Mini Project Title

Haptic Proximity Module (HPM) with Real-Time GPS tracking

Submitted in partial fulfilment of the requirements of the degree of

THIRD YEAR ENGINEERING IN

Computer Science and Engineering

(Internet of Things and Cyber Security Including Block Chain Technology)

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2022

Jawahar Education Society's

A. C. Patil College of Engineering, Kharghar

CERTIFICATE

This is to certify that the Project entitled

"Haptic Proximity Module (HPM) with Real-Time GPS tracking"

is a bonafide work of

submitted to the University of Mumbai in partial fulfilment of the requirement for the award of the degree of Third Year Engineering in Computer Science and Engineering (Internet of Things and Cyber Security Including Block Chain Technology)

(Prof. SUREKHA KHOT)
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Prof. S. P. Pawar
Head of Department

DR. V N PAWAR
PRINCIPAL

Mini Project Approval

This Mini Project entitled "**Haptic Proximity Module (HPM) with Real-Time GPS tracking"** by **MRUNMAI BASUTKAR (38) for** the course Mini Project– 2 A is approved for the degree of **THIRD Year Engineering** in **Computer Science and Engineering (Internet of Things and Cyber Security Including Block Chain Technology)**

Examiners

1……………………………………..
(Internal Examiner Name & Sign)

2………………………………………
(External Examiner name & Sign)

Date:

Place: KHARGHAR

Abstract

Safe mobility is the greatest challenge faced by the blind in day-to-day life. The objective of this project is to develop a knee above obstacle detection, and warning system for the visually impaired employing ultrasound range-based ranging to enhance the horizontal and vertical range of the cane. The smart solution for the blind giving them extra senses with the help of technology. We have used an Ultrasonic sensor for detecting the knee above obstacles which are otherwise difficult with a normal traditional cane, a buzzer to notify the person with a sound about the obstacle, a GPS chip to locate the stick, a battery and all these are interfaced with Arduino Uno and Node MCU. Components: Arduino Uno, Node MCU, Piezo Buzzer, Battery and a 3D printed remote like case (If designing aspects permit). The Haptic Proximity Module's goal is to bring the white cane up to technological modernity while maintaining its affordable price. The Haptic Proximity Module is geared towards an elderly, less affluent demographic group that would demand comfort, accessibility, and affordability from the product. The existing electronic aids for blind people are not up to the mark. Based on the limitations in existing aids, this project proposes an enhanced assisting electronic aid using latest technology like Ultrasonic sensor, vibration, GPS, buzzer. Using the ultrasonic sensor, microcontroller, and vibration motor, the HPM greatly increased the object detection range, thereby improving the lives of the blind and visually impaired users

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CHAPTER 1: INTRODUCTION

1.1 Introduction

• This project is an IOT based smart cane stick for visually impaired and blind people to provide them guidance for movement in surrounding without any external help.

• In Our project the main focus will be on developing a cheap smart cane module for visually impaired / blind people, for their movement in surrounding without any other support. Currently available system are guidance dogs and cane stick, which are not that reliable.

• HPM has 3 main modules viz. Real-Time GPS Tracking, Obstacle Detection and RF Remote to find the stick in case dropped accidently.

• This project is feasible economically and technically to any visually impaired or blind person. Any such user can move around in surrounding without any help and this module is very easy to maintain. This project will create awareness of importance of technology in our society while having safety and security to the user.

• The cost of the module is in the range of INR 3000-3500.

1.2 Motivation

• Blind people are liable to get in contact with whatever obstacle which pass before them during walking which may lead them to risk of injury caused from fall and it could also cause great damage to them.

• Blind peoples have trouble seeing things which other people take for granted, like Road signs, traffic lights, and so forth. They are more prone to falls and other accidents because they cannot clearly see their surrounding environment.

• The smart solution for the blind is giving them extra senses with the help of technology

• The aim of this project is that the Blind people can use this smart cane stick for their guidance to reach a destination with the help of the GPS tracker so they can be safe in any situation.

1.3 Problem Statement & Objectives

Blind peoples have trouble seeing things which other people take for granted, like Road signs, traffic lights, and so forth. They are more prone to falls and other accidents because they cannot clearly see their surrounding environment.
The smart solution for the blind is giving them extra senses with the help of technology.

Chapter 2 : LITERATURE SURVEY

2.1 Survey of Existing System

• A wearable band for blind people which vibrates on detecting any object in vicinity, so as to warn that person.

• But it not much effective and the family member cannot track the location of the user.

• Guide dogs (colloquially known as seeing eye dogs) are assistance dog trained to lead blind and visually impaired people around obstacles. Although dogs can be trained to navigate various obstacles, they are red–green color blind and incapable of interpreting street sign. The human does the directing, based on skills acquired through previous mobility training. The handler might be likened to an aircraft's navigator, who must know how to get from one place to another, and the dog is the pilot, who gets them there safely. In several countries guide dogs, along with most service and hearing dogs, are exempt from regulations against the presence of animals in places such as restaurants and public transportation. A white cane is a device used by many people who are blind or visually impaired. A white cane allows its user to scan their surroundings for obstacles, but is also helpful for other people in identifying the user as blind or visually impaired and taking appropriate care. The latter is the reason for the cane's white colour, which in many jurisdictions is mandatory.

PAPER NAME	AUTHOR NAME	ADVANTAGE	DISADVANTAGE
Smart Wrist Band for Obstacle Detection ICMEIE-2015 AT: RU,RAJSHAHI BANGLADESH	● Juliana Shetara ● Sharmin ● Majumder ● Shatabdi Acharjee ● Sharith Dhar	● In a heavy traffic or in a noisy place it is difficult to hear the sound with other ongoing sounds.	● It is not much effective and the family member cannot track the location of the user
Development of an Intelligent guide-stick for the blind IEEE International Conference on Robotics and Automation-2001	● Sung-Jae Kang ● Young Ho ● In Hyuk Moon	● The intelligent guide stick followed the path of the road successfully avoiding the obstacle.	● User cannot find the guide stick once the stick is lost as the system does’nt have GPS installed

Table 1 Tabular Literature Survey

2.2 Limitation Existing system or research gap

• More than 161 million people worldwide are visually impaired. Among them 124 million have low vision and 37 million are blind. Another 153 million people suffer from visual impairment due to uncorrected refractive errors such as near sightedness, far-sightedness or astigmatism. +

• Virtually all these people could restore normal vision with eyeglasses or contact lenses. More than 90% of the world's visually impaired people live in low- and middle-income countries.

2.3 Mini Project Contribution

SR.NO	NAME	WORK
1	SOHAIL SHAIKH	HARDWARE, BUYING COMPONENTS
2	AISHA PATEL	INFORMATION GATHERING, CODING, PRESENTATION
3	MRUNMAI BASUTKAR	INFORMATION GATHERING, REPORT MAKING, HARDWARE
4	SUPRIT PATIL	HARDWARE, PRESENTATION,CODING

Table 2 Mini Project Contribution

Chapter 3: PROPOSED SYSTEM

3.1 Introduction

- Haptic Proximity Module with Real-Time GPS tracking is a smart cane stick which will alert the user about any knee above obstacle through vibration feedback on the stick's handle. If the stick is dropped accidently by the user, there's a Radio Frequency Remote Control to wirelessly trigger a buzzer on the stick, so that the user to can follow the direction of sound to locate the stick.
- There's also a GPS sensor on the smart cane stick to track the location of stick in Real-Time whenever in use. This location will be uploaded to Blynk Cloud. The Real-Time location of the user can be accessed only by family/friend of the user on an smartphone, which will have Blynk API installed.
- The main objective is to make an IOT based smart device to make movement for visually impaired and blind people, independent of anyone's help. This device uses simple modules such as Ultrasonic sound sensor, vibrating motor, Arduino, etc. which are cheap in market hence resulting in reduction of cost for the final product when manufactured in bulk.
- Also, after gaining some free will to move in surrounding without any help makes for visually impaired and blind people, their friends and family members may have concern about the safety of the that person, so as to overcome this situation, our device will upload a Real-Time GPS location of the user onto an API, which will be installed on the phone of user's family or friend.
- So, our first module is Arduino – HC-SR04 – Buzzer/Vibrating Motor in this module we are using ultrasonic sensor to find the obstacle in front of the user when the obstacle is in the range of 100 cm the Arduino will ring the buzzer and when the obstacle is less than 10 cm the intensity of buzzer will increase.

  Our second module is NodeMCU ESP8266 – SIM28 – Blynk API using this module we can find out the real time location of the user. The components which are used in this module are SIM28 GPS module, NodeMCU and Blynk API.
- Family Members can monitor the location of the user Real-Time on their smartphone using the Blynk API which will send the real time GPS location using SIM28 GPS module.
- The third module is RF Transmitter & Receiver in this module we are using radio frequency transmitter and receiver so that the user can find the stick if the stick is falls on the ground or forget where it is been kept using the remote the user can ring the buzzer and easily find the stick.

- Blynk Application and Cloud Services.

Blynk was designed for the Internet of Things. It can control hardware remotely, it can display sensor data, it can store data, visualize it and do many other cool things.

- Connection to the cloud using:

- Wi-Fi
- Bluetooth and BLE
- Ethernet
- USB (Serial)
- GSM

- Set of easy-to-use Widgets
- Direct pin manipulation with no code writing
- Easy to integrate and add new functionality using virtual pins

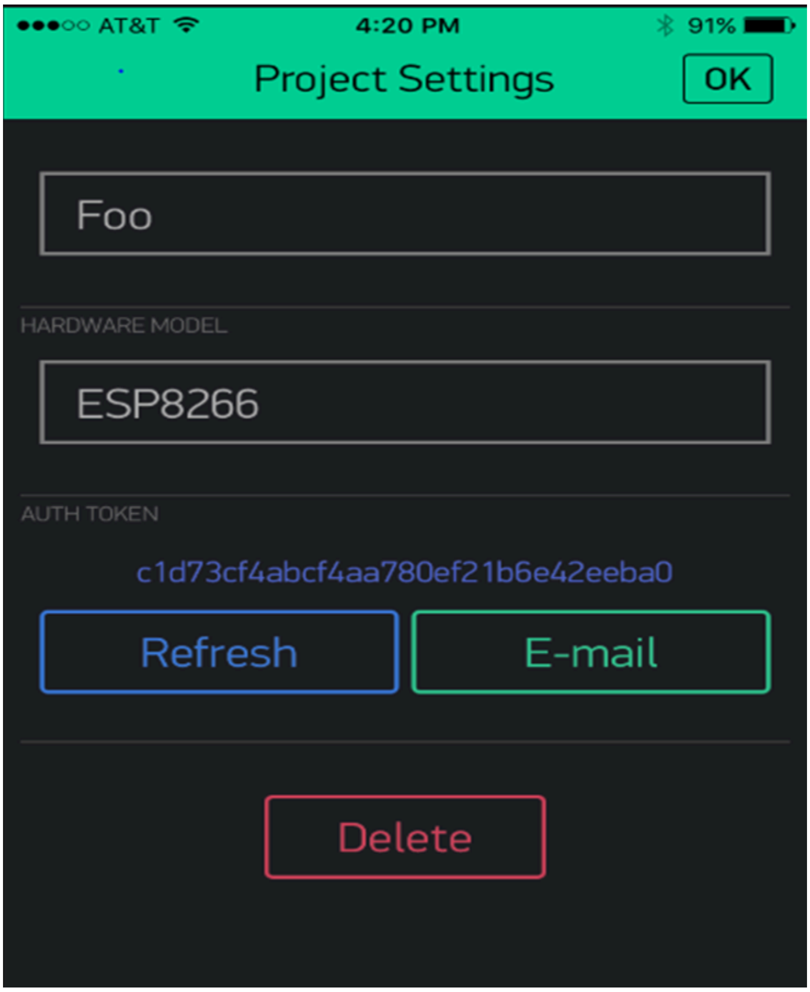

Figure 1 Project Interface

3.2 Architecture/ Framework

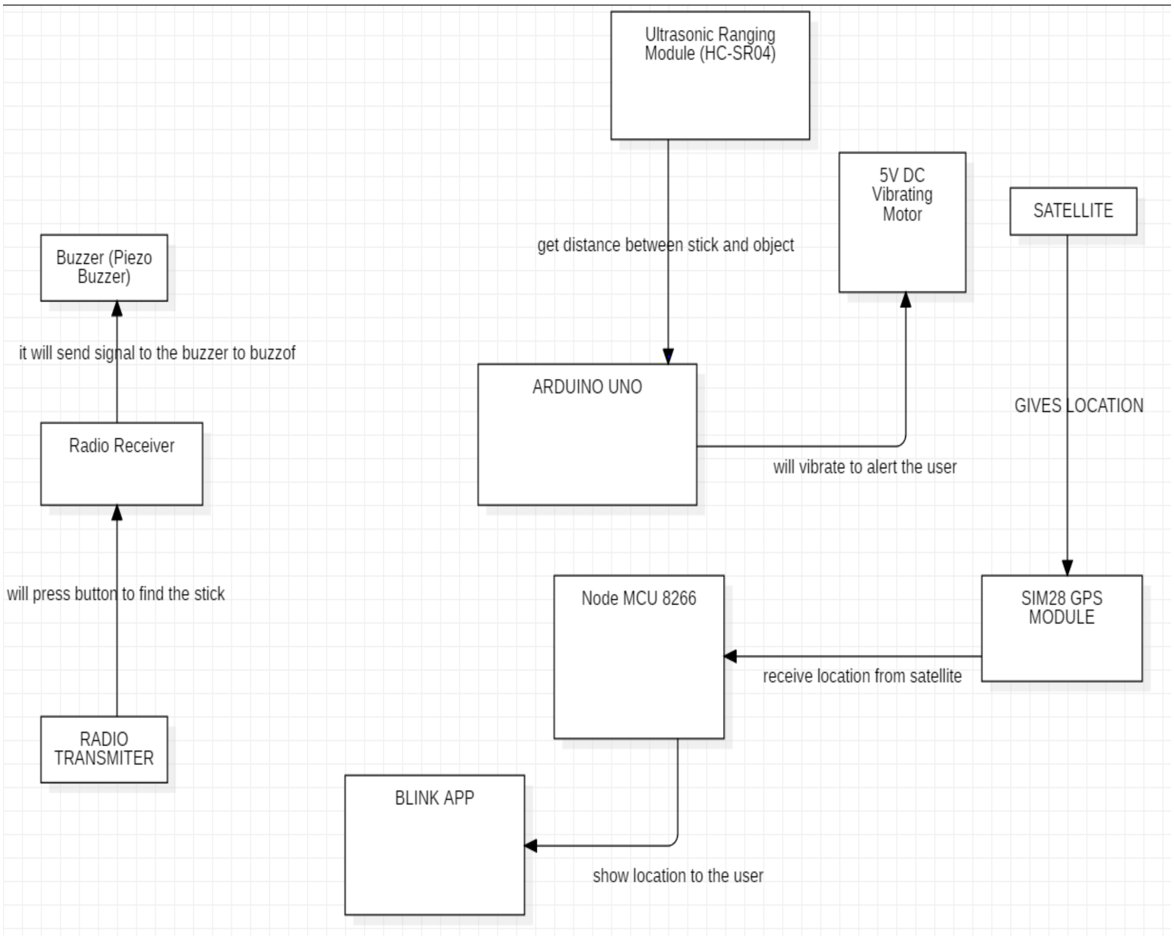

Figure 2 Component Diagram

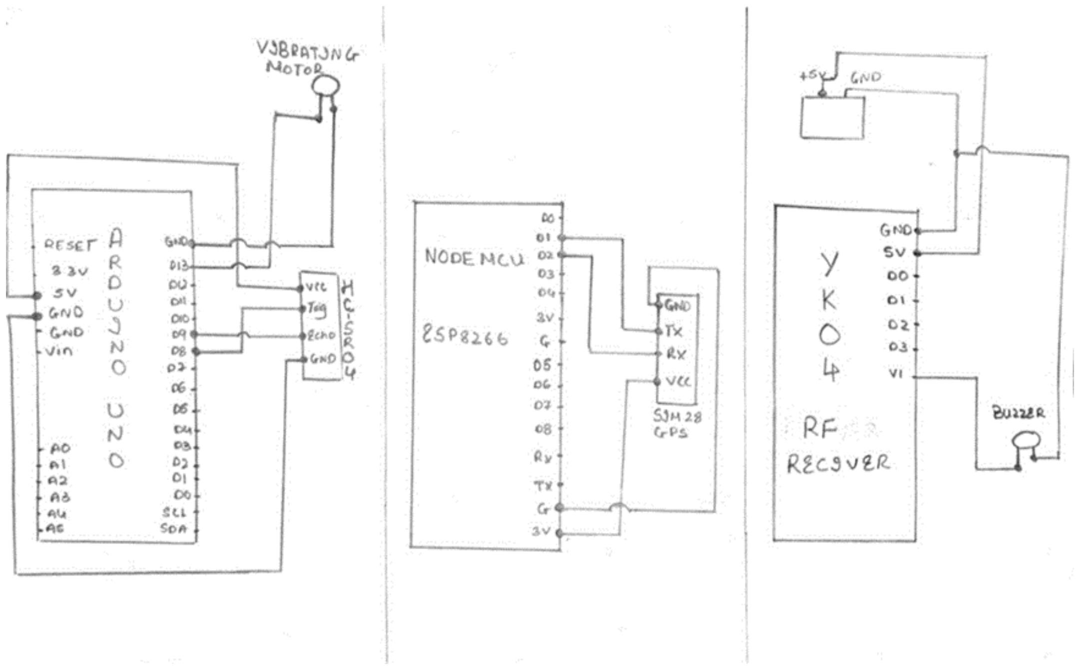

Figure 3 Circuit Diagram

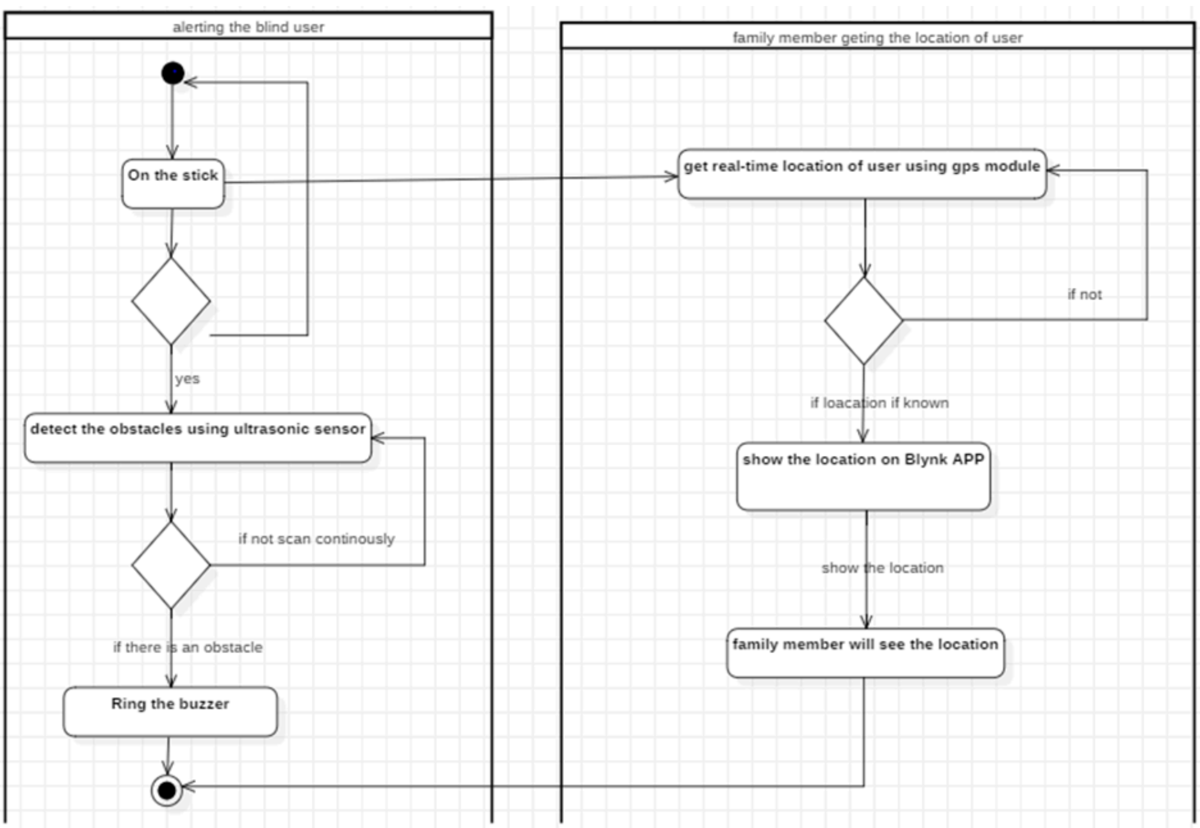

Figure 4 Activity Diagram

3.3 Algorithm and Process Design

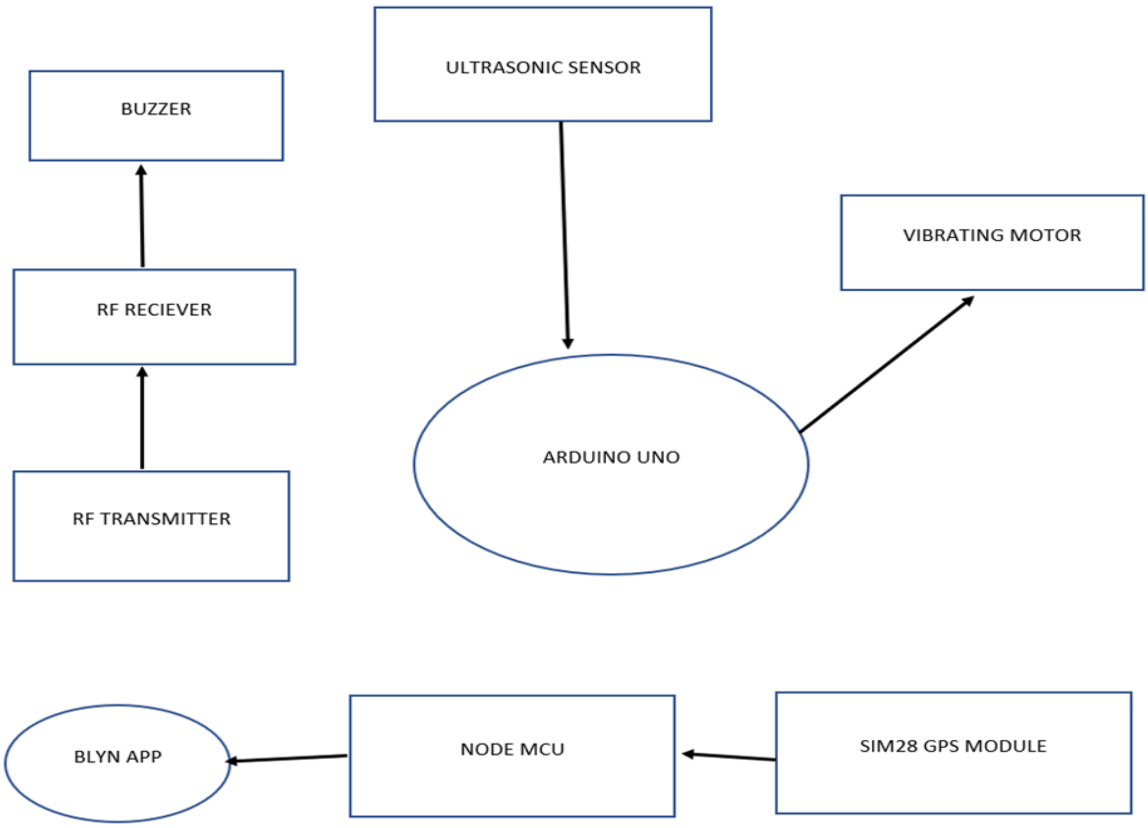

Figure 5 Data Flow Diagram

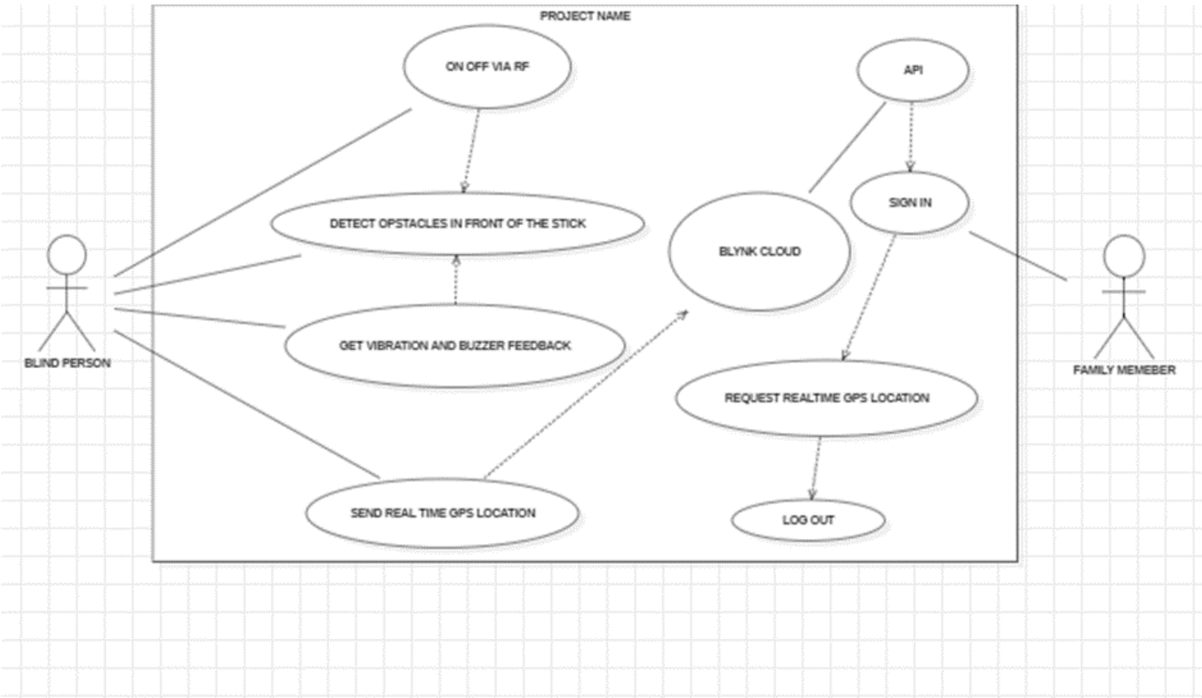

Figure 6 Use-Case Diagram

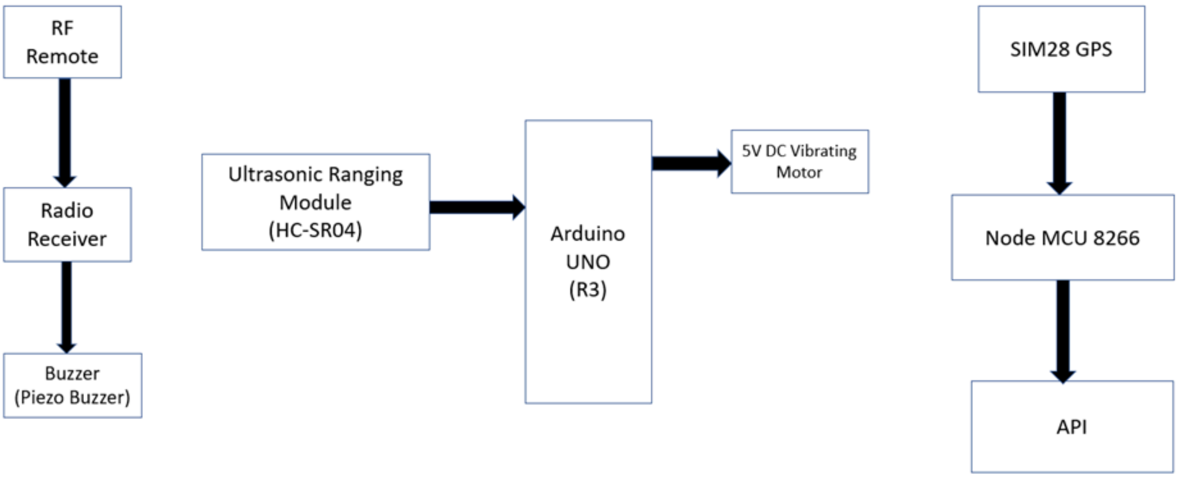

Figure 7 Block Diagram

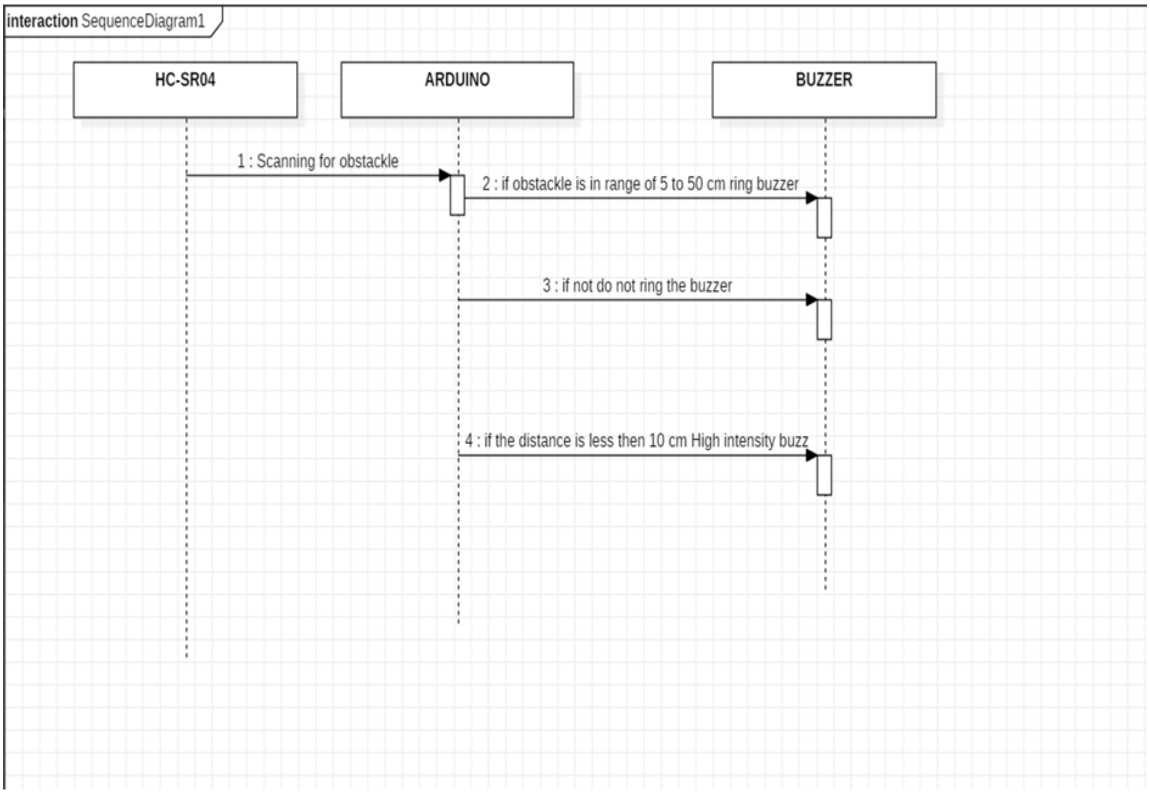

Figure 8 Sequence Diagram

EVENT	TIGGER	SOURCE	ACTIVITY	RESPONSE	DESTINATION
OBSTACLE DETECTED	ARDUINO	HC-SR04	OBSTACLE AHEAD	VIBRATING MOTOR	USER
REAL-TIME LOCATION	NODEMCU ESP8266	SIM28	MOVEMENT	API	API
RF BUTTON TRIGGER	RF RECIVER	TRANSMITTER	BUTTON PRESSED	BUZZER	BUZZER

Figure 9 Event Table

- <u>Coding for Arduino for Ultrasonic Sensor</u>

```
/*

This code should work to get warning cross the buzzer when something be closer than 0.5 meter

Circuit is ultrasonic sensor and buzzer +5v and Arduino uno is used

*/

// Define pins for ultrasonic and buzzer

int const trigPin = 10;

int const echoPin = 9;

int const buzzPin = 2;

void setup()

{

pinMode(trigPin, OUTPUT); // trig pin will have pulses output

pinMode(echoPin, INPUT); // echo pin should be input to get pulse width

pinMode(buzzPin, OUTPUT); // buzz pin is output to control buzzering

}

void loop()

{

// Duration will be the input pulse width and distance will be the distance to the obstacle in centimeters

int duration, distance;

// Output pulse with 1ms width on trigPin

digitalWrite(trigPin, HIGH);

delay(1);

digitalWrite(trigPin, LOW);

// Measure the pulse input in echo pin

duration = pulseIn(echoPin, HIGH);

// Distance is half the duration devided by 29.1 (from datasheet)

distance = (duration/2) / 29.1;

// if distance less than 0.5 meter and more than 0 (0 or less means over range)

if (distance <= 50 && distance >= 0) {
```

```
// Buzz
digitalWrite(buzzPin, HIGH);
} else {
// Don't buzz
digitalWrite(buzzPin, LOW);
}
// Waiting 60 ms won't hurt any one
delay(60);
}
```

- Coding Details/ Source code of Node MCU:

```
#include <TinyGPS++.h>
#include <SoftwareSerial.h>
#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>

//static const int RXPin = 4, TXPin = 5;   // GPIO 4=D1(conneect Tx of GPS) and GPIO 5=D2(Connect Rx of GPS)
static const uint32_t GPSBaud = 9600; //if Baud rate 9600 didn't work in your case then use 4800

TinyGPSPlus gps; // The TinyGPS++ object
WidgetMap myMap(V0);  // V0 for virtual pin of Map Widget

SoftwareSerial ss(4, 5);  // The serial connection to the GPS device

BlynkTimer timer;

float spd;       //Variable  to store the speed
float sats;      //Variable to store no. of satellites response
String bearing;  //Variable to store orientation or direction of GPS
```

```
char auth[] = "gBFSTU5dbhuuefZpRsIdX80WZNRDpeh1";          // Project authentication key
char ssid[] = "moto";                                        // Name of network (HotSpot or Router name)
char pass[] = "hellomoto";                                   // Corresponding Password

//unsigned int move_index;        // moving index, to be used later
unsigned int move_index = 1;      // fixed location for now
 void setup()
{
 Serial.begin(115200);
 Serial.println();
 ss.begin(GPSBaud);
 Blynk.begin(auth, ssid, pass);
  timer.setInterval(5000L, checkGPS); // every 5s check if GPS is connected, only really needs to be done once
}
void checkGPS(){
 if (gps.charsProcessed() < 10)
  {
   Serial.println(F("No GPS detected: check wiring."));
      Blynk.virtualWrite(V4, "GPS ERROR");  // Value Display widget  on V4 if GPS not detected
  }
}
void loop()
{

   if (ss.available() > 0)

    // sketch displays information every time a new sentence is correctly encoded.
    if (gps.encode(ss.read()))
      displayInfo();
```

```
  Blynk.run();
  timer.run();
}
void displayInfo()
{
if (gps.location.isValid() )
  {
     float latitude = (gps.location.lat());     //Storing the Lat. and Lon.
    float longitude = (gps.location.lng());
    Serial.print("LAT:  ");
    Serial.println(latitude, 6);  // float to x decimal places
    Serial.print("LONG: ");
    Serial.println(longitude, 6);
    Blynk.virtualWrite(V1, String(latitude, 6));
    Blynk.virtualWrite(V2, String(longitude, 6));
    myMap.location(move_index, latitude, longitude, "GPS_Location");
    spd = gps.speed.kmph();               //get speed
       Blynk.virtualWrite(V3, spd);
       sats = gps.satellites.value();    //get number of satellites
       Blynk.virtualWrite(V4, sats);
       bearing = TinyGPSPlus::cardinal(gps.course.value()); // get the direction
       Blynk.virtualWrite(V5, bearing);
  }
  else
//void disp()
{
    Blynk.virtualWrite(V1, "----");
    Blynk.virtualWrite(V2, "----");
    Blynk.virtualWrite(V3, "----");
    Blynk.virtualWrite(V4, "No Satellite(s) in Range");
    Blynk.virtualWrite(V5, "----");
```

```
}
Serial.println();    }
```

Source code of ultrasonic sensor:

```
#include <LiquidCrystal.h>
#define trigPin 8
#define echoPin 9
#define buzrPin 13

long duration, distance;

void check_distance()
  {
    delay(5);
    digitalWrite(trigPin, LOW);
    delayMicroseconds(2);

    digitalWrite(trigPin, HIGH);
    delayMicroseconds(10);

    digitalWrite(trigPin, LOW);

    duration = pulseIn(echoPin, HIGH);
    distance = (duration/2) / 29.1;

    if(distance<50)
      {
          digitalWrite(buzrPin,HIGH);
          digitalWrite(vibrPin,HIGH);
          delay(50);

          digitalWrite(buzrPin,LOW);
          digitalWrite(vibrPin,LOW);
```

```
        delay(50);
    }

  else
    {
        digitalWrite(buzrPin,LOW);
        digitalWrite(vibrPin,LOW);
    }
}
```

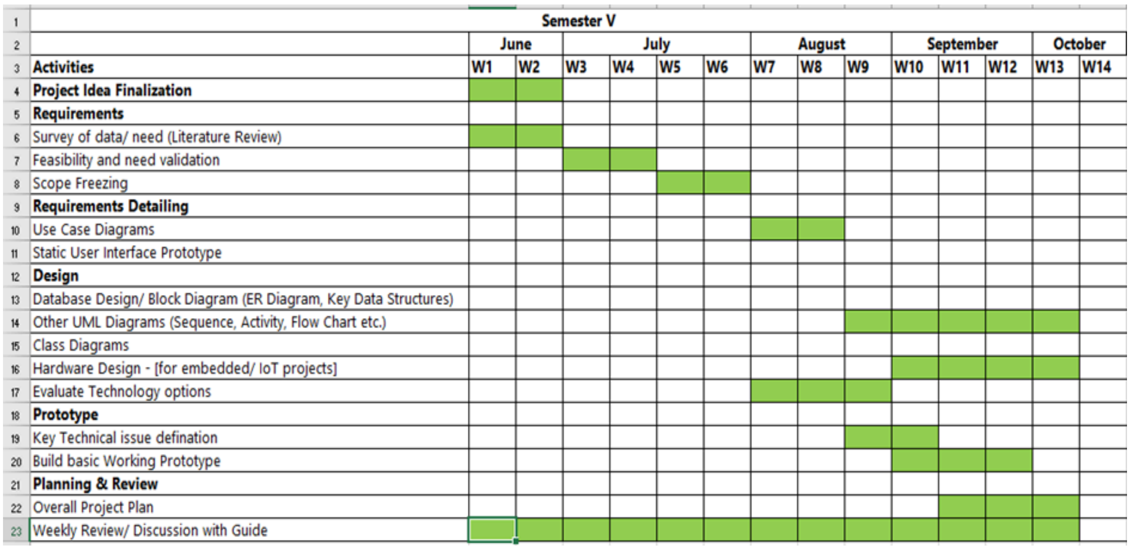

Figure 10 Gantt Chart

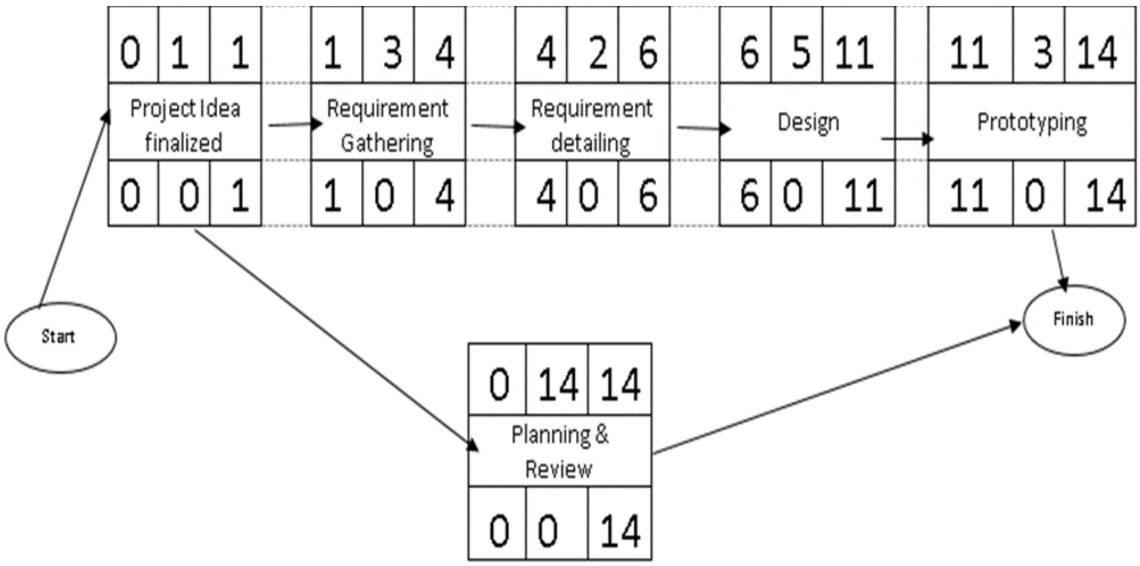

Figure 11 Pert

3.4 Details of Hardware & Software

HARDWARE REQUIREMENT:

1. Arduino Uno
2. Ultrasonic Sensor: Module No. HCSR04
3. NodeMCU ESP8266
4. SIM28 GPS Module
5. Piezo Buzzer and vibrating motor
6. RF Transmitter and Receiver
7. Battery
8. Jumping Wires

SOFTWARE REQUIREMENT:

1.Blynk API

This API can control the hardware remotely and can display sensor data.

2.Arduino IDE

Arduino IDE The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, macOS, Linux)

Chapter 4

4.1 Result and Discussion

The developed system majorly aims on providing a safe and secure path for the user to reach his/her destination. On completion of the project, the system will be delivered as a smart device to complete the above task. To develop this proposed system, we require minimum tools, cheap and easily available components and a simple cane. In order to move freely the user has use IOT based Haptic Proximity Module to detect knee above obstacles in his/her path, the user will get the feedback in terms of vibration, the intensity of vibration will convey the approximate distance of the obstacle so as to avoid that way and choose a different path.

This module also has a Radio Frequency remote control to wirelessly sound a buzzer on the stick to find the stick if dropped accidently by the user. The direction of the sound of buzzer will guide the user towards the stick. An onboard GPS sensor will continuously upload the Real-Time Location of the device while in use, this location will be visible on an API of the user's friend or family member to deal with safety issues of the user.

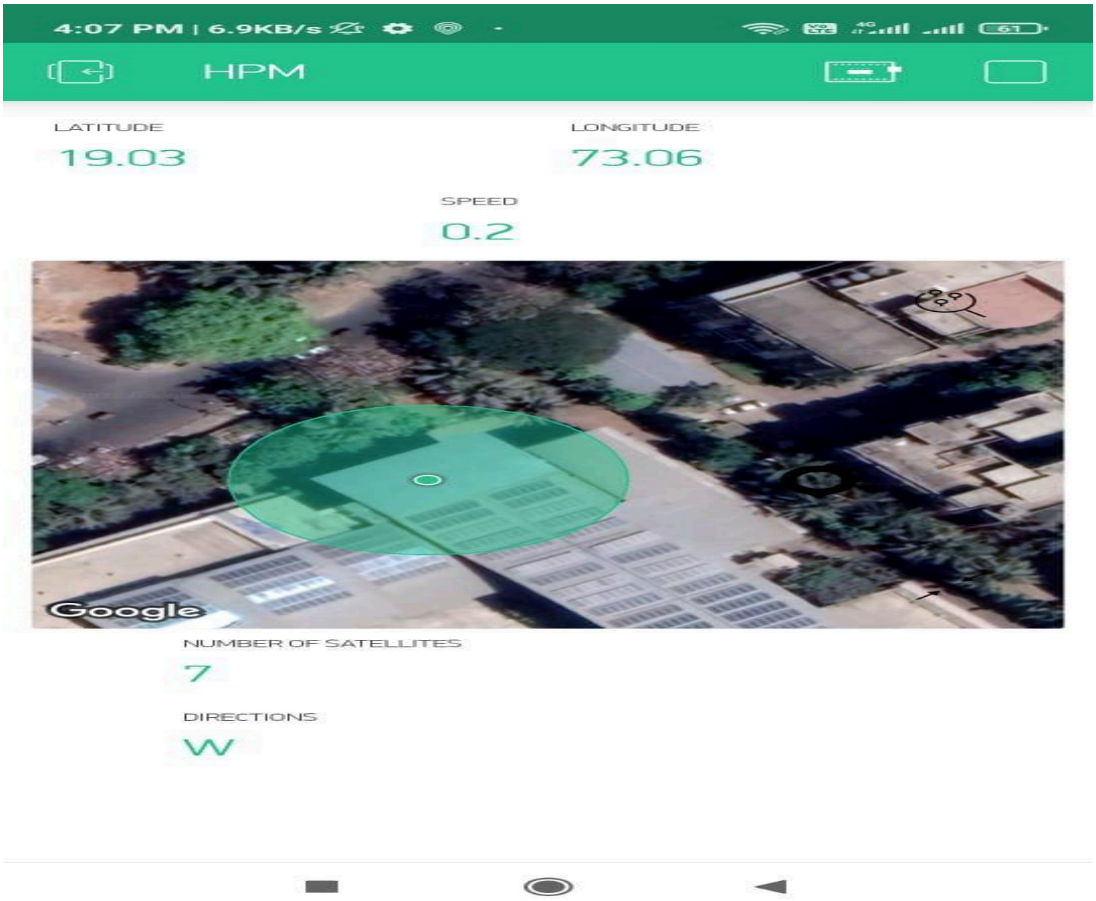

Figure 12 User API

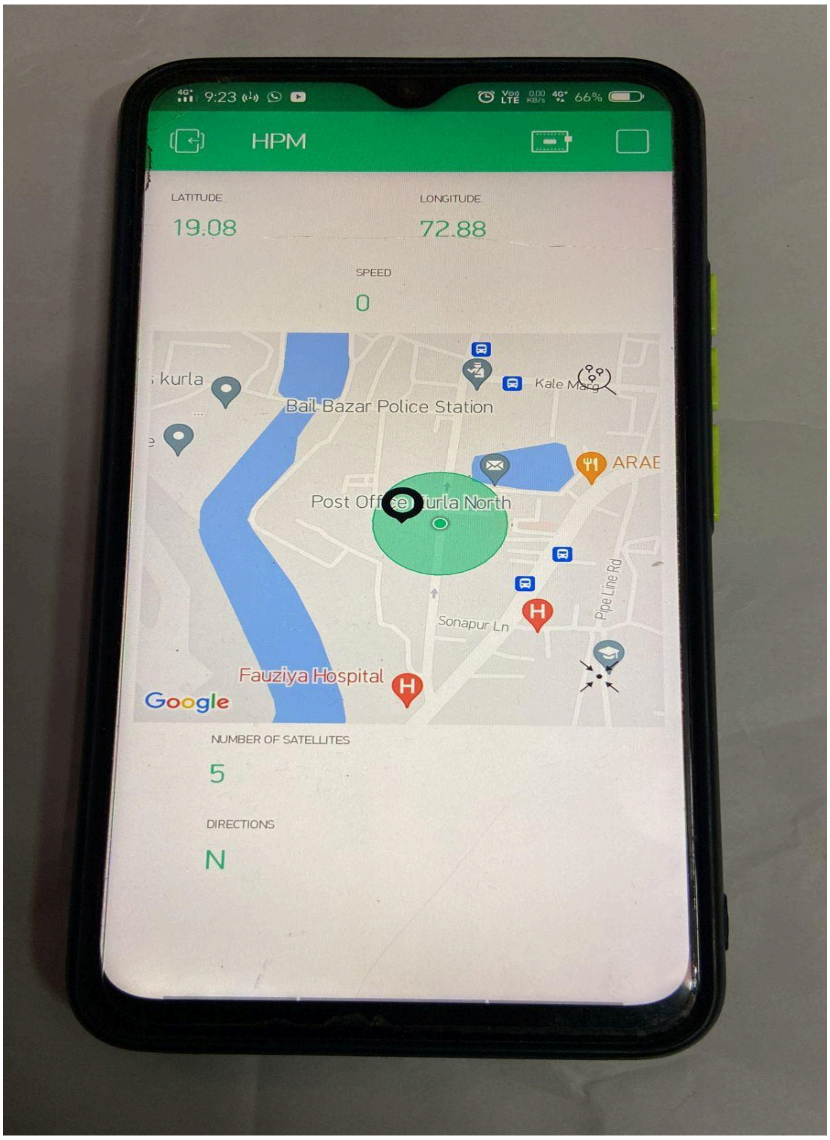

Figure 13 User API II

Figure 14 Haptic Stick

Conclusion

This project is feasible economically and technically to any visually impaired or blind person. Any such user can move around in surrounding without any help and this module is very easy to maintain. This project will create awareness of importance of technology in our society while giving safety and security to the user.

References

•Dambhara, S. & Sakhara, A., 2011. Smart stick for Blind: Obstacle Detection, Artificial vision and Real-time assistance via GPS.

•Osama Bader AL-Barrm International Journal of Latest Trends in Engineering and Technology (IJLTET)

•Kang, S. J., Ho, Y., K. & Moon, I. H., 2001. Development of an Intelligent Guide-Stick for the Blind. Seoul, Korea, IEEE March 2013].

• Koley, S. & Mishra, R., 2012. VOICE OPERATED OUTDOOR NAVIGATION SYSTEM FOR VISUALLY IMPAIRED PERSON

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Date: