Fall 2020-21: PROJECT REPORT

School of Electronics Engineering (SENSE)

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Asset Tracking and Monitoring system

ECE3501 IOT Fundamentals

Slot: G1+TG1 & Lab: L39+L40 **Group Number: 7**

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ABSTRACT:

Today, the growth of technology is rapid and provides all necessary and effective solutions for the requirements. One of the most important areas of concern is security.

In this scenario, IOT Asset tracking system is developed to increase the safety of women, children, people with mental disorder and any valuable items through the technology of Radio Frequency along with IOT.

Radio Frequency module consists of transmitter and receiver. The transmitter is placed with the object to be tracked which sends radio waves to the receiver.

If the object being tracked moves out of frequency range, an alert message and call will be sent to specified guardians through Global System for Mobile communication.

Further the location of the object can be tracked whenever required through Global Positioning System. In addition, by using Google map API key we can locate the object and for the latitude and longitude values we can use Thinkspeak channel id and API key.

The frequency range between transmitter and receiver and location of assets are displayed in ThingSpeak which is an open source IOT platform.

OBJECTIVE

- The Main objective of IOT Asset Tracking System is to track the location of assets
- The major goal is to ensure maximum security and enable tracking by providing current location.

INTRODUCTION

Nowadays, safety is one of the major issues as crime is rapidly growing across the world. IOT Asset Tracking System is focused with the safety and security of women, children, people with mental disorder and any valuable things. This system is going to help people to monitor and track the location of assets.

Overview

The system uses RF technology which refers to communicating through wireless electromagnetic signal with radio frequency that ranges from 3 kHz to 300 GHz. RF modules comprises of RF transmitter and RF receiver.

The transmitter is placed within the asset to be tracked and the receiver is with the owner/ guardian of the asset.

The transmitter and receiver communicate with each other through RF signal. Once the asset goes out of frequency range the location of the object can be tracked using GPS.

IOT plays a vital role in the development of the system which allows devices to connect, interact and exchange data over the internet and can be remotely controlled and monitored.

There are many IOT platforms. One such platform is ThingSpeak which is an open-source Internet of Things application to store and retrieve data from things using the internet or through Local Area Network. Here, IOT ThingSpeak displays all the sensor data and location information via widget on smart phone.

LITERATURE SURVEY:

[1] Steven Chan, Adam Connell, Eribel Madrid, Dongkuk Park, Ridha Kamoua, "RFID for personal asset tracking" - This paper deals with how Radio Frequency Identification (RFID) keeps track of registered objects that are within range of the user. The goal is to provide a new security for keeping belongings that are carried around. If the object was lost and not stolen, RFID reader and GPS receiver gives the user information on where the object was last detected.

[2] Fatin Balkis Binti Alzahri, Maziani Sabudin, "Vehicle Tracking Device"- This paper Vehicle Tracking Device (VTD) give information of location coordinate to mobile phone whenever there is a request for it through the SMS.VTD is an integration of hardware and software.

[3] Aditi Gupta, Vibhor Harit, "Child Safety and Tracking Management System"- This paper looks to ensure maximum security and live tracking for kids. This application proposed a model for child safety through smart phones that provides the option to track the location of the children and the child can send SMS in case of emergency through GPS technology.

[4] Daniel Patricko, Hendry Hendry, Jonathan Adiel Pranoto, Adi kurniawan, "Human tracking in certain indoor and outdoor area by combining the use of RFID and GPS" - In this paper An RFID tag was carried by a user and continuously read whenever he/she access a room while GPS was used mainly when the user was staying outdoors. GPS will be activated automatically whenever the user leaves the room 3 meters away

[5]Pratik Kanan, Dr. Mamta Padole ,"Real-time Location Tracker for Critical Health Patient using Arduino, GPS Neo6m and GSM Sim800L in Health Care"- In this paper, an IoT device is made which locates the exact GPS coordinates of the patients to the server. Moreover, using the web interface on the server and Google Maps, doctors and hospital staff can track the exact location of the patient and serve him. The system is made using sensors like GPS Neo 6m, Arduino, GSM Sim800L.

SYSTEM DEVELOPMENT:

Arduino

Arduino is an open-source project that created microcontroller-based kits for building digital devices and interactive objects that can sense and control physical devices.

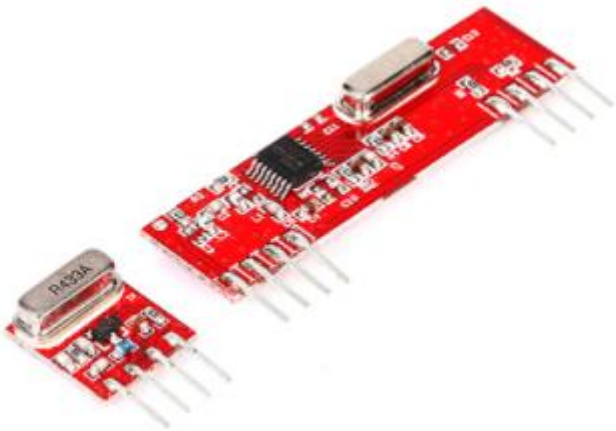
Robocraze RF434 Rf Module Transmitter:

- An RF transmitter module is a small PCB sub-assembly capable of transmitting a radio wave and modulating that wave to carry data.
- Transmitter modules are usually implemented alongside a microcontroller which will provide data to the module which can be transmitted.
- RF transmitters are usually subject to regulatory requirements which dictate the maximum allowable transmitter power output, harmonics, and band edge requirements.

Robocraze RF434 Rf Module Receiver:

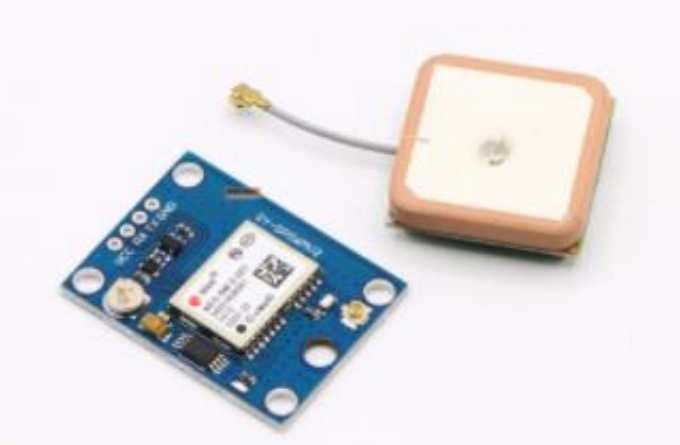
- An RF receiver module receives the modulated RF signal and demodulates it.
- There are two types of RF receiver modules: superheterodyne receivers and super-regenerative receivers.
- Superregenerative modules are usually low cost and low power designs.

- It uses a series of amplifiers to extract modulated data from a carrier wave. Super-regenerative modules are generally imprecise as their frequency of operation varies considerably with temperature and power supply voltage.



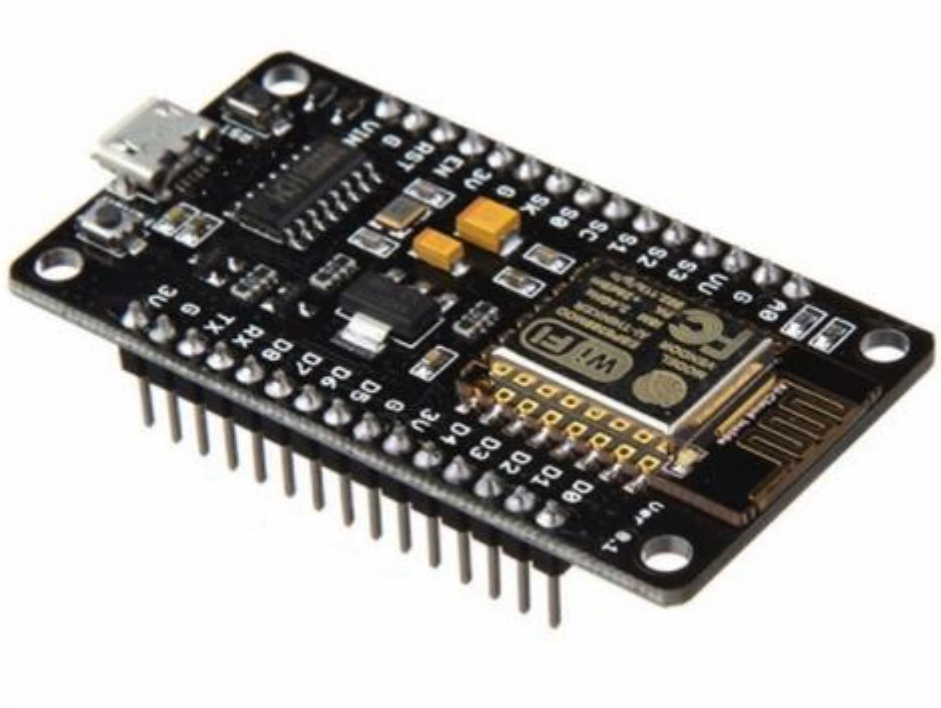
Mazatron U-BLOX NEO-6M GPS Positioning Module:

- The NEO-6 module series is a family of stand-alone GPS receivers featuring the high performance u-blox 6 positioning engine.
- These flexible and cost effective receivers offer numerous connectivity options in a miniature 16 x 12.2 x 2.4 mm package.
- Their compact architecture and power and memory options make NEO-6 modules ideal for battery operated mobile devices with very strict cost and space constraints.
- The 50-channel u-blox 6 positioning engine boasts a Time-To-First-Fix0(TTFF) of under 1 second.

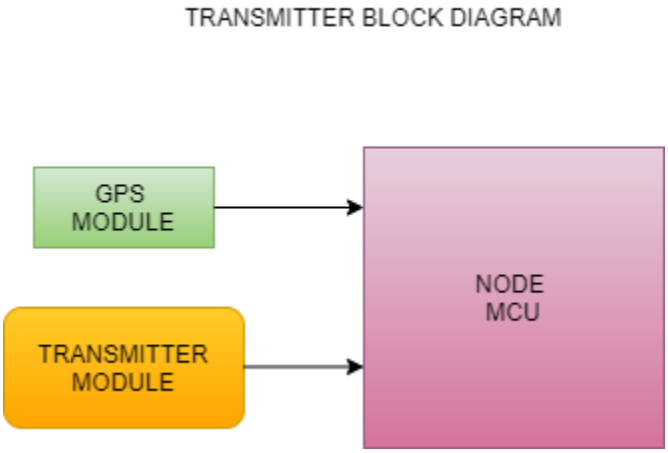


ESP8266 Nodemcu:

NodeMCU is an open-source firmware and development kit that helps you to prototype or build IoT products. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The firmware uses the Lua scripting language.



SYSTEM DESCRIPTION:

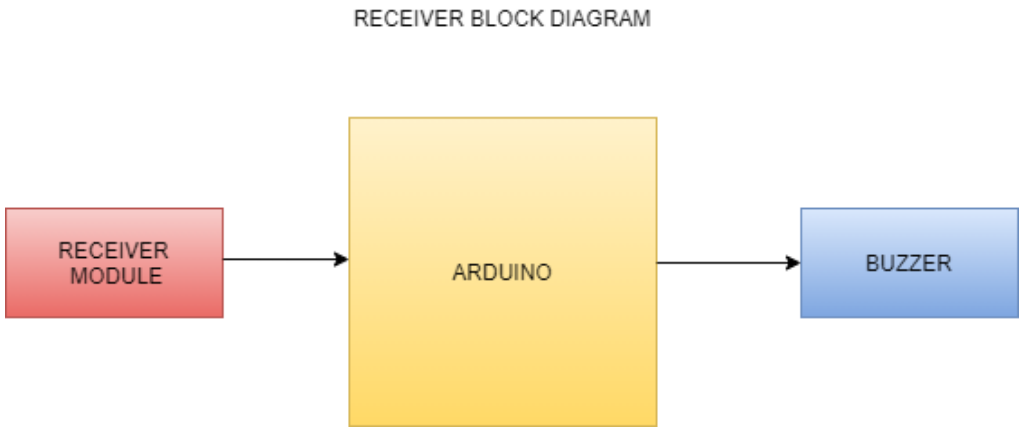


Transmitter module with NODEMCU:

- Vdd of transmitter - Vin digital pin of Node MCU
- Gnd of transmitter - Gnd pin of Node MCU
- Data pin of transmitter - D6 digital pin of Node MCU

GPS module:

- Vdd of GPS module - Vin digital pin of Node MCU
- Gnd of GPS module - Gnd pin of Node MCU
- Rx pin of GPS module - D0 digital pin of Node MCU
- Tx pin of GPS module - D1 digital pin of Node MCU



Receiver Module with Arduino:

- Data pin of Receiver - Digital pin 2 of Arduino
- Vdd of Receiver - Vin digital pin of Arduino
- Gnd of Receiver - Gnd pin of Arduino

Buzzer with Arduino:

- Buzzer - Digital pin 10 of Arduino
- Gnd of Receiver - Gnd pin of Arduino

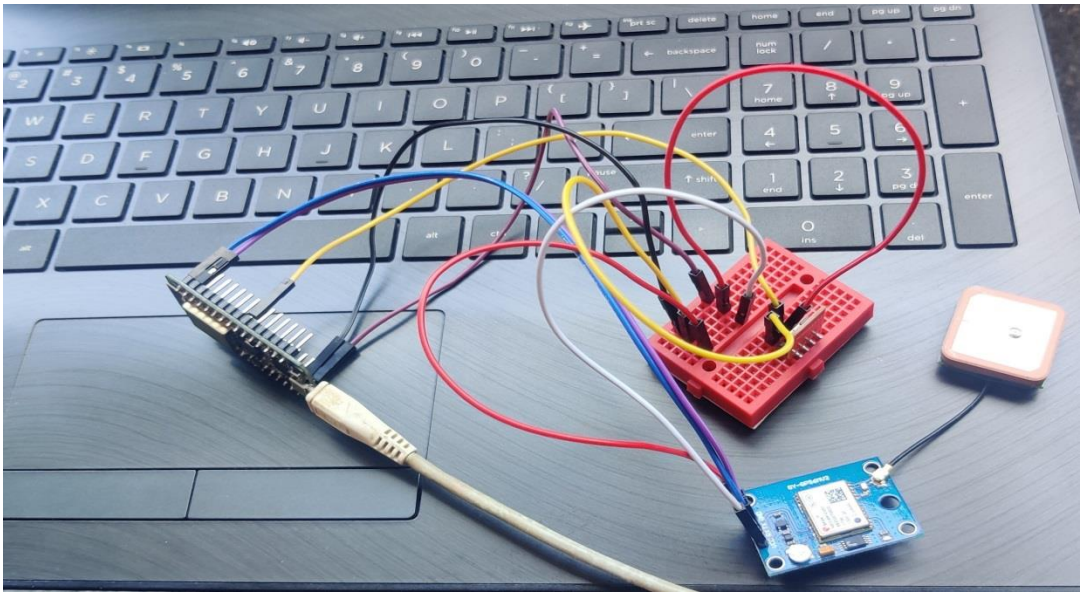
PROPOSED METHODOLOGY:

- Asset tracking device has two main processors
  1) Arduino
  2) NodeMCU.

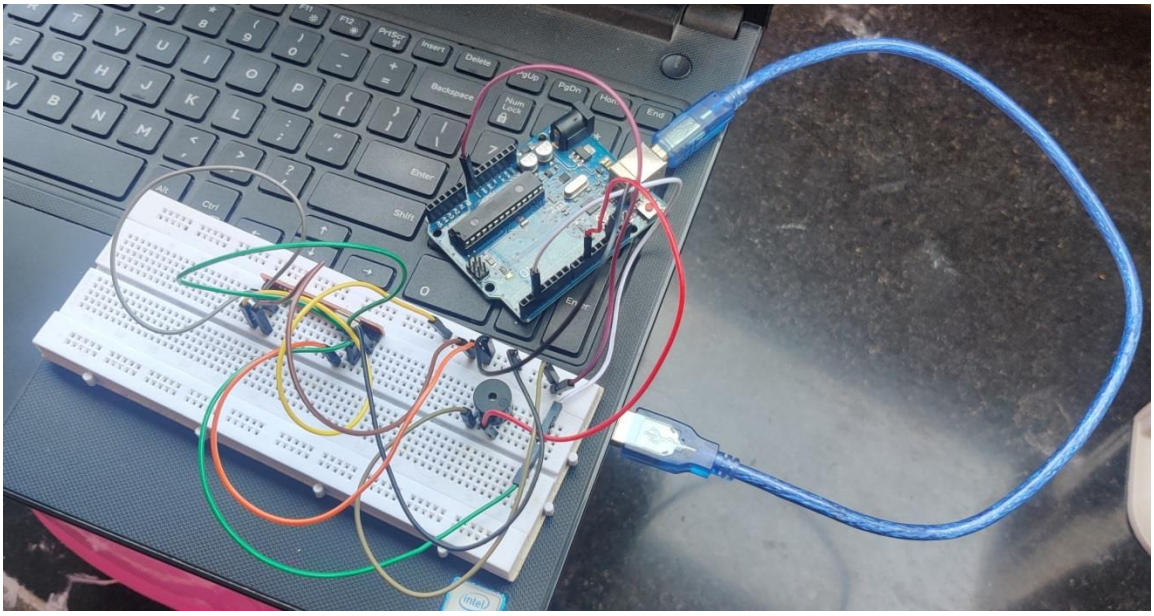
- We have an asset and an observer. Arduino will be present with the observer and NodeMCU is attached to the asset.
- The asset keeps transmitting the data with the help of the RF transmitter.
- Arduino will keep receiving the data with the help of the RF receiver, and once the receiver couldn't pick the signal transmitted it means that the asset is out of range.
- We always keep track of the location of the asset with the help of GPS module noting the values to Thingspeak.
- Once the asset is out of range, we activate buzzer and we locate the asset on Thingspeak .
- For locating asset we created a HTML page using google map API key and for longitude and latitude values we used Thingspeak channel id and API key.

HARDWARE MODEL:

At Transmitter Side:



At Receiver Side:



SOFTWARE SIMULATION:

Interfacing RF with GPS module at transmitter side:

gps.ino | Arduino 1.8.13 (Windows Store 1.8.42.0)

File Edit Sketch Tools Help

gps.ino

```
#include <RCSwitch.h>
#include "ThingSpeak.h"
#include <ESP8266WiFi.h>
#include <TinyGPS++.h> // library for GPS module
#include <SoftwareSerial.h>
#include <ArduinoJson.h>
#include <ESP8266HTTPClient.h>
const char* ssid     = "oneplus7";
const char* password = "rushyanth";
unsigned long myChannelNumber = 1177187;
const char * myWriteAPIKey = "N4N1YNNEFKVYM9L4";
WiFiClient  client;
TinyGPSPlus gps;  // The TinyGPS++ object
SoftwareSerial ss(5, 16); // The serial connection to the GPS device
float latitude , longitude;
int year , month , date, hour , minute , second;
String date_str , time_str , lat_str , lng_str;
int pm;
RCSwitch mySwitch = RCSwitch();
//int vibr_pin=14;
WiFiServer server(80);

void setup() {
  ss.begin(9600);
  Serial.begin(115200);
  Serial.print("Connecting to ");
  Serial.println(ssid);
  WiFi.begin(ssid, password);
  while (WiFi.status() != WL_CONNECTED) {
```


gps.ino | Arduino 1.8.13 (Windows Store 1.8.42.0)
File Edit Sketch Tools Help
gps.ino
void setup() {
ss.begin(9600);
Serial.begin(115200);
Serial.print("Connecting to ");
Serial.println(ssid);
WiFi.begin(ssid, password);
while (WiFi.status() != WL_CONNECTED) {
delay(500);
Serial.print(".");
}
Serial.println("");
Serial.println("WiFi connected");
Serial.println("IP address: ");
Serial.println(WiFi.localIP());
Serial.print("Netmask: ");
Serial.println(WiFi.subnetMask());
Serial.print("Gateway: ");
Serial.println(WiFi.gatewayIP());
ThingSpeak.begin(client);
mySwitch.enableTransmit(12);
}
void loop() {
while (ss.available() > 0) //while data is available
if (gps.encode(ss.read())) //read gps data
{
if (gps.location.isValid()) //check whether gps location is valid
{


gps.ino | Arduino 1.8.13 (Windows Store 1.8.42.0)
File Edit Sketch Tools Help
gps.ino
Serial.println(WiFi.subnetMask());
Serial.print("Gateway: ");
Serial.println(WiFi.gatewayIP());
ThingSpeak.begin(client);
mySwitch.enableTransmit(12);
}
void loop() {
while (ss.available() > 0) //while data is available
if (gps.encode(ss.read())) //read gps data
{
if (gps.location.isValid()) //check whether gps location is valid
{
latitude = gps.location.lat();
lat_str = String(latitude , 6); // latitude location is stored in a string
longitude = gps.location.lng();
lng_str = String(longitude , 6); //longitude location is stored in a string
Serial.println(lat_str);
Serial.println(lng_str);
ThingSpeak.setField(1, lat_str);
ThingSpeak.setField(2, lng_str);
ThingSpeak.writeFields(myChannelNumber, myWriteAPIKey);
mySwitch.send(32, 6);
Serial.println("transmitting");
delay(1000);
}
}
}

Interfacing RF at Receiver side:

rec.ino | Arduino 1.8.13 (Windows Store 1.8.42.0)

File Edit Sketch Tools Help

rec.ino

```
#include<RCSwitch.h>
RCSwitch mySwitch = RCSwitch();
int buzzer = 10;
int count = 0;
void setup(){
  pinMode(buzzer,OUTPUT);
  Serial.begin(9600);
  mySwitch.enableReceive(0);

}
void loop(){
  int value = mySwitch.getReceivedValue();
  if(mySwitch.available()){
    count = 0;
    digitalWrite(buzzer,LOW);
    Serial.println(mySwitch.getReceivedValue());
  }
  else
  {
    /*digitalWrite(buzzer,HIGH);*/
    Serial.println("Not Receiving");
    count++;
    Serial.println(count);
  }
  if(count>10)
  {
    digitalWrite(buzzer,HIGH);
    delay(500);
   digitalWrite(buzzer,LOW);
```

rec.ino | Arduino 1.8.13 (Windows Store 1.8.42.0)

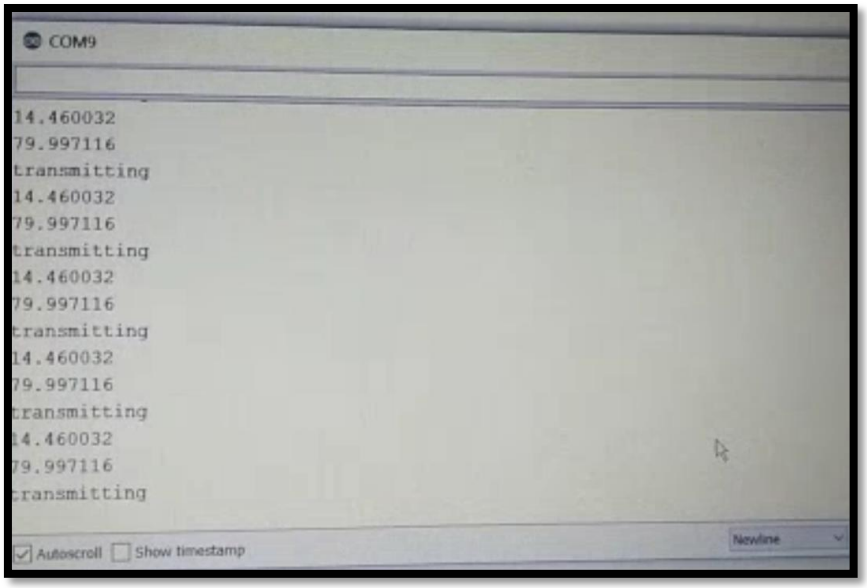
File Edit Sketch Tools Help

rec.ino

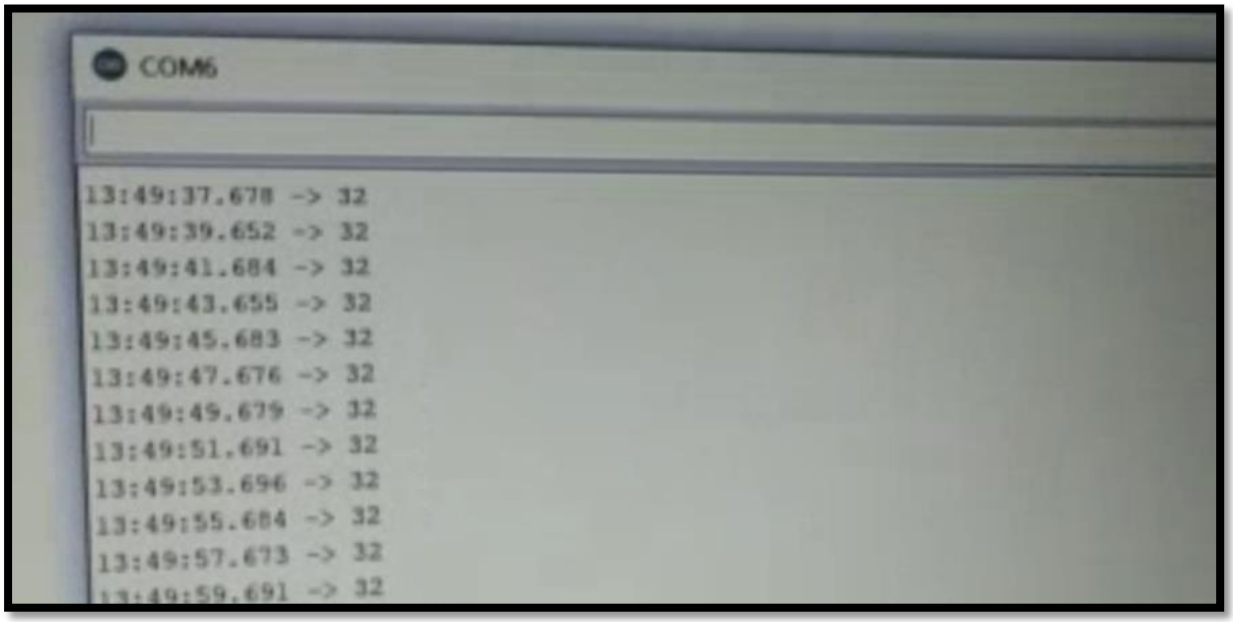
```
void setup(){
  pinMode(buzzer,OUTPUT);
  Serial.begin(9600);
  mySwitch.enableReceive(0);

}
void loop(){
  int value = mySwitch.getReceivedValue();
  if(mySwitch.available()){
    count = 0;
    digitalWrite(buzzer,LOW);
    Serial.println(mySwitch.getReceivedValue());
  }
  else
  {
    /*digitalWrite(buzzer,HIGH);*/
    Serial.println("Not Receiving");
    count++;
    Serial.println(count);
  }
  if(count>10)
  {
    digitalWrite(buzzer,HIGH);
    delay(500);
   digitalWrite(buzzer,LOW);
  }
   mySwitch.resetAvailable();
   delay(2000);
}
```

RESULT ANALYSIS:

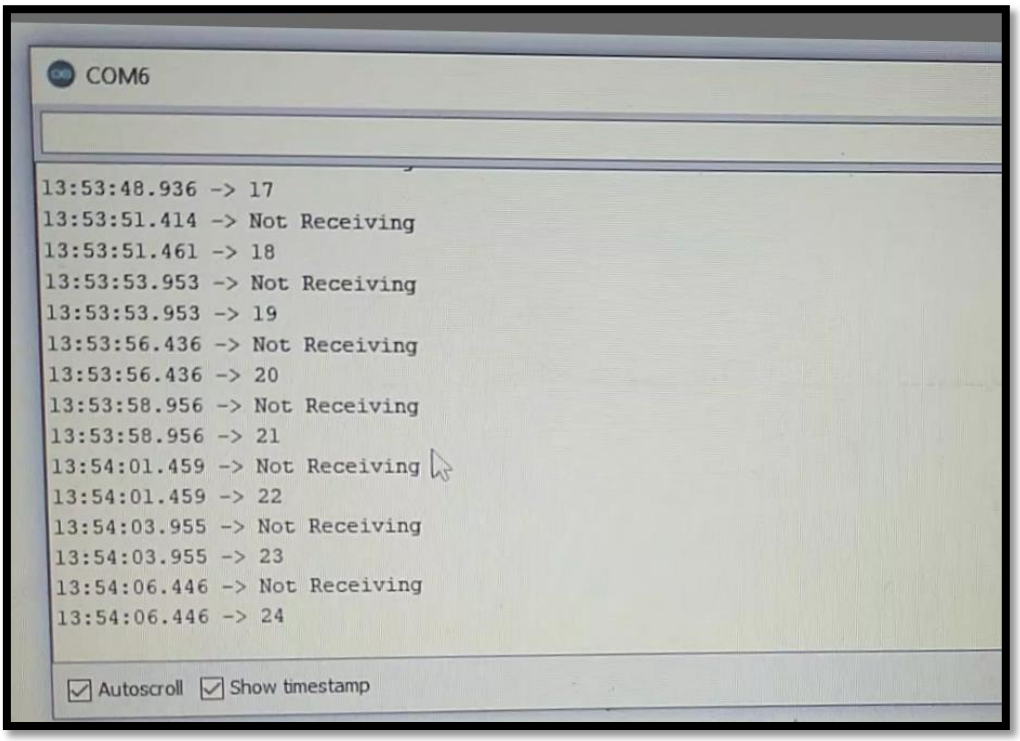
Serial Monitor Output after GPS module interfacing at Transmitter side:



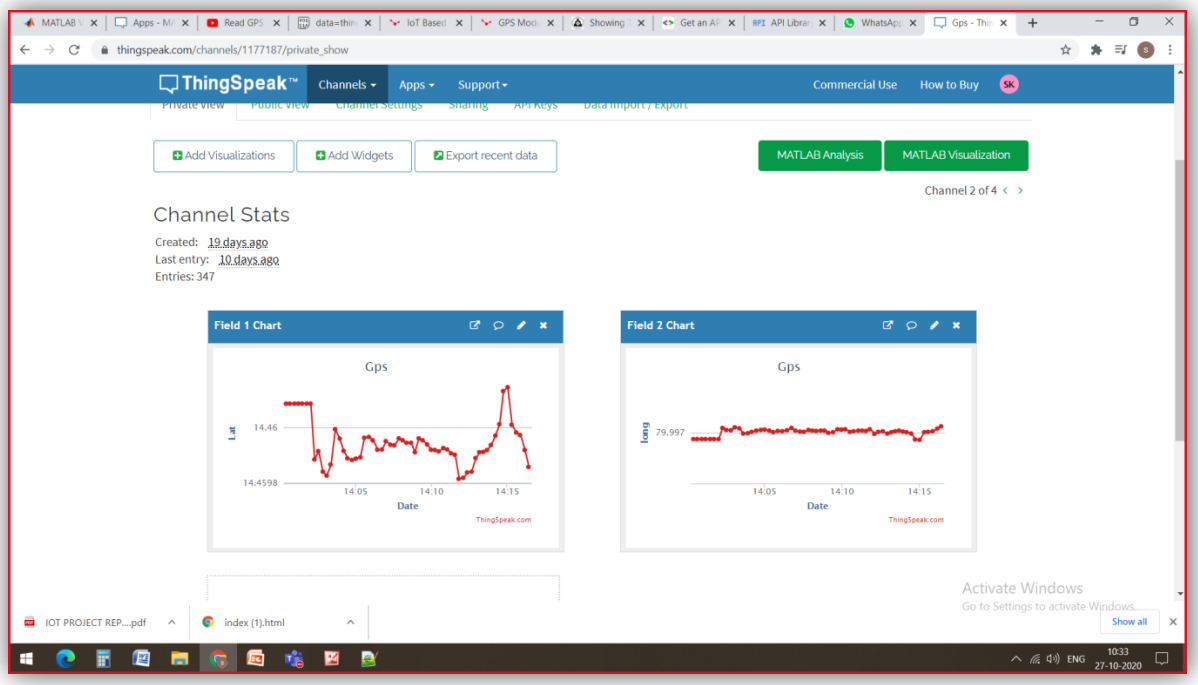
Serial Monitor Output at Receiver side when data is received:



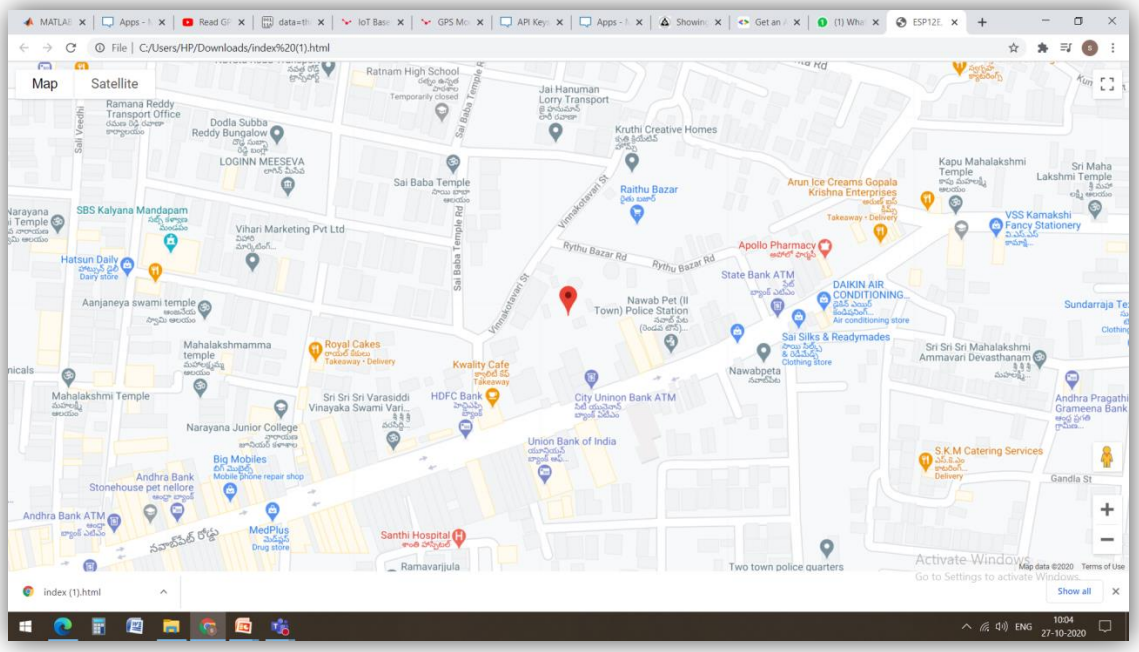
Serial Monitor Output at Receiver side when data is not received:



Thingspeak Output:



Real Time Location:



Drive link of Project Video:

https://drive.google.com/drive/folders/1de3oabgYzE9x5lhAB7NTfaT0YONSgySX?usp=sharing

CONCLUSION:

The proposed IOT Asset Tracking System has been developed to ensure safety and security of assets like people with psychological disorder, women, children and any valuable objects.

The major advantage is the use of sensors like sound sensor and vibration sensor that sense and alert. IOT Asset Tracking System can be used for both personal and business purpose.

In future, IOT Asset Tracking System is going to play a major role in our day to day life. EEPROM can be used to store the previous navigation position up to 256 locations by increasing its memory.

The accuracy of GPS receiver can be increased by increasing its cost. The size of the kit can be reduced by employing GPS and GSM in the same module. The system can be extended to track vehicle and with the help of high sensitivity vibration sensors accidents can be detected and send the location to the owner, hospital and police.

REFERENCE:

[1] Steven Chan, Adam Connell, Eribel Madrid, Dongkuk Park, Ridha Kamoua, "RFID for personal asset tracking".

[2] Fatin Balkis Binti Alzahri, Maziani Sabudin, "Vehicle Tracking Device".

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