.
- After clicking on the link in the help mail, the relative person will get the location of the blind person.



Rx 2 (Receiver Section 2):

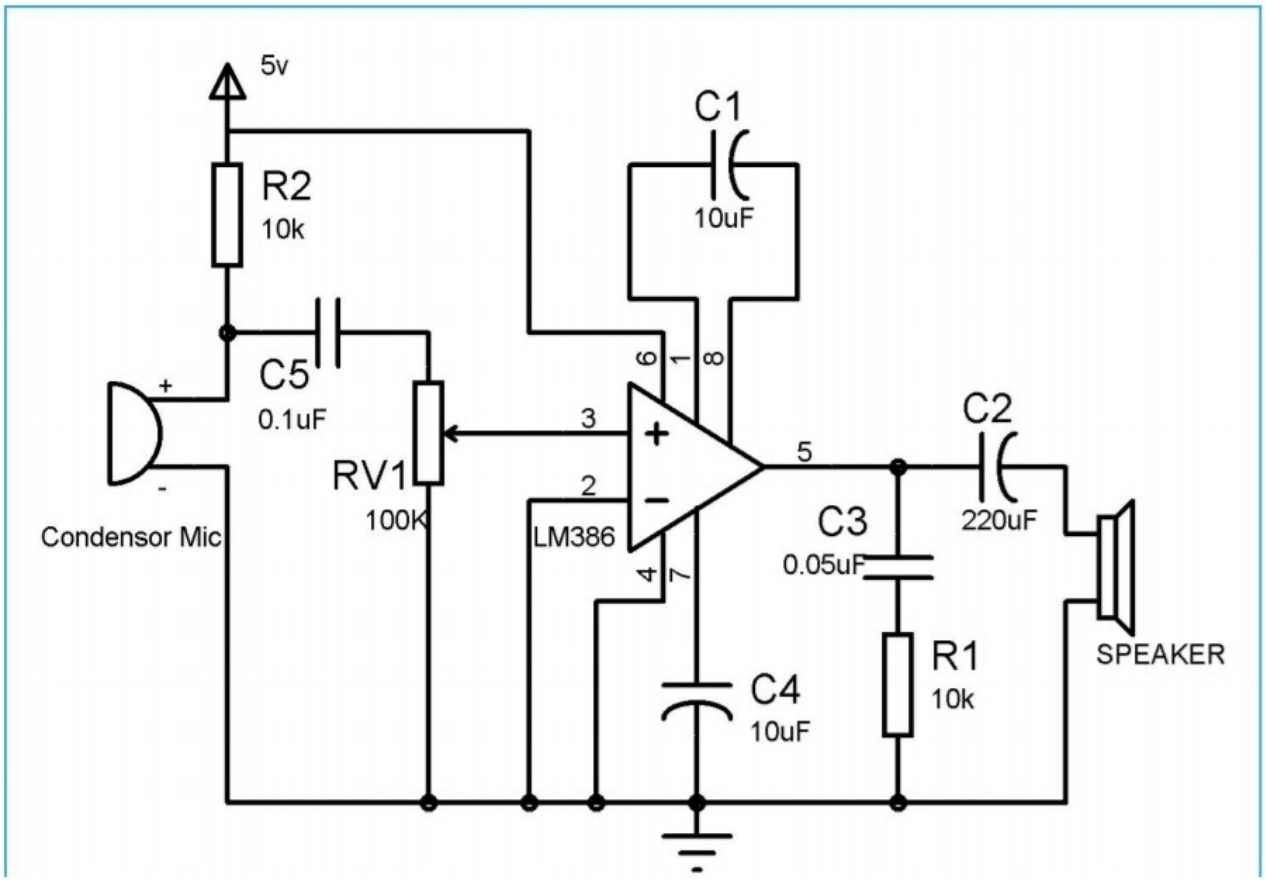


IMPLEMENTATION

- To get connected to the controllers in the circuit, we have to turn on our Wi-Fi.
- All the three sensors would be always detecting for obstacles around as they are programmed to.
- If ultra 1 and ultra 2 doesnt detect obstacles on left/right or front, ultra 3 would keep detecting the ground.
- If the shoe comes to a place where there is no floor detected ahead for example, while walking down the stairs ultra 3 would detect no floor ahead before stepping and send an alert signal to the remote.
- The text-to-speech module in the remote will alert the blind person.

IMPLEMENTATION

Circuit Diagram:- Text to speech Module:



IMPLEMENTATION

- We need to give external power supply to the remote through power bank because, the lithium-ion batteries in the remote would only provide power supply to the text-to-speech module i.e. for the speaker and not the controller.
- In the remote, we have to insert the cable of power bank into Node-MCU for power supply. After connecting the cable, we switch on the kit.
- We can see the two red lights turned on in the kit after we switched it on. One is the power LED and the other one is the reception LED.
- The reception LED will start blinking as soon as it connects to the network and starts receiving data from the shoe of the blind person wearing it.
- If there are no obstacles around or in front of the blind person, our speaker would keep saying Go.

IMPLEMENTATION

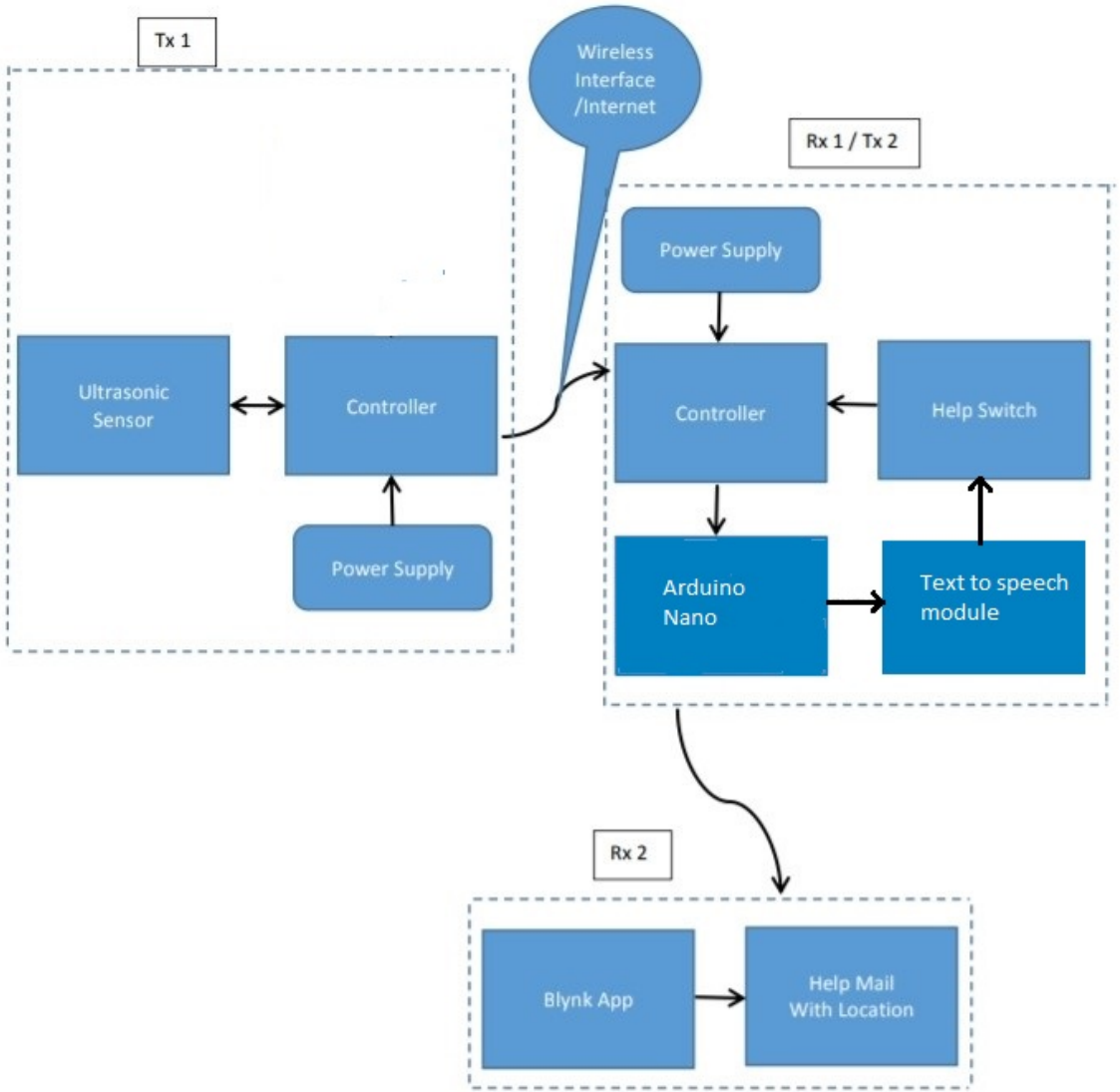
- Whenever an obstacle is detected it takes 5 seconds to update because, the controller of the shoe is communicating to the controller of the remote and the controller of the remote is forwarding it to the Arduino nano controller which will communicate with the text-to-speech module.
- Then the text-to-speech module will convert the text into speech and make the text audible through the speaker.
- If ultra1 detects an obstacle on its left/right, it will give output as Not through the speaker. Not means the user can go straight as there is no obstacle in the front of the user.
- If there is an obstacle in front of the user, ultra2 will give output as Left for the user to turn left. If both the sensors i.e. ultra1 and ultra2 detect obstacles in front of them, it will give output as Stop and alert the user to stop.
- The main purpose of ultra3 is to detect the depth.

IMPLEMENTATION

- As long as it is detecting the floor, it wont give any instructions. But if it detects slope in front of the shoe it will say Alert to the user.
- It is mainly useful while walking down the stairs to alert the user. It is also helpful for pothole detection.
- In case of emergency, the blind person can press the help button on the remote.
- The Blynk app on the phone of the blind person will locate the blind person through the GPS of his phone after he presses the help button.
- The Blynk app will send an emergency help mail to the family with the location it detected of the blind person.

BLOCK DIAGRAM

Block Diagram:-



ADVANTAGES

- Simple to use.
- Auto detection.
- Reliable assistive technology indicating the obstacles.
- User friendly system.
- An ease to carry the project without any embarrassment.
- Blind people blending in along with normal people brings significant improvement in confidence and quality of life of the visually impaired.
- Reduction in accidents.
- Offering Independency to the user

DISADVANTAGES

- Water can damage the circuit.
- Less mechanical strength.
- Shoe can feel a bit heavy.

FUTURE SCOPE

- We can add Iot based Health monitoring of the blind person : This system can be integrated with our current system in future.
- We can also make prosthetic leg rather than shoe which will be a robotic prosthetic leg for the people who are blind and handicapped (leg) as well,which will be helpful for them to not only for detecting obstacles but also helpful in walking by their own.

CONCLUSION

- In order to make use of latest technology, we have proposed a project of IOT based smart blind shoe system for the blind preson.
- We have designed a wearable shoe on which electronic kit is proposed.
- Main goal of this proposed system is to provide navigation assistance for this visually impaired person and security to the blind person.
- Sensors will detect obstacles and remote system will announce the commands according direction.
- HELP switch is also mounted on the remote for getting a help to the blind person by the family i.e mail will be sent to the family member's mail id with location of that person.
- Our approach is to make easy application to make visually impaired person to live independently.

REFERENCES

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Thank you