

PROJECT ABSTRACT

IoT Garbage Truck Tracker with Route Log

A GPS tracker fitted to garbage collection trucks that logs every trip — live location, route playback, trip-wise route log and zone alerts on a web dashboard.

Project type: Hybrid (hardware + software)

Availability: Built to order

Price: Request a quotation

Suitable branches: IoT/Embedded

Technologies: ESP32, NEO-M8N GPS, SIM800L GSM, buck converter, trip-processing backend, web dashboard

01 Title

IoT Garbage Truck Tracker with Route Log

02 Introduction / Background

Municipal solid-waste collection depends on trucks covering assigned routes reliably, yet supervisors have little visibility into what happens between the depot gate and the transfer station. Paper logbooks are easy to falsify, and commercial fleet trackers are priced for large logistics fleets rather than municipal pilots or student projects. Commodity modules have changed the economics: a GPS receiver, a GSM modem and a Wi-Fi-capable microcontroller together cost a fraction of a commercial tracker and can be assembled, programmed and explained by an undergraduate. This project builds that assembly into a complete vehicle tracker: an ESP32 reads a NEO-M8N GPS receiver, uploads positions over a SIM800L GSM link, and a web dashboard turns the raw fixes into live maps, route playback and a trip-wise route log with halt and zone analysis.

03 Problem Statement

Waste contractors and municipal bodies cannot verify route compliance after the fact: missed streets, unofficial detours and over-long halts leave no trace in a paper logbook. There is a need for an affordable, open tracker that records every trip with timestamps, distances and zone crossings, so coverage can be audited rather than assumed.

04 Objectives

- Build a vehicle-powered GPS tracker (ESP32 + NEO-M8N + SIM800L) that uploads a position every 10 seconds.
- Buffer positions in flash during network dead zones and upload them in order on recovery.

- Group fixes into trips and compute distance, duration, halts and zone crossings per trip.
- Provide a dashboard with live map, route playback, searchable route log and daily collection report.
- Raise zone entry/exit events with optional SMS alerts to the supervisor.

05 Proposed System / Working

The NEO-M8N receiver streams NMEA sentences to the ESP32, which packages latitude, longitude, speed, heading and timestamp every 10 seconds and sends them over the SIM800L's GPRS link to the server. When the network is unavailable, fixes accumulate in flash and are uploaded chronologically once coverage returns, so the route log never has gaps. The server groups fixes into trips: a trip starts when the truck leaves the depot geofence and ends on return or after a long parked period. Distance is the haversine sum of consecutive fixes; halts are segments where speed stays near zero beyond the configured threshold (default 5 minutes); zone crossings are evaluated against the depot, transfer-station and ward geofences. The dashboard renders the live map with truck marker and heading, a route-playback slider, the route log table, halt markers and an auto-generated daily collection report. Zone events can additionally trigger an SMS to the supervisor's number.

06 Technologies / Components Used

ESP32 DevKit (Arduino-core firmware); NEO-M8N GPS module with magnetic-mount antenna (± 2.5 m CEP typical, datasheet); SIM800L quad-band GSM/GPRS module; 12 V to 5 V buck converter with reverse-polarity protection; rugged enclosure; backend ingest API with trip-grouping and zone-evaluation logic; web dashboard (live map, playback, route log, alerts, reports).

07 Key Features

- Live GPS tracking with 10-second updates, heading and speed.
- Route playback with a time slider for street-by-street coverage verification.
- Trip-wise route log: start/end times, distance, duration, halts, zone crossings.
- Geofenced depot, transfer-station and ward zones with entry/exit events and optional SMS.
- Halt detection flagging stops beyond the configurable threshold.
- Offline buffering — no gaps in the route log during network dead zones.
- Daily collection report per truck: trips, distance, halts, zone visits, coverage notes.

08 Applications / Use Cases

- Municipal solid-waste route compliance auditing.
- Private waste-contractor fleet supervision.
- School-bus and staff-transport route verification (same hardware, new zones).

- Delivery-fleet trip logging for small operators.
- Academic demonstration of GPS, GSM and geofencing in one system.

09 Results & Scope

Design target: continuous trip logging with distance computed from track points and halt/zone events matching the configured geofences; the evaluation procedure replays recorded trips and checks trip grouping, halt flags and zone events against the dashboard output. GPS accuracy follows the NEO-M8N datasheet (typically ± 2.5 m CEP in open sky) and degrades in urban canyons, tunnels and covered parking; trip distances are estimates inheriting GPS error, documented as such. Scope is one tracker per vehicle; the SIM800L needs 2G/GPRS coverage on the buyer's carrier.

10 Conclusion

The project delivers a complete, open vehicle-tracking loop — sensing, communication, trip processing and visualization — at a student-buildable cost, turning an invisible municipal operation into auditable data.

11 References

- u-blox NEO-M8N datasheet — GNSS performance and CEP figures.
- SIMCom SIM800L hardware design and AT command manual.
- Haversine-based distance computation for GPS track analysis (standard geodesy).