PROJECT ABSTRACT

GPS Vehicle Tracker with Geofence Alerts

An SMS-based GPS vehicle tracker — Arduino with NEO-6M and SIM800L answering LOC queries and sending geofence alerts, with a map dashboard demo — delivered as a built-to-order hybrid student project with firmware, demo, report, PPT and viva kit.

01. Title

GPS Vehicle Tracker with Geofence Alerts

02. Introduction / Background

Vehicle tracking rests on two independent wireless systems. GPS satellites broadcast timing signals from which a receiver computes latitude and longitude (the NEO-6M module outputs this as standard NMEA sentences at a datasheet accuracy of about 2.5 m CEP). The GSM network carries the result to the owner: the SIM800L module speaks the AT command set, sending and receiving SMS without any internet. A geofence — a virtual boundary defined by a centre point and radius — turns raw positions into intelligence: crossing it triggers an alert. Together they make a tracker that works anywhere with sky and cellular coverage.

03. Problem Statement

Vehicle theft and unauthorized use are discovered after the fact, when the vehicle is already gone. Commercial trackers solve this with subscriptions and closed platforms — expensive and opaque for a student project. What is needed is an SMS-native tracker: query the position from any phone, get automatic alerts when the vehicle leaves a defined zone, and see the whole story on a map dashboard. The project must handle the real difficulties honestly — GPS cold-start time, GSM signal dependence and honest accuracy claims — rather than pretending a bench demo equals a product.

04. Objectives

- Acquire GPS position from a NEO-6M module by parsing NMEA sentences.
- Answer an SMS LOC command with a coordinates-plus-Google-Maps-link reply.
- Implement a circular geofence with haversine boundary math and entry/exit SMS alerts.
- Support owner-number configuration and an SOS panic command.
- Manage SIM800L power and network registration for reliable SMS operation.
- Reduce idle draw with GPS sleep modes between fixes.
- Visualize tracks and geofence events on a map dashboard demo.

05. Proposed Methodology

The NEO-6M is validated first with raw NMEA output on serial, then a parser extracts GGA/RMC position and fix-quality fields. The SIM800L is exercised through AT commands — registration check, text-mode SMS send and receive — before the command engine (LOC, SOS, owner management) is wired to the GPS layer. Geofence math uses the haversine formula against the stored centre and radius; crossing detection compares successive fixes with a confirmation count to suppress GPS-jitter alerts. A Leaflet-based dashboard demo visualizes a sample track, the geofence circle and alert events to show how the data would be presented. Testing covers cold-start acquisition time, SMS round-trip latency and geofence alert correctness on walk-throughs.

06. System Architecture / Working

The Arduino polls the NEO-6M for position fixes and evaluates the geofence on each valid fix: leaving or entering the circle fires an SMS alert to the owner number. In parallel, the SIM800L listens for incoming SMS — LOC triggers an immediate position reply with a maps link, SOS sends a panic message. Power design uses a buck converter and battery with GPS sleep between fixes. The map dashboard demo renders a representative track with the geofence boundary and alert markers, demonstrating the software half of the hybrid project.

07. Hardware / Software Requirements

- Arduino Uno (ATmega328P).
- NEO-6M GPS module (~2.5 m CEP per datasheet; active antenna recommended).
- SIM800L GSM module with 2G SIM (SMS, AT commands).
- Buck converter + battery pack for vehicle-grade power.
- Dashboard demo: HTML/CSS/JS with Leaflet map library.
- Software: Arduino IDE (C/C++ firmware); any modern browser for the dashboard.

08. Expected Outcomes

A working tracker that replies to SMS position queries with a maps link, sends automatic geofence entry/exit alerts, and handles owner configuration and SOS commands. The dashboard demo visualizes tracks and alerts on a real map. Cold-start acquisition time and SMS latency are documented as measured, and the accuracy discussion stays anchored to the NEO-6M datasheet figure.

09. Applications

- Two-wheeler and car anti-theft tracking.
- Small-fleet vehicle monitoring demos.
- Personal safety and SOS devices.

- Logistics and delivery tracking prototypes.
- Pet and livestock tracking (collar variant).

10. Future Scope

A 4G module would future-proof the design as 2G sunsets; MQTT/cloud upload would enable live web tracking. Onboard SD black-box logging, accelerometer-based tow detection and OBD-II integration are natural next steps.