

# Implementation of Microcontroller Based Vehicle Location Tracker Using GSM and GPS

Yu Yu Mon Win, Thin Thin, Kyaw Zue Thar

**Abstract**— Location Tracker uses GPS and GSM to track and provide complete location information to user over mobile phone. This system gives minute by minute update about vehicle location by sending SMS through GSM Module. This SMS contains longitude and latitude of the vehicle location. Arduino microcontroller is the central processing unit of the overall system. Arduino gets the coordinates from GPS module and then it sends this information via SMS to send the owner of the vehicle.

**Keywords**— Arduino, GPS, GSM, Location Tracker, Mobile Phone, SMS

## 1 INTRODUCTION

The development of satellite communication technology is easy to identify the vehicle locations. Today GPS used in cars, ambulances, fleets and police vehicles are common sights on the road of the developed countries. All the existing technologies support tracking the vehicle place and status. The GSM/GPS based system is one of the most important systems. The presenting location tracker is a low-cost, and very useful in case of vehicle theft situations for monitoring adolescent drivers by their parents as well as in car tracking system.

## 2. BLOCK DIAGRAM

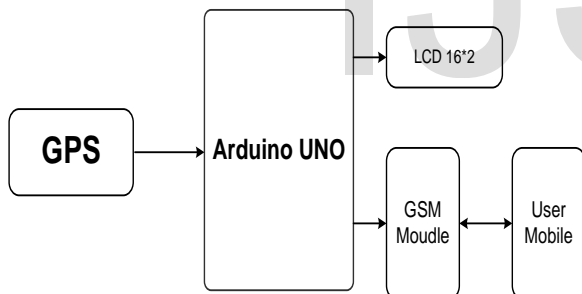


Figure 1. System Block Diagram

The proposed system can be interconnected with the vehicle and alerts to the user's mobile phone. This tracking system is composed of a GPS receiver, Arduino and a GSM Module. GPS Receiver gets the location information from satellites in the form of latitude and longitude. The Microcontroller processes information and this processed information is sent to the user/owner using GSM module.

## 3. HARDWARE COMPONENTS REQUIRED

The developed system is built of the following components. These are:

- Arduino Microcontroller ,
- SIM 900A GSM Module,
- GPS Module, and
- 16-character x 2-line LCD Module.

### 3.1 Arduino Microcontroller

Arduino UNO is the heart of the system that is used for interfacing to various hardware peripherals. It reads the coordinates tracked from GPS and extracts location information. This information is then sent to user's mobile phone via a SMS and display on LCD in the vehicle.



Figure 2. Arduino UNO Microcontroller

### 3.2 SIM 900A GSM Module

GSM interfaces to the MCU through the level shifter IC Max232. Firstly the user insert the SIM card to GSM module and lock it. Then it connects the adapter to GSM module and turn it ON. Now wait for some time and see the blinking rate of status LED or Network LED. Once the connection is established successfully, the status/network LED will blink continuously every 3 seconds. Making a call to the mobile number of the SIM card inside GSM module. If the user hears a ring back, the GSM module has successfully established network connection. The SIM card inside GSM module that receiving SMS from any cell phone sends GPS sensing data to the MCU through serial communication.

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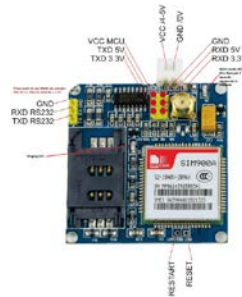


Figure 3. GSM SIM 900A Module

Pin 3	D6 of LCD
Pin 2	D7 of LCD

### 3.3 Global Positioning Unit (GPS)

GPS is a space-based satellite navigation system. Three satellites give exact position which means GPS modem should receive the signal from three satellites. GPS receives from antenna. GPS antenna should be sky facing.



Figure 4. GSM SIM 900A Module

### 3.4 Liquid Crystal Display (LCD)

Liquid Crystal Display (16 x 2) is used to display the location information sent from GPS processed by Arduino.



Figure 5. GSM SIM 900A Module

## 4 IMPLEMENTATION OF THE COMPLETE SYSTEM

The circuit connection of the system is very simple as shown in table 1.

Table 1. Pin Assignment of The System

Arduino UNO Pin	Components
Pin 0	Tx of GPS
Pin 1	Rx of GPS
Pin 10	Tx of GSM
Pin 11	Rx of GSM
Pin 7	RS of LCD
Pin 6	EN of LCD
Pin 5	D4 of LCD
Pin 4	D5 of LCD

### 4.1 Interfacing GPS and UNO

After connecting the GPS and Arduino, a program is uploaded. The tested result can be seen on serial monitor in the figure 6 and figure 7.

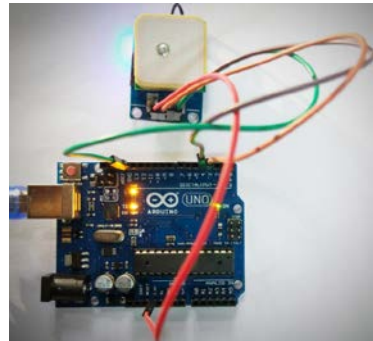


Figure 6. Testing GPS Module



Figure 7. Testing Result GPS Raw Data

### 4.2 Reading GPS data on Serial Monitor

In serial monitor, there are sentences that start from \$ sign, The sentences are called NMEA (National Marine Electronics Association) message sentences. They are real time tracking positioning data in NMEA format. In which, the four important sentences are given below:

- \$GPGGA : Global Positioning System Fix Data,
- \$GPGSV : GPS satellites in view,
- \$GPRGSA : GPS active satellites, and
- \$GPRMC : Recommended minimum specific GPS Data

These strings contains many GPS parameter like: time, date longitude, latitude, speed, number of satellite in use, altitude and many other things. Now in this system, \$GPGGA is used to get location. The sample result shown in below. In this sentence.

```
$GPGGA,022527.00,2414.85025,N,09714.28923E,
```

NMEA message starts with the \$ character, GP represents GPS Position, 022527 represents in "Hours, Minutes and Seconds" in UTC format (Coordinated Universal Time),

2414.85025,N represents "Degree Minutes.Minutes Latitude", and 09714.28923,E represents "Degree Minutes.Minutes Longitude".

### 4.3 Interfacing GSM and UNO

GSM module is checked whether it is connected or not by sending AT command to GSM module.



Figure 8. Testing GPS Module

If response OK is received, it is ready to use. Then ECHO is turned off by sending the ATE0 command. Then Network availability is checked through the "AT+CPIN?" command, if inserted card is SIM card and PIN is present, it gives the response +CPIN: READY. The AT commands for SMS are shown in Table 2.

Table 2. AT Command for SMS

Commands	Description
AT+CMGS	Send SMS message
AT+CMGF	Select SMS Message format
AT+CNMI	New SMS Message indication
AT+CPIN	Check Pin

### 4.4 Overall Circuit Diagram of The System

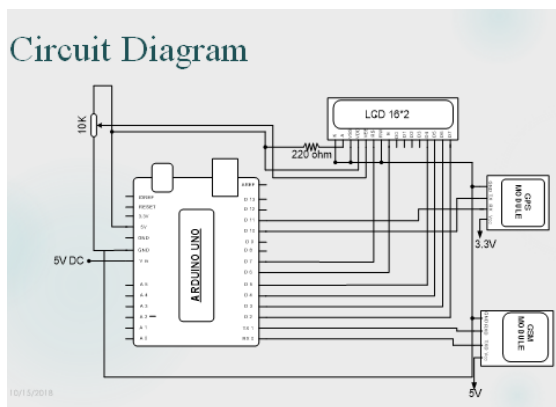


Figure 9. Overall Circuit Diagram

When the circuit is ready after programming, it can be installed in the vehicle and powered it up. Then a predefined SMS is needed. In this system "Track My Car" is predefined.

For SMS. Sent Message is received by GSM module which is connected to the system and sends message to Arduino. Arduino reads it and extracts main message from the whole message. And then compare it with predefined message in Arduino. If any match occurs then Arduino reads coordinates by extracting \$GPGGA string from GPS and send it to user by GSM module. This message contains the coordinates of the vehicle's location. This location information is also displayed on LCD to notify the vehicle driver and passengers where they arrived at that time.

### 4.5 System Flowchart

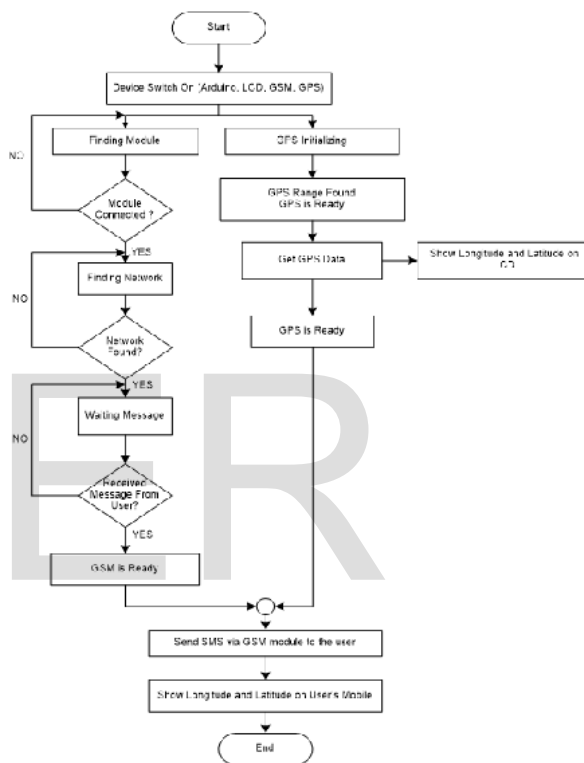


Figure 10. System Flowchart

## 5 TESTS AND RESULTS

The system is tested with two parts and complete circuit is tested then. The first test is the interfacing with GPS and LCD processed by Arduino. It can be simulated using Proteus Software. The result is acceptable as shown in Figure 10.

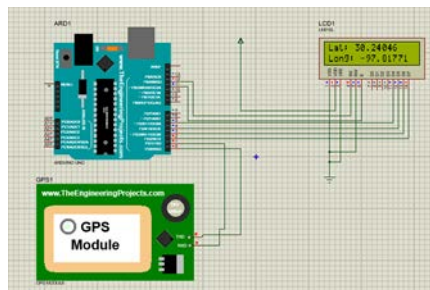


Figure 11. GPS and LCD Interfacing Result  
The second part is hardware test and result of GSM and Ar-

duino.It can be seen in Figure 12.

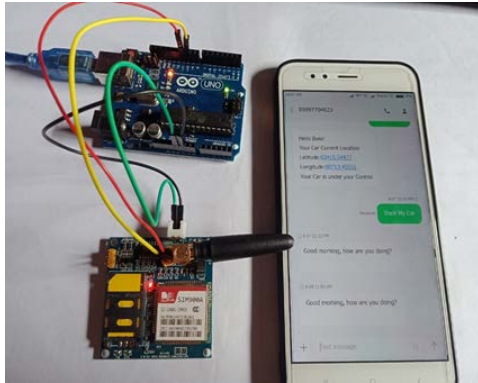


Figure 12.GSM and Arduino Interfacing Result

Finally the complete circuit is tested and the results are shown in the following.



Figure 12. Overall Test Results

## 6. CONCLUSION

The vehicle tracking both in case of personal as well as business purpose improves safety and security, communication medium, performance monitoring, and increase productivity. So in coming year, it is going to play a major role in day-to-day living. The GPS and GSM based this tracking system is one of the less delay time and the most effective system for the present day.

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## REFERENCES

- [1] Kaskar Saif and Shaikh Junaid: Vehicle Tracking System Using GPS and GSM Technology, Submitted in partial fulfillment of the requirement of the degree of Bachelor of Engineering, Department of Electronics and Telecommunication, AIKTC, (2017).
- [2] Gichana Martin Ogeto: VEHICLE TRACKING USING GPS, University of Nairobi, Dept; of Electrical and Information Engineering, (2015).
- [3] Essam Zouhier Adwan: Real Time Cost Effective of People Tracking System, Islamic University Gaza Deanery of Graduate Studies Faculty of Information Technology, (2015).
- [4] Saniah Ahmed: Real Time Vehicle Tracking System, Department of Electrical and Electronics Engineering of BRAC University, (2015).