# IntelliTrack - IOT Based Smart Vehicle Tracking System


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***Abstract*– This study introduces an innovative vehicle tracking system that combines GPS technology with a user-friendly mobile interface. The system provides real-time location data, enhancing operational efficiency, asset protection, and security. Through integrated GPS devices and the mobile interface, users gain instant access to vital vehicle information. The system improves safety in unfamiliar parking areas and boosts customer satisfaction with accurate delivery updates. Overall, it signifies a notable advancement in vehicle tracking technology.**



***Keywords– IoT Vehicle Tracking, Smart Tracking System, Vehicle GPS Tracking, Real-time Vehicle Monitoring, GPS-GSM Integration, Arduino-based Tracking, Vehicle Security System, Remote Vehicle Tracking, Location Tracking Technology, IoT Embedded Systems, Vehicle Theft Prevention, Mobile App Tracking, Geo-Location Services, Vehicle Fleet Management, GPS Navigation System***


## I. INTRODUCTION

This research introduces an advanced vehicle tracking system designed to transform vehicle management and monitoring across various domains. The system leverages GPS technology seamlessly integrated with an intuitive mobile application interface. Its core objective is to provide real-time location information for vehicles, facilitating users in optimizing operational processes, safeguarding assets, and bolstering overall security measures. Through the integration of GPS tracking devices within vehicles and a robust mobile application, users are granted immediate access to vital data concerning the location and status of their vehicles. The system also improves safety measures by simplifying vehicle tracking in unfamiliar parking areas. Moreover, the invention aims to enhance customer satisfaction by delivering transparent and precise updates on delivery schedules, fostering trust and loyalty. Overall, this vehicle tracking solution signifies a notable technological advancement, offering increased efficiency and effectiveness in vehicle management.

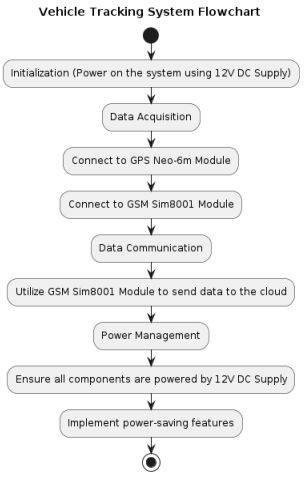



*Fig.1. Vehicle Tracking Flowchart*

## II. OBJECTIVE

To address the challenges outlined, we propose an elegant solution: the integration of a compact location tracker/sensor within the vehicle, seamlessly interfaced with our mobile platform via cloud-based services. This approach obviates the complexities associated with navigating unfamiliar parking structures or identifying surrounding vehicles. Instead, the system provides precise directional guidance to locate the vehicle and offers the capability to activate a tactile alarm via our interface, enhancing user convenience and efficiency.

1. **Unfamiliar Parking Areas**
    a. Problem: When visiting a new city or location, drivers often struggle to locate their parked vehicle due to unfamiliarity with the parking area or structure.
    b. Solution: Our system offers directional guidance, eliminating confusion and streamlining the vehicle location process.
2. **Crowded Parking Lots**
    a. Problem: In densely populated parking lots or events, identifying one's vehicle among numerous similar ones becomes challenging and time-consuming.
    b. Solution: The tactile alarm feature can be activated to pinpoint the vehicle, saving time and reducing frustration.
3. **Multiple Parking Structures**
    a. Problem: Large facilities with multiple parking structures or levels can lead to confusion and difficulty in remembering the exact location of the parked vehicle.
    b. Solution: Our cloud-connected tracker provides clear location data, ensuring drivers can easily locate their vehicle regardless of the parking structure's complexity.

## III. PROPOSED SYSTEM

This paper introduces an IoT-based Smart Vehicle Tracking System designed to locate and track vehicles in the event of loss or theft, leveraging the capabilities of GPS and GSM technologies. The system utilizes an Arduino Nano microcontroller to manage the integration and communication between various components. Installed within the vehicle, the system employs a GPS receiver module to acquire accurate location data, which is then transmitted via a GSM module to the vehicle owner's mobile device. This enables real-time tracking and facilitates prompt action in the event of an emergency or unauthorized vehicle usage.

### A. Flow Diagram

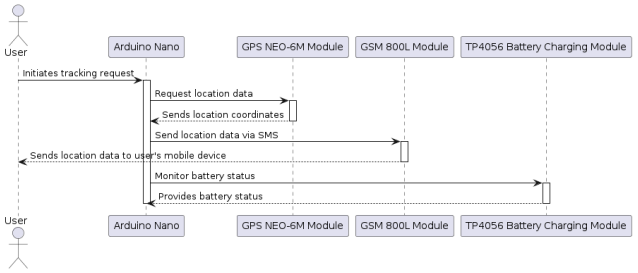



Fig.2. Sequence diagram for IOT based tracking system

- The User initiates a tracking request.
- The Arduino Nano microcontroller coordinates the interactions between the components.
- The Arduino requests location data from the GPS NEO-6M Module.
- The GPS module sends the location coordinates back to the Arduino.
- The Arduino sends the location data to the GSM 800L Module.
- The GSM module sends the location data to the user's mobile device.
- Additionally, the Arduino periodically monitors the battery status using the TP4056 Battery Charging Module.

### B. Interfacing Devices

**i) Arduino Nano:**
The Arduino Nano microcontroller functions as the central processing unit for the vehicle tracking system. Offering versatile input and output pins, it enables seamless integration with other embedded devices. Operating at a standard voltage of 5V, the Arduino Nano features a flash memory of 32KB and a static RAM of 2KB, providing sufficient storage and processing power for executing tracking algorithms. Furthermore, Arduino Nano supports programming in embedded C language through the Arduino Integrated Development Environment (IDE), allowing for flexibility and customization.

**ii) Global Positioning System (GPS NEO-6M Module):**
The GPS NEO-6M module serves as the cornerstone of the vehicle tracking system, facilitating accurate positioning of the vehicle. This module harnesses satellite signals to

determine precise geographical coordinates, enabling real-time tracking functionality. By leveraging signals from the Global Navigation Satellite System (GNSS) network, the GPS NEO-6M module provides continuous updates on the vehicle's location, ensuring effective monitoring and recovery measures.

**iii) Global System for Mobile Communication (GSM 800L Module):**

The GSM 800L module plays a crucial role in enabling seamless communication between the vehicle tracking system and the user's mobile device. Serving as a reliable serial communication interface, this module facilitates data transmission over cellular networks, ensuring timely delivery of location information to the vehicle owner. With its robust connectivity capabilities, the GSM 800L module empowers users to remotely access essential tracking data via a dedicated mobile application, facilitating proactive response and intervention.

**iv) TP4056 Battery Charging Module:**

The TP4056 battery charging module is a vital component of the vehicle tracking system, responsible for efficiently managing the charging of onboard batteries. This module employs advanced charging algorithms to optimize the charging process, ensuring the longevity and reliability of the vehicle's power supply. With its compact design and versatile functionality, the TP4056 battery charging module offers a convenient and effective solution for maintaining optimal battery performance, essential for prolonged operation of the tracking system.

**C. Hardware Specifications:**

**1. Arduino Nano:**

- Role: The Arduino Nano serves as the main microcontroller unit in the tracking system. It controls the overall operation, collects data from sensors, processes information, and communicates with other modules.
- Functions:
    - Reads data from GPS and GSM modules.
    - Implements algorithms for vehicle tracking, data processing, and communication.
    - Interfaces with other peripherals and sensors.
    - Controls power management and system behavior.

**2. GPS Neo-6m Module:**

- Role: The GPS Neo-6m module provides accurate location data by receiving signals from GPS satellites. It determines the latitude, longitude, and altitude of the vehicle's position.
- Functions:
    - Receives satellite signals and calculates the vehicle's current location.
    - Provides real-time GPS data to the Arduino Nano for processing.
    - Supports navigation, route planning, and geofencing functionalities in the tracking system.

**3. GSM Sim8001 Module:**

- Role: The GSM Sim8001 module enables cellular communication, allowing the tracking system to transmit data to a remote server or cloud platform via GSM networks.
- Functions:
    - Establishes a cellular connection for data transmission.
    - Sends location updates, status messages, and alerts to a central server.
    - Supports SMS and GPRS communication protocols for data exchange.

**4. 10k Pot (Potentiometer):**

- Role: The 10k potentiometer is typically used as a voltage divider to adjust analog input signals. In the context of a vehicle tracking system, it may be used for calibration, setting thresholds, or adjusting sensor readings.
- Functions:
    - Provides analog voltage signals to the Arduino Nano.
    - Allows for fine-tuning or calibration of sensor readings, such as GPS or environmental sensors.
    - Adjusts system parameters or thresholds dynamically based on user preferences.

**5. Zero PCB (Printed Circuit Board):**

- Role: The Zero PCB serves as a platform for mounting and interconnecting electronic components within the tracking system. It provides a compact and organized layout for assembling the hardware components.
- Functions:
    - Hosts and secures electronic components, including the Arduino Nano, GPS module, GSM module, and other peripherals.
    - Facilitates the routing of electrical connections between components.
    - Ensures reliability, durability, and efficient use of space within the tracking system enclosure.

**6. 12V DC Supply:**

- Role: The 12V DC power supply provides electrical power to the tracking system, ensuring its continuous

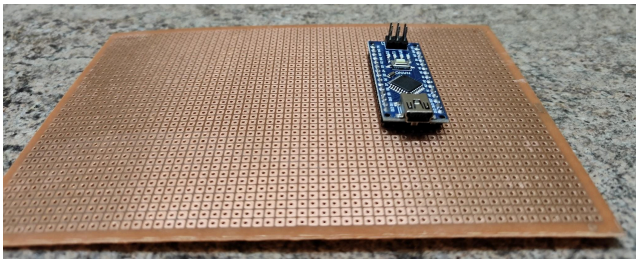
operation. It can be sourced from the vehicle's battery or an external power source.
- Functions:
    - Powers the Arduino Nano, GPS module, GSM module, and other electronic components.
    - Regulates voltage levels to meet the requirements of individual components.
    - Supports proper functioning of the tracking system under varying vehicle operating conditions.

By integrating these components, the smart vehicle tracking system can accurately determine the vehicle's location, communicate with remote servers or users, and perform various tracking and monitoring functions effectively. Each component plays a crucial role in the overall operation and functionality of the system.

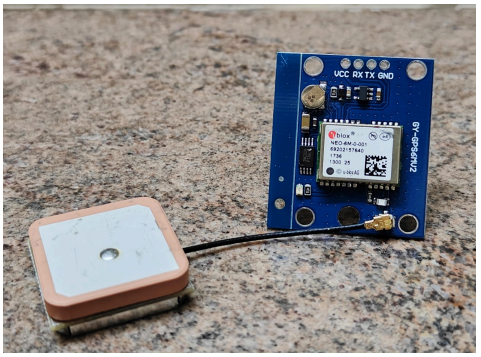
## IV. IMPLEMENTATION

**List Of Components:**

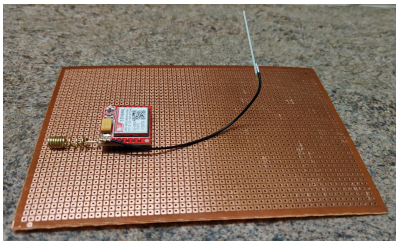
1. Arduino Nano



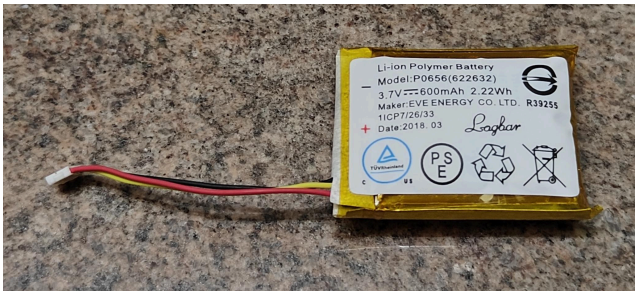
2. GPS Neo-6m Module




3. GSM Sim800L Module



4. Zero PCB
5. 12V DC Supply




A smart vehicle tracking system utilises GPS (Global Positioning System), GSM (Global System for Mobile Communications), and microcontroller boards like Arduino Nano and Arduino Zero to track and monitor the location of vehicles in real-time. Here's how it works:

**1. GPS Module:** The GPS module receives signals from satellites to determine the vehicle's precise geographic location (latitude and longitude). This module typically communicates with the Arduino board using serial communication protocols.

**2. Arduino Nano/Zero:** The Arduino Nano or Arduino Zero acts as the brain of the tracking system. It receives data from the GPS module and processes it to extract location information.

**3. GSM Module:** The GSM module enables communication between the vehicle tracking system and a central server or a user's mobile device via cellular networks. It allows the system to send location data in the form of SMS (Short Message Service) or through GPRS (General Packet Radio Service) to a remote server.

**4. Data Processing:** The Arduino board processes the GPS data and formats it into a suitable message format. This message typically includes the vehicle's current coordinates, timestamp, and possibly other relevant information such as speed or direction.

**5. Communication with Central Server/User:** Once the data is processed, the Arduino board utilizes the GSM module to transmit this information to a central server or directly to the user's mobile device. This communication can occur periodically at predefined intervals or triggered by specific events such as vehicle movement.

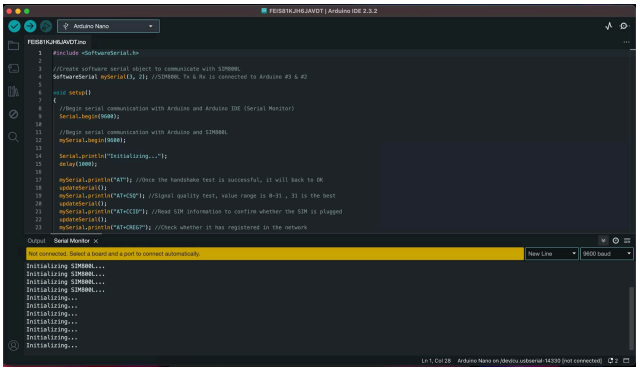
**6. Server/Cloud Storage:** The central server receives the location data from multiple vehicles and stores it in a database. This allows users to access real-time and

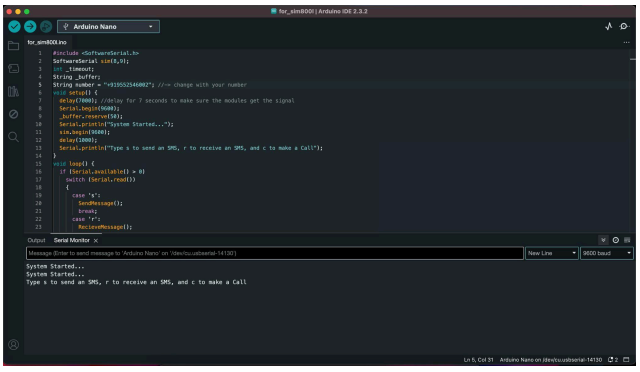
historical tracking information through web or mobile applications.

**7. User Interface:** Users can access the tracking information through a user-friendly interface on their smartphones, tablets, or computers. This interface displays the vehicle's current location on a map, along with additional details such as speed, direction, and historical routes.

**8. Alerts and Notifications:** The tracking system can be programmed to send alerts and notifications to users under certain conditions, such as unauthorized vehicle movement, exceeding speed limits, or deviating from predefined routes. These alerts can be sent via SMS, email, or push notifications.

Overall, a smart vehicle tracking system using GPS, GSM, and Arduino boards provides real-time monitoring, enhances security, and enables efficient fleet management for various applications, including logistics, transportation, and vehicle rental services.





## V. APPLICATIONS

**(i) Fleet Management for Transportation Companies**:
Large transportation companies use vehicle tracking systems to monitor their fleet in real-time. This helps in optimizing routes, reducing fuel consumption, and ensuring timely deliveries.

**(ii) Smart Parking Solutions in Urban Areas**:
Cities are adopting smart parking solutions with IoT-based vehicle tracking to guide drivers to available parking spaces, reducing traffic congestion and pollution.

**(iii) Emergency Response and Recovery**:
Emergency services like ambulance and fire departments use vehicle tracking to dispatch the nearest available vehicle to an emergency location quickly, saving crucial time.

**(iv) Public Transportation Management**:
Public transportation agencies use vehicle tracking to provide real-time updates to passengers about bus or train locations, reducing wait times and improving passenger experience.

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