Vehicle Tracking System Using GPS

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Abstract

The Vehicle Tracking System using GPS is a real-time monitoring application designed to track vehicles via live GPS coordinates and visualize them using an interactive map. This system helps in providing accurate, live location updates and history-based tracking using IoT integrations such as ThingSpeak and Mapbox. It improves fleet management, enhances vehicle security, and allows end-users or administrators to monitor vehicle movement via web platforms.

Kaywords: *GPS, Real-time Tracking, Vehicle Monitoring, Mapbox, IoT, ThingSpeak, Web Application*

I. INTRODUCTION

In the modern era of technological advancement and digital transformation, vehicle tracking systems have emerged as a vital tool across multiple sectors, including logistics, transportation, law enforcement, and personal vehicle security. The growing demand for real-time monitoring and efficient management of vehicles has made such systems increasingly indispensable. A vehicle tracking system provides the capability to determine the precise location of a vehicle at any given time, thus enhancing operational efficiency, reducing costs, and ensuring the safety of assets and personnel.

At the heart of these systems lies Global Positioning System (GPS) technology, which enables the continuous acquisition of location data by leveraging satellite signals. When integrated with Internet-based services and IoT platforms, GPS data becomes a powerful means of communication between mobile vehicles and central monitoring units.

This research presents the development and implementation of a GPS-based Vehicle Tracking System that leverages the ThingSpeak IoT platform to collect and store real-time geolocation data. The system architecture is designed to transmit GPS coordinates from a vehicle-mounted device to ThingSpeak, which acts as a cloud-based intermediary. To facilitate a user-friendly experience, the collected data is then visualized using Mapbox, an interactive mapping service that renders the vehicle's current and historical positions on a dynamic map.

A PHP-based web interface has been developed to serve as the front-end platform, allowing users to access vehicle tracking information conveniently from any web browser. The system provides a reliable, cost-effective, and scalable solution suitable for fleet operators, logistics managers, and individual users who seek to monitor vehicle movement for security, operational, or analytical purposes.

This paper explores the design, integration, and performance evaluation of the system, demonstrating its effectiveness in real-world scenarios while highlighting the benefits and challenges associated with GPS-based vehicle tracking.

II. LITURATURE SURVEY/BACKGROUND

Vehicle tracking systems have become a crucial component in intelligent transportation and fleet management systems. These systems utilize GPS, GSM, and Internet of Things (IoT) technologies to track, monitor, and manage vehicle movement in real-time. The integration of such systems enhances logistics efficiency, improves security, and enables automated data collection for further analysis.

In [1], a GPS-GSM based tracking system was proposed where the GPS module captures the vehicle's location and the GSM module transmits the data to a remote server. The system was effective in real-time monitoring but lacked visual mapping integration. Another work by Kumar et al. [2] improved upon this by implementing a GPS and Arduino-based tracker that sends data to a web interface; however, it faced issues with scalability and continuous data flow due to hardware limitations.

Recent studies have shifted focus to IoT-based platforms like ThingSpeak for cloud data storage and analytics. In [3], a vehicle monitoring system using NodeMCU and ThingSpeak was introduced, which successfully logged data to the cloud for visualization and analysis. Map integration, however, was not extensively utilized. Integrating Mapbox as a visualization tool provides a more interactive and customizable interface for users, as noted by Sharma et al. [4], who employed it in traffic analysis systems.

Furthermore, PHP-based web applications offer lightweight, server-side rendering suitable for building real-time dashboards. Combining PHP with JavaScript and Mapbox enables efficient tracking solutions with minimal latency and enhanced UI/UX. The literature supports that an integrated system leveraging GPS for data collection, ThingSpeak for cloud communication, and Mapbox for visualization holds significant potential for both commercial and personal vehicle tracking applications

III. PROPOSED WORK/SYSTEM

1. System Overview

The proposed system is developed to track the real-time location of vehicles using GPS technology. It integrates IoT (Internet of Things) with web-based mapping to monitor vehicle movement effectively. The system provides users with a live interface to view current vehicle positions on a digital map through a web browser.

2. Hardware Component

A GPS module (such as Neo-6M) is installed in the vehicle to fetch live latitude and longitude data. If required, a microcontroller like Arduino or NodeMCU is used to read GPS data and send it to the internet. The setup may also include a GSM module for communication, depending on how the GPS data is transmitted to the cloud.

3. Data Transmission

The GPS module collects location data at regular intervals. This data is sent to the ThingSpeak platform using an internet connection (via Wi-Fi or GSM). ThingSpeak acts as a cloud database, receiving and storing GPS coordinates securely using API communication.

4. Cloud Integration (ThingSpeak)

ThingSpeak is used as the IoT cloud service to collect, store, and share GPS data. Each GPS update is posted to a ThingSpeak channel using a unique API key. The system uses HTTP GET/POST methods to interact with the channel, making it easy to access data from any external system.

5. Backend Development (PHP)

The backend is built using PHP, which fetches live GPS coordinates from the ThingSpeak API. It processes the received JSON data, extracts the required latitude and longitude, and prepares it for frontend display. PHP also handles data flow control and backend logic.

6. Frontend & Map Visualization (Mapbox)

The frontend interface uses Mapbox, a customizable map API, to visualize the GPS data. It displays the vehicle's live location using a moving marker or icon. The map updates automatically as the GPS coordinates change, offering a smooth real-time tracking experience for the user.

7. Vehicle Registration Module

Users can register vehicles by filling out a form with details like vehicle name, icon type, and unique identifier. This data is stored for easy tracking and display. Each vehicle is assigned a specific marker icon on the map for better visibility and distinction.

8. Real-time Tracking Flow

The system fetches updated coordinates from ThingSpeak at short intervals (e.g., every 15–20 seconds). As the GPS data updates, the map reflects the new position of the vehicle. This continuous process creates a real-time vehicle movement simulation on the web interface.

9. System Architecture Diagram

A block diagram is used to show the complete flow of the system: GPS Device → ThingSpeak → PHP Backend → Mapbox Map (Frontend)

This visual helps explain how data travels from the vehicle to the user's screen.

10. Scalability & Flexibility

The system is designed to support multiple vehicles. It can be easily scaled by registering more vehicles and channels. Future improvements can include features like geofencing, historical route playback, SMS alerts, or fuel tracking. The architecture is modular, making it easy to upgrade.

11. Technology Stack Summary

- Hardware: GPS Module (e.g., Neo-6M), Microcontroller (if any)
- Cloud: ThingSpeak
- Backend: PHP
- Frontend: HTML, CSS, JavaScript, Mapbox
- Communication: REST APIs (for ThingSpeak data fetch)

IV. RESULT AND DISCUSSIONS

The Vehicle Tracking System was successfully tested for real-time GPS tracking. The GPS module sent accurate location data to the ThingSpeak platform, which was fetched using PHP and displayed on Mapbox. The system updated vehicle location every 15–20 seconds and displayed smooth movement on the map. Users could register vehicles, and each was shown with a custom icon. The interface handled multiple vehicles effectively with real-

time updates. The project proved to be reliable, user-friendly, and scalable. It offers a cost-effective solution for real-time vehicle tracking and can be enhanced with features like route history and alerts.

V. CONCLUSION

The proposed Vehicle Tracking System using GPS successfully provides real-time location tracking through the integration of ThingSpeak, PHP, and Mapbox. It offers an efficient, low-cost, and scalable solution for monitoring vehicles. The system is reliable and can be further enhanced with features like route history, alerts, and mobile app integration for better usability in real-world applications.

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