Vehicle Tracking System Based on GPS and GSM

MINI-PROJECT

Submitted to the Department of Computer Science Engineering

Of

PRESIDENCY UNIVERSITY

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DECLARATION

we hereby declare that our project work entitled "**Vehicle Tracking System Based on GPS and GSM**" submitted to Presidency University, Bangalore is a record of an original work done by us under the guidance of Mr. Prakash B Metre, Professor Dept. Of Computer Science & Engineering.

This project work is submitted in the partial fulfilment of the course **Internet of Things**. The results embodied in this thesis have not been submitted to any other University or Institute for the award of any degree or diploma, the work has not been presented elsewhere for assessment.

I assert the statements made and conclusions drawn are an outcome of our Mini Project. I further certify that

I. The work contained in the report is original and has been done by me under the general supervision of my supervisor.

II. The work has not been submitted to any other Institution for any other degree/diploma/certificate in this university or any other University of India or abroad.

III. We have followed the guidelines provided by the university in writing the report.

Date: 11.11.2020

Signature of Supervisor

(Mr. Prakash B Metre)

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Project would not have been the same as presented here.

Nobody has been more important tome in the pursuit of this project than the members of my family. I would like to thank my parents,whose love and guidance are with me in whatever I pursue. They are the ultimate role models. Last, but certainly not least, my special thanks also extend to our family for the continual encouragement and support.

ABSTRACT

Vehicle tracking system is a well-established technology in this era which is used by fleet system and owner of vehicle all over the world. It is a very safe and reliable technology. In our project we are going to design a system which is used for tracking and positioning of any vehicle by using Global Positioning System [GPS] and Global System for Mobile Communication [GSM]. We will be primarily focusing on tracking a Vehicle using Arduino Uno R3 and GSM module sim800c. The design is an embedded application, which will continuously monitor a moving vehicle and report the status of vehicle on demand. For doing so the Arduino Uno R3 is interfaced serially to a GSM modem and GPS receiver.

The GSM modem is used to continuously send the position of the vehicle from remote place. The GPS modem that uses satellite technology for its navigation system will continuously give data like longitude, latitude, speed, distance travelled etc. When the request by user is sent to the number at the modem in the form of SMS, the system automatically sends a return reply to the mobile indicating the position of the vehicle in terms of latitude and longitude via SMS. We will also view the position of vehicle on a digital mapping i.e. on Google map with the help of software via Internet.

INDEX

ABBREVIATIONS

1. GPS- Global Positioning System
2. GSM- Global System for Mobile Communication
3. SMS- Short Message Service
4. AVL- Automatic Vehicle Location
5. GIS- Geographic Information System
6. RF- Radio Frequency
7. AGPS- Assisted Global Positioning System
8. EEPROM- Electrically Erasable Programmable Read only Memory
9. ICSP- In-Circuit System Programming
10. DC- Direct Current
11. IDE- Integrated Development Environment

INTRODUCTION

With advancements in technology, there has been an increase in the usage of vehide tracking systems. The design of vehicle tracking systems enable the display of a vehicle's position on Google Maps. The GPS, GSM/GPRS modules controlled by Arduino are placed inside the vehicle. In this way, the vehicle position is updated every 10 seconds as the vehide is moving. Vehicle tracking systems are very useful nowadays. This system enables the owner to observe and track the vehicle and find out about vehicle movement and past activities of automobile. This technology popularly called real time Vehicle Tracking Systems has proved useful in ensuring the security of vehicles.

This hardware is fitted onto the vehicle in such a manner that persons who are in or outside of the vehicle cannot see it. Thus, it is used as a covert unit which continuously, or as a result of interruptions to the system, sends location data to the monitoring unit. When a vehicle is stolen, the location data from the tracking system can be used to find the location and so inform the police for further action. When users make a request, the GPS coordinates of the vehicle are sent to a specified mobile. The user will be provided with the position of the vehicle in terms of latitude and longitude which can be viewed using Google Maps. This service is typically provided at a low cost.

A Vehicle Tracking System is a device that is fitted in a vehicle, to enable the vehide owner to identify the vehicle's location. This paper proposes the design of a vehicle tracking system that utilizes GPS and GSM technology. This system built based on an embedded system, can be used for tracking and any car through GPS - Global Positioning System and GSM - Global System for Mobile Communication. This design will continuously monitor the location of a moving vehicle and report the status of the vehicle on demand.

IMPACT OF INTRODUCING TRACKING SYSTEM IN VEHICLE

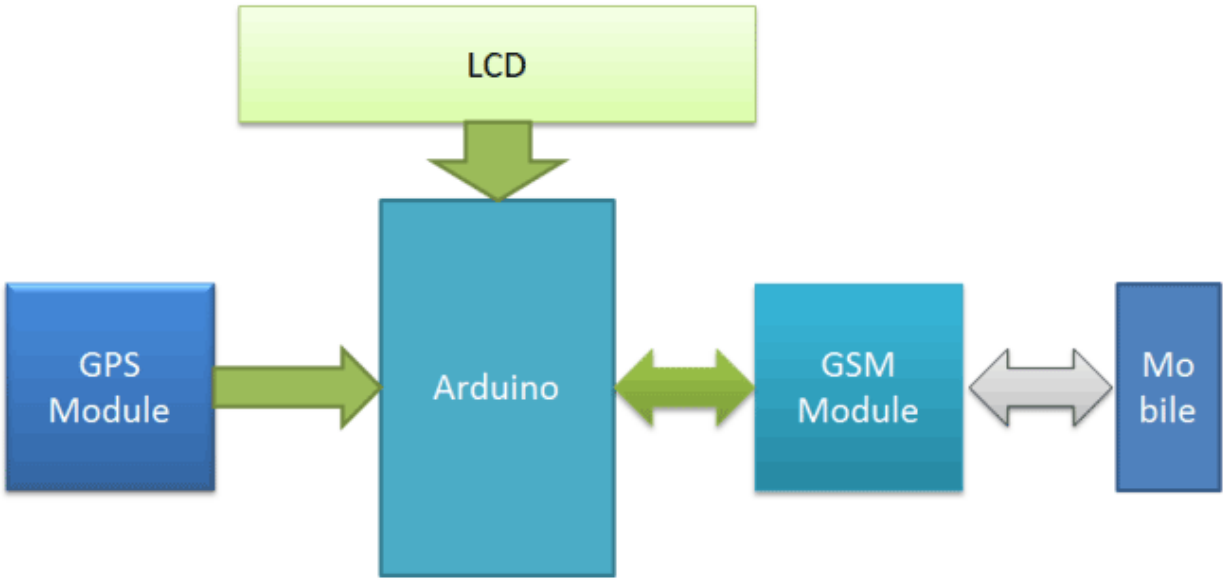
Vehicle tracking systems are commonly used by fleet operators for fleet management functions such as fleet tracking, routing, dispatch, on-board information and security. Commercial fleet operators as well as urban transport companies use this system for various purposes that include monitoring schedules of buses in service, triggering any change of buses' destination and manage per-recorded announcements for passengers. The American Public Transportation Association estimated that, at the beginning of 2009, around half of the public buses in the United States were already using a tracking system to trigger automated stop impaired customers and to do any important announcements to the passengers already on board.

This also includes external announcements triggered by the opening of the bus door at a bus stop, announcing the vehicle's route number and destination, primarily for the benefit of visually identifying the next stop, as the bus approaches a stop. As the vehicle follows its route the data are collected and is stored in a computer system where it is compared with the location the vehicle was scheduled to be in at that very moment. It also updates the driver telling him how early or late he is at any given time making it easier for the driver. This device also helps to provide customers with real-time information such as time required for the arrival of the next bus at a given stop, it helps to save passengers time as it provides the passenger with updated information.

Transport companies that offer this kind of information assign a unique number to each stop, and passengers can obtain information by entering the stop number on the transit system's website. To provide accurate information to passengers some transit agencies have uploaded a map on their website, with icons indicating the current locations of buses in service on each route. There are also some transit companies that keep this information only for their own use which can be accessed by their employees only. Other applications include monitoring driving behaviour of the driver which is helpful if the company have appointed any new driver. The vehicle tracking system is also used as an anti-theft system. If a vehicle is stolen the owner can easily track the car and will be able to control the car by turning off the engine and lock the door of the vehicle via SMS. After the introduction of vehicle tracking system the chances of recovering the car has increased enormously. Vehicle tracking system has made people’s life much easier than before.

Now, owner of cars can easily track their car from any corner of the world and control it if it is stolen. Passengers can even get notification about schedule of public transport that saves their precious time.

BLOCK DIAGRAM



The block diagram of vehicle tracking system shows how our system actually works. The vehicle tracking unit is installed inside the vehicle that is to be tracked. The GPS receiver receives the coordinate from the satellite which is then send to the GSM tower by the GSM modem. The coordinate is then sent to a computer via internet where it is stored in the database for displaying the location on Google map. The user can also see the location of the vehicle in a mobile phone, when the user sends an SMS to the GSM modem in the vehicle, the GSM modem send another SMS back to the user with the coordinates of the location of the vehicle along with a Google map link.

SYSTEM OVERVIEW

REVIEW OF LITERATURE

Global Positioning Systems (GPS) were designed by the United States Government and military, which the design was intended to be used as surveillance. The GPS was invented as a collaborative effort by the United States‟ Department of Defence and Dr. Ivan Getting as a means to create a satellite course-plotting system, primarily used for navigation purposes.

At that time, the GPS project cost approximately $12 billion for the design and launch of 18 satellites, six in each of the orbital planes spaced 120 degrees apart, and their ground stations. GPS uses these satellites as reference points to determine and give the accurate geographical positions on map. The idea for a global positioning system was initially planned to be used by military and intelligence organizational during the Cold War, with the introduction of the project stemming from the Soviet-launched spacecraft Sputnik.

Since its introduction in the 1960s, GPS has developed into a larger and more advanced satellite network constellation that orbits Earth at fixed points in space to send signals to anyone with a GPS receiver. The signals carry a time code and geographic data point that enables us to display a device's exact position anywhere on the planet. The design of GPS is partly similar to the design of ground-based radio navigation systems, such as LORAN and the Decca Navigator, developed in the early 1940s and were used during World War II.

Additional inspiration for the GPS system came when the Soviet Union launched the first Sputnik in 1957. A team of U.S. scientists led by Dr. Richard B. Kershner were monitoring Sputnik's radio transmissions. They discovered that, because of the Doppler Effect, the frequency of the signal being transmitted by Sputnik was higher as the satellite approached and lower as it moves away from them. They realized that since they knew their exact location on the globe, by measuring the Doppler distortion it was possible to pinpoint where the satellite was along its orbit.

The first satellite navigation system was first successfully tested in 1960. It delivers a navigational fix approximately once per hour using a constellation of five satellites. In 1967, the U.S. Navy introduced the taxation satellite which demonstrated the ability to place accurate clocks in space that is the technology used by the GPS system. In the 1970s, the ground-based Omega Navigation System, based on signal phase comparison, became the first world-wide radio navigation system. In February 1978 the first experimental Block-I GPS satellite was launched.

The GPS satellites were initially manufactured by Rockwell International and are now mass-produced by Lockheed Martin. In 1983, after Soviet interceptor aircraft shot down the civilian airliner KAL 007 in restricted Soviet airspace, killing all 269 people on board, U.S. President Ronald Reagan announced that the GPS system would be made available for civilian

uses once it was completed. Hence, the government signed a treaty to allow civilians to buy GPS units also only the civilians would get precise downgraded ratings.

The oldest GPS satellite still in operation was launched in August 1991. By December 1993 the GPS system achieved initial operational capability and a complete constellation of 24 satellites was in orbit by January 17, 1994. In the initial period of tracking only two radios were used to exchange the information. One radio was attached to the vehicle while another at base station by which drivers were enabled to talk to their masters. Fleet operator could identify the progress through their routes.

The early technology also has some limitation. It was restricted by the distance which became a hurdle in accuracy and better connectivity between driver and fleet operators. Base station was dependent on the driver for the information and a huge size fleet could not have been managed depending on man-power only. The scene of vehicle tracking underwent a change with the arrival of GPS technology.

This reduced the dependence on man-power. Most of the work of tracking became electronic. Computers proved a great help in managing a large fleet of vehicle. This also made the information authentic. As this technology was available at affordable cost all whether small or big fleet could take benefit of this technology. Because of the accessibility of the device computer tracking facilities has come to stay and associated with enhanced management.

Today each vehicle carries tracking unit which is monitored from the base station. Base station receives the data from the unit. All these facilities require a heavy investment of capital for the installation of the infrastructure of tracking system for monitoring and dispatching. Today's GPS applications have vastly developed. It is possible to use the Global Positioning Systems to design expense reports, create time sheets, or reduce the costs of fuel consumption.

We can also use the tracking devices to increase efficiency of employee driving. The GPS unit allows us to create Geo-Fences about a designated location, which gives us alerts once the driver passes through that location. This means we have added security combined with more powerful customer support for our workers. Nowadays GPS units are great tracking devices that help fleet managers stay in control of their business.

The applications in today's GPS units make it possible to take full control of any company. It is clear that the tracking devices offer many benefits to companies, since we can build automated expense reports anytime. GPS units do more than just allow companies to create reports. These devices also help to put an end to thieves. According to recent reports, crime is at a high, which means that car theft is increasing. If we have the right GPS unit, we can put an end to car thefts because we can lock and unlock our car anytime we want to.

GPS is small tracking device that is installed in a car and it will supply feedback data from tracking software that loads from a satellite. In this paper GPS based vehicle navigation system is implemented. This is done by fetching the information of the vehicle like location, distance, etc. by using GPS and GSM. The information of the vehicle is obtained after every specified time interval defined by the user. Then this periodic information of location is transmitted to monitoring or tracking server.

This transmitted information is displayed on the display unit by using the Google earth to display the vehicle location in the electronic Google maps. This system uses Global Positioning System (GPS) which is used to receive the coordinates of latitude and longitude form the satellite during the critical information. We all know that tracking system is now-a-days a very important in modern world. This system can be used in the monitoring our car, also in tracking the theft of the vehicle and in many more other applications.

This system uses Arduino UNO, Global Positioning System (GPS) and Global System for Mobile Communication (GSM). Only one GPS device is used in this system and GSM enable a two way communication process. GSM modem is providing with a SIM card which uses the same and regular communication process as we are using in regular phone. From the above-mentioned vehicle tracking techniques we can say that each technique is appropriate with its function but in some system, we need continuous net access and this system can go down if net fails.

In the first system the GPS tracks the vehicle location and send it to the controller and the Google maps display the location of the Vehicle on the display unit, this system is us eless without net because the location of vehicle can only be presented by the Google maps. In the other system an SMS of the coordinate of the location is send to the user on request which does not require an access to internet. By considering all these factors the upcoming implementation should introduce many more facilities which will make the system user friendly and efficient.

HARDWARE COMPONENTS

The core function of our project is to develop a tracking system that is cost effective so we have made use of the following components that has effective operation and usage. In this section, hardware part, i.e. hardware components used for the project are discussed in details. The heart of the project that is, as microcontroller we used Arduino Uno. Initially, we worked on getting geo coordinates i.e. latitude and longitude and for this we made use of the GPS module to capture location, speed and time of last received data in accordance. Then using GSM technology, the captured data already sent to the web server is stored and for this we have used SIM800c module.

Components used:

- Arduino UNO R3
- Sim 800c Module
- 16*2 LCD Display
- U-blox 6m GSM Tracker
- II2C Display Module (16pin)
- GPRS Sim
- 2 x Lithium ion Batteries
- 1 x 9volt cell
- Jumper wires (Male<->Female)

Arduino Uno R3

Microcontroller used for our project is Arduino Uno R3. The R3 is the third, and latest, revision of the Arduino Uno. The Arduino Uno is a microcontroller board based on the ATmega328. The ATmega328 has 32 KB (with 0.5 KB occupied by the boot loader). It also has 2 KB of SRAM and 1 KB of EEPROM (which can be read and written with the EEPROM library). It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analog inputs), a USB connection, a power jack, an in-circuit system programming (ICSP) header, and a reset button.

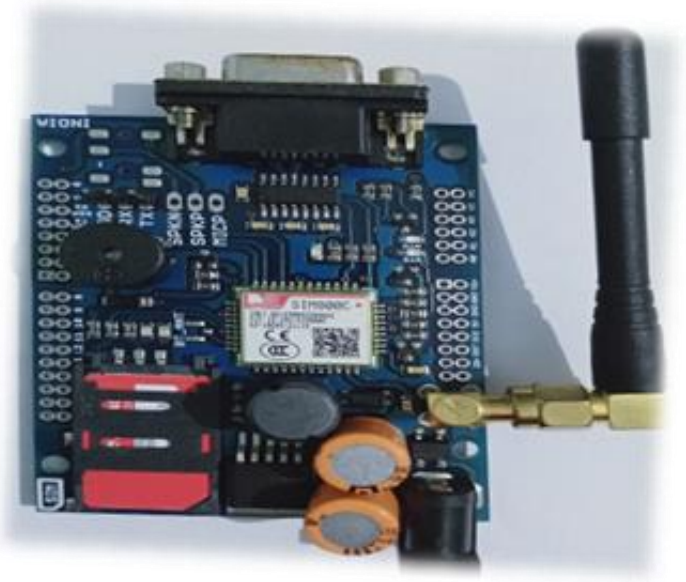
It is simply connected to a computer with a USB cable. The VIN is the input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). The 5V pin outputs a regulated 5V from the regulator on the board. The microcontroller board can be supplied with power either from the DC power jack (7 - 12V), the USB connector (5V), or the VIN pin of the board (7-12V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage your board.

So it is advised not to do so. Maximum current draw is 50 mA [5]. An Arduino board is based on an AVR microcontroller chip and when the board with nothing wired or attached to it consumes around 80ma of 5 volt current. The Clock speed of the Arduino is 16 MHz so it can perform a particular task faster than the other processor or controller. The AVR chip is clocking at 16 MHz continuously no matter what the code is doing, it never 'halts' so its current consumption is basically independent of the code you have it execute.

Only if you put the AVR chip into one of its 'sleep modes' can you halt code execution and drastically cut current consumption for the AVR chip, however the rest of the other components on the Uno will continue to draw their normal current consumption. Also the Arduino does not provide any 'sleep mode' examples so one will have to look for other user supplied coding example. Arduino board supports I2C and SPI communication. The Arduino software includes wire library for I2C and SPI library for the SPI communication. Various power-saving options for running the project from battery power are listed below

- Turn off internal modules in software that are not needed (e.g. SPI, I2C, Serial and ADC).
- Turn off brownout detection.
- Turn off the watchdog timer.
- Put the processor to sleep.
- Do not use inefficient voltage regulators - if possible run directly from batteries.
- Don not use power-hungry displays (e.g. indicator LEDs, backlit LCDs).
- Arrange to wake the processor from sleep only when needed.
- Turn off (with a MOSFET) external devices (e.g. SD cards, temperature sensors) until needed.

- **SIM800c Module**



SIM800c module is a complete Quad-Band GSM / GPRS module which combines GPS technology for satellite navigation. It has a SIM application toolkit where SIM card can be inserted. The compact design which integrated GPRS and GPS in a SMT package significantly saves both time and cost for one to develop GPS enabled applications. A modem GSM & GPRS with SIM800c module allows to create data connections on the GSM network through a standard USB interface. The cellular modems, particularly USB-stick ones, are now at very affordable prices. However, they are limited: they are explicitly designed for Internet connections, so one cannot use it as a normal modem and so implement, for example, a point to point data communications with them.

To switch ON the cellular module, the microcontroller has to put high the line ON/OFF (pin 1 on connector). This saturates the T2 transistor that drives to low the line PWR of GSM. SIM800c is designed with power saving technique so that the current consumption is as low as 2A in sleep mode (GPS engine is powered down). The range of DC005 voltage input is 7-12V, when use the 5V power as the power, it is needed to make sure that the power supply can provide 2A current. The SIM800c module has two different serial ports on board, one for the cellular section of the module and one for the GPS section.

The serial port on cellular allows the full management of SIM800c module, therefore it can be used to configure and communicate with the GPS receiver, in order to call for data about satellite status and geographical positioning and to transfer them to the microcontroller. This is the approach followed in the design of this project. All the GPS function is controlled by AT command via serial port. This module uses AT command to execute user's desired functions. While using the GPS function, two AT commands are send to open the GPS function, and the commands are AT+CGPSPWR=1 and AT+CGPSRST=1 respectively; two instructions are used to power GPS and reset GPS.

And then, the GPS TTL level interface will send data out and the baud rate is 9600 by default.

- **GPS and GSM Antenna GPS Antenna**

This GPS antenna draws about 10mA and will give you an additional 28 dB of gain. It got a 5 meter long cable so it will easily reach wherever it is needed to. The antenna is magnetic so it will stick to the top of a car or truck or any other steel structure. Its operating frequency range is 1575.42±1.023 MHz and voltage range is 2.5V- 5.5V and corresponding current range is 6.6 mA - 16.6 mA. GPS signals are extremely weak and present unique demands on the antenna so the choice of antenna plays an important role in GPS performance. A GPS unit needs to have a clear, unobstructed sky view, to best receive the microwave signals that allow it to communicate with satellites. GPS Down/Up converter used for very long cable runs.

This GPS antenna that receives the GPS signal, converts it to a lower frequency which is then sent down the cable. Next to the GPS receiver is an up converter that converts the signal back to the original frequency and delivers it to the GPS receiver.

- **GSM Antenna**

GSM communications are dependent on antennas. The antenna is what allows communications signals to be sent and received. The antenna that we have used in our project provides operation at both GSM Quad Band Frequencies with +2dBi gain. This antenna operates in Quad Band 890/960, 1710/1880 MHz Frequencies and it's an Omni-directional.

- **Battery**

We have used a 2-lithium ion battery of 3.7V each which has nominal capacity of 4800mAh. It is rechargeable and has maintenance -free operation and low discharge functionality.

- **LCD**

This type of LCD is ideal for displaying text and numbers, hence the name 'character LCD'. The I2C LCDs that we are using in this tutorial come with a small add-on circuit mounted on the back of the module. This module features a PCF8574 chip (for I2C communication) and a potentiometer to adjust the LED backlight. The advantage of an I2C LCD is that the wiring is very simple. You only need two data pins to control the LCD. Standard LCDs typically require around 12 connections, which can be a problem if you do not have many GPIO pins available. Luckily, you can also buy the I2C add-on circuit separately on Amazon, so you can easily upgrade a standard LCD as well.

SOFTWARE COMPONENT

- **Method Followed**

In this project, we built a vehicle tracking device which will be imbedded into a vehide and monitoring that vehicle in real time. In tracking device, GPS receiver receives the data or information mainly latitude and longitude of the particular vehicle from the satellite which information is transferred over mobile phone via Short Message Service (SMS) by using GSM modem.

GSM modem is connected with Arduino Uno R3 microcontroller. Since the geo positional data is retrieved every second and the maps updated at the same interval, thus a real time vehicle tracking is achieved.

- **Arduino IDE**

For designing the vehicle tracking system we need to have knowledge about various programming languages to ensure the communication between microcontroller and GSM SIM module and to store and retrieve data of vehicle's location into the web application through Google Map. For receiving data from the satellite and sending data into the database, Arduino microcontroller and SIM908 module had been programmed by using Arduino IDE software.

Arduino IDE software is an open source software which is used for compiling the program into the microcontroller. In this software C- programming language has been used for code. The coding has mainly two parts – void setup () which is known as preparation for the program, runs only once and another part is void loop () which is known as execution of the program. We had written some function to get the authentication of SIM, GPS data.

We had used AT command for SIM800c to communicate with the Arduino and the server or mobile device. For monitoring the location of the vehicle into a google map, a web application had been built.

- **Google Map**

Google has developed Google maps for the computer or mobile mapping service. It offers 2D map, satellite map and 360 panoramic views of streets (Street View). Sites were established which feature satellite images of interesting natural and man-made landmarks, including such novelties as "large type" writing visible in the imagery, as well as famous stadia and unique earth formations.

Although Google uses the word "satellite", most of the high-resolution imagery is aerial photography taken from airplanes rather than from satellites. Google Maps uses JavaScript extensively. As the Google Maps code is almost entirely JavaScript and XML, some end-users reverse-engineered the tool and produced client-side scripts and server-side hooks which allowed a user or website to introduce expanded or customized features into the Google Maps interface.

SYSTEM DESIGN AND ANALYSIS

System Design

Vehicle tracking device is made up with Arduino Uno R3, SIM800c module including GPS and GSM antenna. The core part of tracking system is microcontroller Arduino Uno. The geo location of a vehicle can be captured through GPS receiver and that data will be transmitted to the user by using GSM technology.

The SIM800c module is initialized to start gathering geo location data from the satellite; device initialization is done using AT commands and includes GPS and GSM module; to turn on the GPS, first it is powered on and put in reset mode. Then the module become ready for receiving coordinates from satellite. The GPRS is next turned on; the process includes GPRS power on. Device initialization process may take up to 1 minute to worm up and calculate the accurate position. In case of network un-availability, the acquisitioned GPS coordinates and other data such as time and speed are stored temporarily until the network returns back to service then the stored coordinates are sent with their time stamp and speed. SIM800c requires 2A peak current.

So, external power supply like 9V-2A battery is used to provide the power. GPS antenna and GSM antenna are connected to the port of SIM800c module. The module and Arduino have a common ground. We had uploaded the program into the Arduino microcontroller which program is written in C programming language. Uploading program into Arduino is done by using Arduino IDE software.

Benefits of Vehicle Tracking System

The in-vehicle tracking device or unit working along with a central server and a software, which let the user or owner of a car to know the whereabouts of his own vehicle, surely comes with several benefits. The GPS and GSM installed inside the vehicle fetches its location information and send it to owner on regular intervals according to user's preferences, in order to remain up to- date all the time. As all the relevant information is displayed on the screen, it is very convenient for the user to monitor and take any actions in case of an emergency.

Also monitoring discourages dangerous and inefficient driving practices of drivers which lead to increased vehicle security and driver safety. The vehicle tracking system plays a vital role if it is used in any companies or organization for any kind of delivery purposes.

This system can also be named as an anti-theft tracking system as this advanced yet affordable system ensures the recovery of stolen vehicles too.

IMPLEMENTATION

CODE

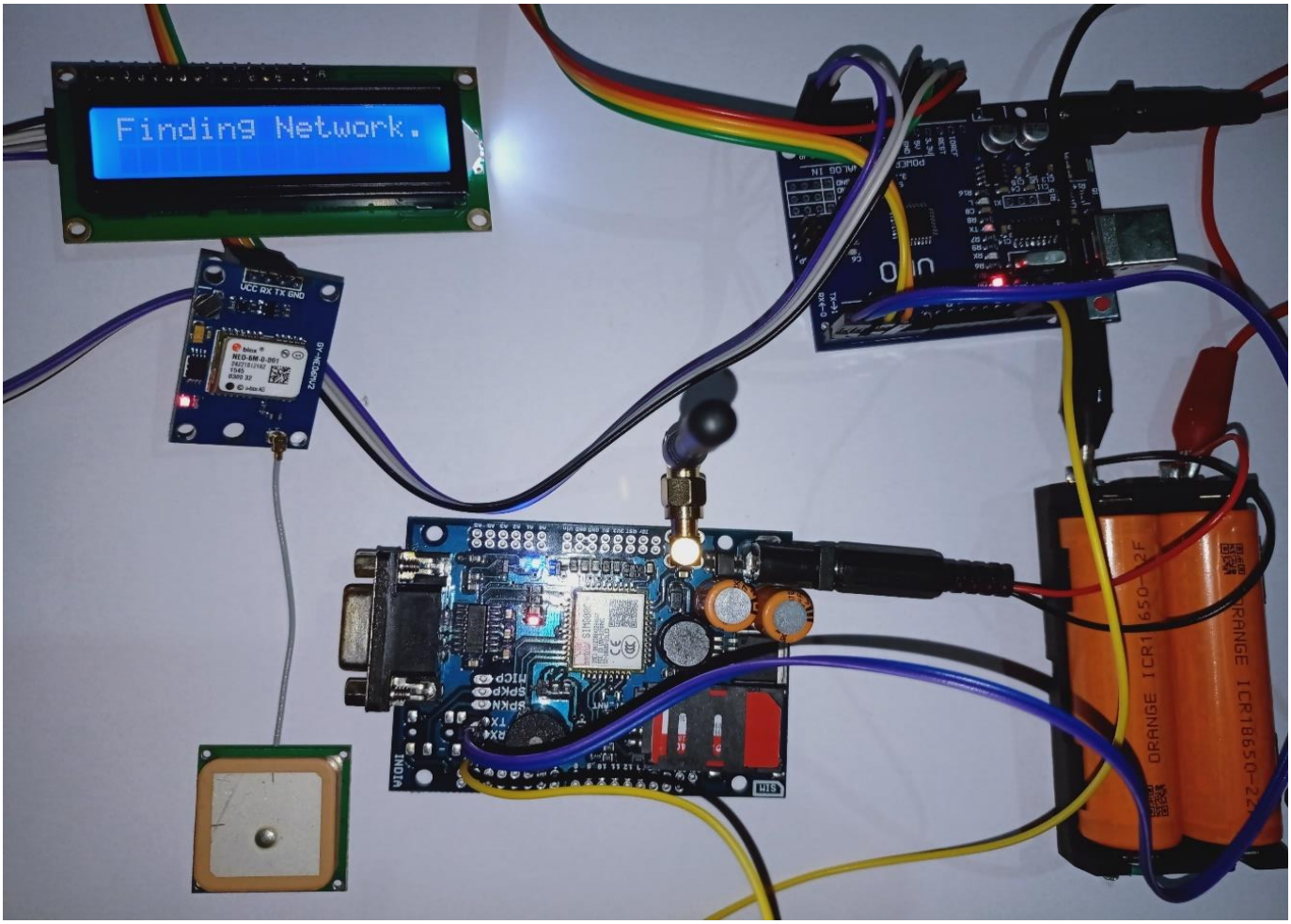
```
#include <TinyGPS++.h>
#include <SoftwareSerial.h>
#include <LiquidCrystal_I2C.h>

LiquidCrystal_I2C lcd(0x27,20,4);

static const int RXPin = 4, TXPin = 3;
static const uint32_t GPSBaud = 9600;
// The TinyGPS++ object
TinyGPSPlus gps;
int temp=0,i;
// The serial connection to the GPS device
SoftwareSerial ss(RXPin, TXPin);
String stringVal = "";
void setup(){
  Serial.begin(9600);
  ss.begin(GPSBaud);
   lcd.init();
    // Print a message to the LCD.
    lcd.backlight();
  pinMode(13,OUTPUT);
  digitalWrite(13,LOW);
  lcd.print("Vehicle Tracking");
  lcd.setCursor(0,1);
  lcd.print("    System      ");
  delay(2000);
  gsm_init();
  lcd.clear();
  Serial.println("AT+CNMI=2,2,0,0,0");
  lcd.print("GPS Initializing");
  lcd.setCursor(0,1);
  lcd.print("  No GPS Range  ");
  delay(2000);
  lcd.clear();
  lcd.print("GPS Range Found");
  lcd.setCursor(0,1);
  lcd.print("GPS is Ready");
  delay(2000);
  lcd.clear();
  lcd.print("System Ready");
  temp=1;
}
```

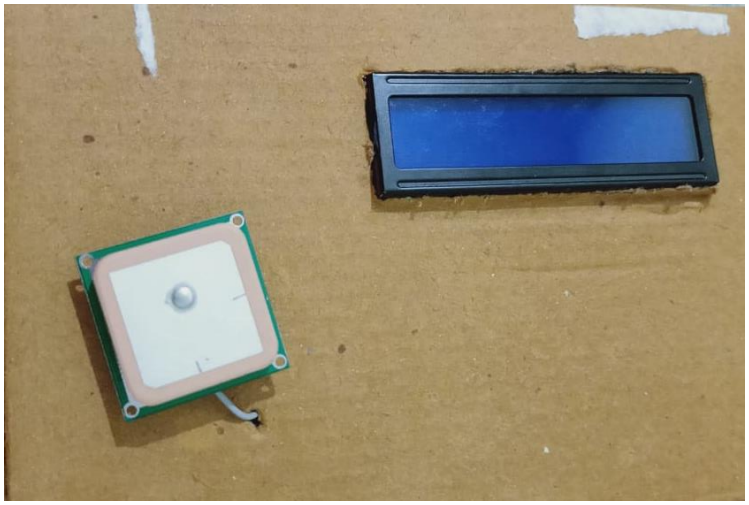
```
void loop()
{
serialEvent();

    while(temp)
    {
     while (ss.available() > 0)
     {
      gps.encode(ss.read());
          if (gps.location.isUpdated())
          {
           temp=0;
           digitalWrite(13,HIGH);
           tracking();
          }
      if(!temp)
      break;
     }
    }
    digitalWrite(13,LOW);
}
void serialEvent()
{
 while(Serial.available()>0)
 {
  if(Serial.find("Track Vehicle"))
  {
   temp=1;
   break;
  }
  else
  {
  temp=0;
  }
 }
}
void gsm_init()
{
 lcd.clear();
 lcd.print("Finding Module..");
 boolean at_flag=1;
 while(at_flag)
 {
  Serial.println("AT");
  delay(1);
  while(Serial.available()>0)
  {
   if(Serial.find("OK"))
```

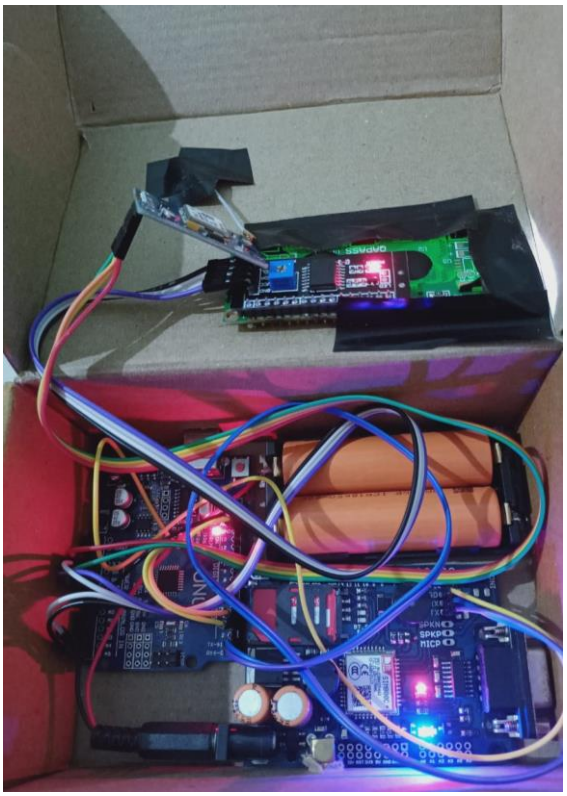
```
    at_flag=0;
   }

   delay(1000);
  }
  lcd.clear();
  lcd.print("Module Connected..");
  delay(1000);
  lcd.clear();
  lcd.print("Disabling ECHO");
  boolean echo_flag=1;
  while(echo_flag)
  {
   Serial.println("ATE0");
   while(Serial.available()>0)
   {
    if(Serial.find("OK"))
    echo_flag=0;
   }
   delay(1000);
  }
  lcd.clear();
  lcd.print("Echo OFF");
  delay(1000);
  lcd.clear();
  lcd.print("Finding Network..");
  boolean net_flag=1;
  while(net_flag)
  {
   Serial.println("AT+CPIN?");
   while(Serial.available()>0)
   {
    if(Serial.find("+CPIN: READY"))
    net_flag=0;
   }
   delay(1000);
  }
  lcd.clear();
  lcd.print("Network Found..");

  delay(1000);
  lcd.clear();
}
void init_sms()
{
  Serial.println("AT+CMGF=1");
  delay(400);
  Serial.println("AT+CMGS=\"+917676946898\"");    // use your 10 digit cell no. here
```

```
  delay(400);
}
void send_data(String message)
{
  Serial.print(message);
 delay(200);
}
void send_sms()
{
  Serial.write(26);
}
void lcd_status()
{
  lcd.clear();
  lcd.print("Message Sent");
  delay(2000);
  lcd.clear();
  lcd.print("System Ready");
  return;
}
void tracking()
{
    init_sms();
    send_data("Vehicle Tracking Alert:");
    Serial.println(" ");
    send_data("Your Vehicle Current Location is:");
    Serial.println(" ");
    Serial.print("Latitude: ");
    Serial.print(gps.location.lat(), 6);
    Serial.print("\n Longitude: ");
    Serial.println(gps.location.lng(), 6);

   // https://www.google.com/maps/@8.2630696,77.3022699,14z
   Serial.print("https://www.google.com/maps/@");
   Serial.print(gps.location.lat(), 6);
   Serial.print(',');
   Serial.print(gps.location.lng(), 6);
   Serial.print(",14z");
    send_sms();
    delay(2000);
    lcd_status();
}
```

RESULT ANALYSIS (SCREENSHOT)







Conclusion and Future work

Conclusion

In our project we have developed a vehicle tracking system that is flexible, customizable and accurate. The GSM modem was configured and we tested and implemented the tracking system to monitor the vehicle's location via SMS with help of Google map. The Arduino is the brain of the system and the GSM modem is controlled by AT commands that enable data transmission over GSM network while the GPS provide the location data. Whenever the GPS receives a new data it is updated in the database and hence, we are able to see the location on the Google map.

We thought of designing a real time vehicle tracking system in our project keeping the scenario of Bangalore in mind where vehicle theft is rapidly increasing. Our device can provide good control on car tracking. The system provides accurate data in real time that makes it possible for the user to track the vehicle and it also enable an early retrieval if the car is stolen. Implementation of GPS tracker in vehicle can certainly bring revolution change in city like Bangalore where there is very high urban as well as rural vehicular transition every day. There can be various other applications that can be built over our existing platform.

Hence, we have designed our system in such a way that upgrading this system is very easy which makes it open for future requirement without the need of rebuilding everything from scratch, which makes our system even more efficient. This project has widely increased our knowledge of GPS and also improved our programming skills. We have also ensured the reliability of our system through various field tests that we have done during our project and the initial results that we obtained through our prototype are very promising. This makes our project complete, robust and we can even think of commercialization of this system in future.

Scope of development

We can send multiple SMS to multiple mobile numbers. Also, we can dial a call to the mobile numbers.

Over-speed detection and hard breaking detection can be done in a future enhancement.

We can send data to a server using IOT (Internet of Things) and then we can see the location by accessing the website through internet.

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