© 2024 IJNRD | Volume 9, Issue 11 November 2024 | ISSN: 2456-4184 | IJNRD.ORG

IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

# Real Time vehicle Tracking System Using Arduino , GPS, GSM and Web Based Technologies

**R.PRADEEP, B.AJAY ADHITYA, C.SIBI**
Department of ECE, Anna university MITcampus,chrompet, Chennai-600044

***Abstract-*** In the modern era, vehicle tracking systems have become an essential technology for fleet management and vehicle owners worldwide, known for their safety and reliability. This paper presents a proposal for a real-time tracking system that utilizes Global Positioning System (GPS) and Global System for Mobile Communication (GSM) technologies. The system is designed as an embedded application that continuously monitors the location and status of a vehicle, providing updates on demand. The tracking device comprises an Arduino Uno R3, a SIM800A GSM module, and a NEO-6M GPS module. The Arduino Uno R3 interfaces serially with both the GSM and GPS modules, allowing the system to function seamlessly. The GSM module transmits the vehicle's position from remote locations, while the GPS module leverages satellite technology to provide critical data such as longitude, latitude, speed, and distance traveled. To visualize the vehicle's location, Google Maps is utilized for digital mapping. The development process incorporates XAMPP, a free and open-source cross-platform web server solution stack that includes the Apache HTTP Server, MySQL database, and interpreters for PHP and Perl scripts. Additionally, the Google Maps API facilitates the embedding of maps onto web pages through a JavaScript interface optimized for desktop browsers. The MySQL databasestores all GPS data, while the Google Maps API presents this location information interactively.

## 1. INTRODUCTION

The **Vehicle Tracking System** is an advanced security and fleet management solution designed to monitor and locate vehicles in real time. It primarily relies on **GPS technology**, which communicates with satellites and ground-based stations to determine the precise location of a vehicle. This system can be installed inside any vehicle and provides continuous monitoring, offering real-time data that can be accessed by the owner or fleet manager. In some cases,other automatic vehicle location technologies are also utilized to enhance accuracy and functionality. One of the major components of the vehicle tracking system is its ability to provide **real-time location updates**. This means that the vehicle's position can be continuously monitored, allowing for immediate responses in case of emergencies or theft. The system collects and stores data that can be downloaded to a computer for future analysis, helping businesses track vehicle usage, monitor driver behavior, and optimize fleet performance. For individuals, this feature offers peace of mind by ensuring that their vehicle can be tracked at any time. **Theft prevention** is one of the key reasons for the popularity of vehicle tracking systems, especially among owners of expensive cars. By providing real-time tracking and location data, the system allows vehicle owners to immediately locate their cars in case of theft. This increases the chances of vehicle recovery and acts as a powerful deterrent against car theft. As a result, the system has gained widespread acceptance as an essential security device. In addition to security, vehicle tracking systems are also invaluable for businesses, particularly those with large fleets. **Fleet managers** can use the system to monitor vehicle performance, track driver routes, and ensure that vehicles are being used efficiently. The data collected can help companies reduce fuel costs, improve route planning, and enhance overall operational efficiency. By enabling better management of resources, vehicle tracking systems contribute to cost savings and productivity improvements in the long run. Lastly, vehicle tracking systems allow for easy access to data through **electronic maps** via the internet or web-based platforms. This feature makes it convenient for both individual users and fleet managers to view the real- time location of their vehicles. The widespread availability and simplicity of the system make it a crucial tool for modern vehicle security and management, enhancing both personal and commercial vehicle operations.

## 2. OVERVIEW OF PROPOSEDSYSTEM

The block diagram of the vehicle tracking system illustrates the operational framework of the proposed solution. To implement this real-time vehicle tracking system, navigational technologies such as GPS and GPRS, along with database technologies, are employed. This system is installed in vehicles, enabling owners to monitor their locations effectively. The Global Positioning System (GPS) accurately determines a vehicle's position. The GPS antenna connects to a receiver module, which captures signals from GPS satellites in NMEA (National Marine Electronics Association) format. This data is then transmitted to a server via the GPRS module. GPRS facilitates an HTTP connection with the tracking server, which receives the vehicle's location information through the network and stores it in a database. Users can access this information over the internet, visualized on a map.

GPS operates as a satellite-based navigation system, comprising 24 satellites placed in orbit. These satellites transmit coded signals to GPS receivers, which use this information to pinpoint vehicle locations on Earth by calculating distances from the satellites. The GPRS network provides a continuous, private data connection, utilizing the existing GSM infrastructure to send and receive HTTP-based data to and from GPRS devices. This network supports packet-switched data services, including email and web browsing, with a maximum data transfer rate of
115.2 kbps, making it particularly suitable for real- time tracking management systems.

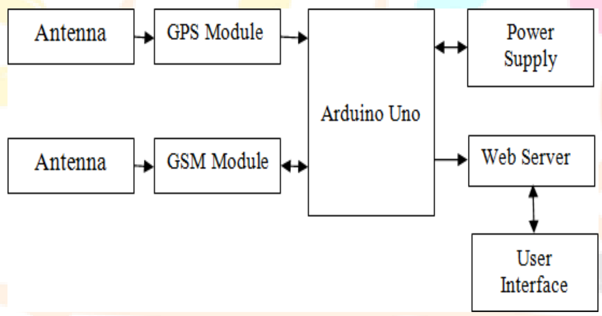


**Figure 1.** Block Diagram for Overall Proposed System

## 3. CONFIGURATION OF REAL TIMEVEHICLE TRAKING SYSTEM

This section provides a detailed overview of the development process for the real-time vehicle tracking system. The system comprises two primary components: hardware and software. The hardware aspect includes the tracking unit, which integrates several key components. Specifically, the tracking device is built using an Arduino Uno R3, a SIM800A module, and a NEO-6M GPS module. At the heart of the vehicle tracking system is the Arduino Uno microcontroller. The GPS module captures the vehicle's geolocation data, which is then transmitted toa web server via GSM technology. The implementation of the tracking unit is illustrated in Fig. 2.

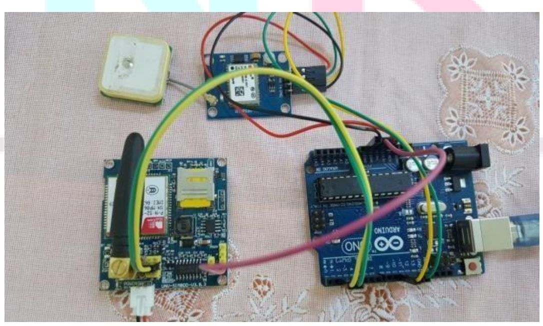

**Figure 2.** Tracking Unit For real Time Vehicle TrackingSystem

The project involves building a GPS and GSM-based real-time tracking system using an Arduino Uno. To meet the SIM800A GSM module's requirement for a peak current of 2A, an external 12V-2A power supply is used. The GPS and GSM modules are connected to the Arduino through its digital input/output pins.

For the GPS module, the TX (Transmit) pin is wired to the Arduino's RX (Receive) pin so that the GPS can send location data to the Arduino. Likewise, the RX pin of the GPS is connected to the Arduino's TX pin to enable two-way communication. Similarly, the GSM module's TX pin is connected to the Arduino's RX pin, while the GSM's RX pin is linked to the Arduino's TX pin. This configuration allows the GSMmodule to exchange data with the Arduino, enabling communication over a GPRS network.

The system operates by having the GPS gather location data and transmit it to the Arduino, which processes it and prepares it for transmission. The GSM module establishes a GPRS connection and sends the data to a remote server via the HTTP protocol. The Arduino continuously monitors the GPRS connection and periodically updates the serverwith the device’s current location.

On the software side, the Arduino IDE is used for writing, compiling, and uploading the code in C/C++. Two key libraries are employed: SoftwareSerial.h, which allows the use of additional serial communication ports, and TinyGPS++.h, a library that simplifies parsing and extracting location data from GPS signals. Together, these components form a user-friendly environment for creating the tracking system devices. In Fig.3, arduino IDE sketch of coding for the proposed real time tracking system is described.

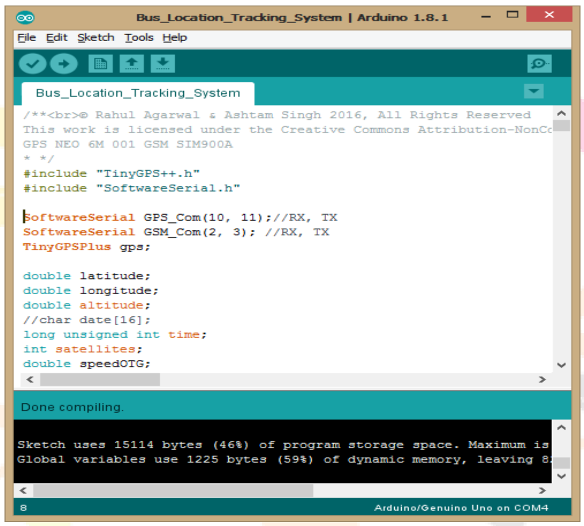


**Figure 3.** Arduino IDE Sketch of Coding for theProposed System

To transmit vehicle location data and other relevant information from the GPS module via the GSM network, the SIM800A module is integrated with an Arduino Uno microcontroller. The communication between the Arduino and the SIM800A module, as well as the connected server, is handled through AT commands. These commands, short for "ATtention," are used to control modems, with each command line starting with "AT" or "at." This is the origin of the term AT commands .

The process begins by verifying the response from the SIM card through AT commands, followed by checking the network connection status. Once the network is confirmed, the GPS status is reviewed, and the vehicle’s GPS data is collected. Afterward, an HTTP request is prepared to access the internet. Initially, the network registration is done using the AT+CGATT command, and the Access Point Name (APN), username, and password are set accordingly. Once the vehicle's location data is retrieved, it is sent to a web server using HTTP requests.

To configure the GPRS settings, the AT+SAPBR command is used. The HTTP service is initiated with the AT+HTTPINIT command, while the HTTPPARAcommand is used to define necessary parameter values.

The step-by-step process to verify the GPRS settings is as follows:

1. Send AT+SAPBR=3,1,"Contype","GPRS" and wait for the "OK" response.
2. Send AT+SAPBR=3,1,"APN","mptnet" and receive "OK" (where the APN for the MPT SIM card is "mptnet").
3. Send AT+SAPBR=3,1,"USER","" and get the "OK"response (for MPT, the USER field is left blank).
4. Send AT+SAPBR=3,1,"PWD","" and receive "OK"(the PASSWORD field is also blank).
5. Send AT+SAPBR=1,1 and get the "OK" response.
6. Send AT+HTTPINIT and wait for "OK".
7. Send AT+HTTPPARA="URL","" and receive"OK".

8. Finally, send AT+HTTPACTION=0 and wait forthe "OK" response.

Figure 4 depicts the serial monitor output from the Arduino IDE while running the tracking system.

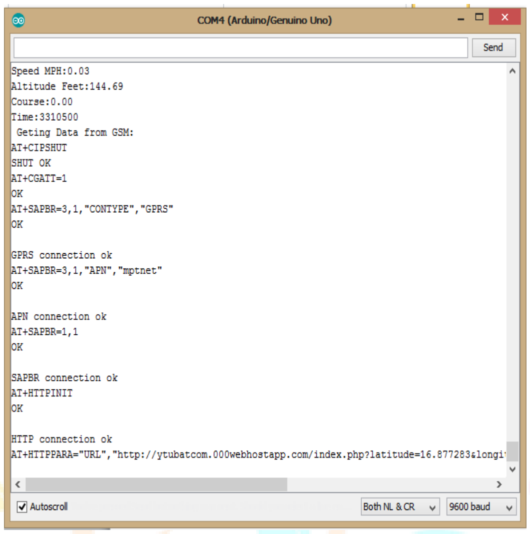


**Figure 4.** Serial Monitor of the Arduino IDEduring Running theTracking System

Once the GPRS service is activated, the system immediately begins using the HTTP protocol to transmit the vehicle's location data to a web server .For this project, a free web hosting platform, 000webhost.com, is utilized to set up the server for real-time vehicle tracking. An account is created onthe platform to host the tracking website.

FileZilla client software is employed to establish a connection with an FTP or SFTP server, facilitating the uploading and downloading of the necessary website files. The website for the vehicle tracking system is built using PHP and MySQL, integrated with the Apache web server to handle data processingand storage. This combination enables seamless communication and real-time updates on vehicle location.

## 4. SIMULATION AND RESULTS

To visualize the vehicle's location on Google Maps, an HTML-based web application is created using PHP. This application integrates the Google Maps API to display the location in a browser. The GPS data transmitted through the GSM module over HTTP is stored in a MySQL database, which is then accessed and displayed on the map using the PHP script's GET and POST functions. The embedded Google Maps API handles communication with Google Maps servers and renders the map, while APIcalls allow the addition of location markers.

The map's center is set using the google.maps.LatLng() method, and for this particularapplication, the ROADMAP view is selected from the different map types that the API offers. To

display the vehicle's location, the getElementByID() method is used to fetch the necessary data.
Additionally, jQuery and the Google Maps API areincorporated into the script to enable real-time tracking of the vehicle on the map.

As shown in Figure 5, the web page allows users to view various details such as latitude, longitude, satellite count, speed, and course. The vehicle's current position is highlighted on Google Maps usinga marker, providing a clear and dynamic tracking interface.

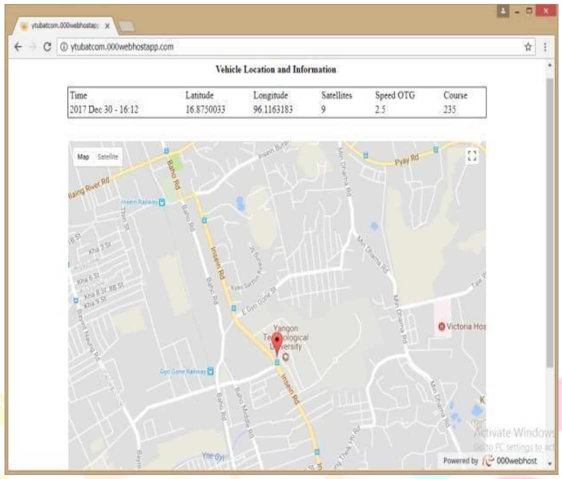


**Figure 5.** Web Page for the Proposed RealTime Vehicle TrackingSystem

## 5. CONCLUSION

This paper introduces a robust and real-time vehicle tracking system that is adaptable, highly customizable, and delivers precise tracking through the integration of GPS and GPRS over the GSM network. Designed for a wide array of global applications, this system leverages the combined power of GPS for location data and GPRS for real- time data transmission, ensuring continuous monitoring. The vehicle's position is visualized on Google Maps using the Google Maps API.

At the core of the system is the Arduino microcontroller, which manages the data flow. The GSM module, controlled via AT commands, facilitates data communication over the GSM network, while the GPS module provides accurate location information. Each time new GPS data is received, it isautomatically updated in the database, allowing the real-time location to be displayed on Google Maps.

In terms of vehicle tracking, the system effectively provides detailed location data, including latitude, longitude, altitude, date, satellite information, speed, and course. The system's performance is comparable to that of commercial-grade tracking devices.

Looking forward, the system can be enhanced byintegrating additional sensors or actuators to expand its functionality and offer a broader range of services.

## 6. REFERENCES

[1] S.Bharthepudi, Dr.S.Umar, S.Sanakkayala and S.Nismitha, "A Review of Low Cost Object Tracking System",International Journal of Computer Science Engineering and Technology, Vol.3, Issue 11, November2013, 423-426.
[2] O .A. Mohamad and R. T. Hameed, "Design

[3] and Implementation of Real Time Tracking System Based on Arduino Intel Galileo",International Conference and Artifical Intelligence, 30 June-02 July,2016.
[4] L. SeokJu, G. Tewolde and K. Jaerock, "Designand Implementation of Vehicle Tracking System Using GPS/GSM/GPRS Technology and Smartphone Application", IEEE World Forum on Internet of Things (WF-IoT), Seoul, March 2014.
[5] S. A. Salunke, V. B. Jagtap and A. D. Harale, "Vehicle Tracking System for School Bus by Arduino", International Research Journal of Engineering and Technology, Vol.04, Issue 03,March 2017, 2395-0072.
[6] S. A. Salunke, V. B. Jagtap and A. D. Harale, "Vehicle Tracking System for School Bus by Arduino", International Research Journal of Engineering and Technology, Vol.04, Issue 03,March 2017, 2395-0072.
[7] http://arduiniana.org/libraries/tinygpsplus/
[8] https://www.codeproject.com/Articles/85636/I ntroductio n-to-AT-commands-and-its-uses
[9] https://developers.google.com/maps