SMART INDIA HACKATHON 2025

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- **Problem Statement ID – 25138**
- **Problem Statement Title- Student Innovation**
- **Theme- Transport And Logistics**
- **PS Category- Software**
- **Team ID-**
- **Team Name - Tree.io**

Tree.io

M-GPS
Unified Platform

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Where did the idea come from ?

MARG was developed to **STREAMLINE LOGISTICS MANAGEMENT** for government operations, tackling challenges like **outsourced systems with limited customization**, **high dependency**, and **lack of real-time visibility**. Noticing how departments struggle without predictive or ETA-based vehicle tracking and face difficulty integrating data from multiple services, we created a UNIFIED GPS PLATFORM that connects all logistics operations under one transparent layer, enabling accurate tracking, efficient resource planning, and data-driven decision-making for smarter governance.

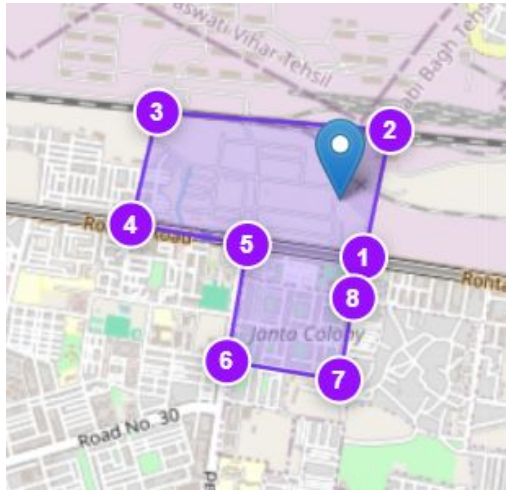
Proposed Solution

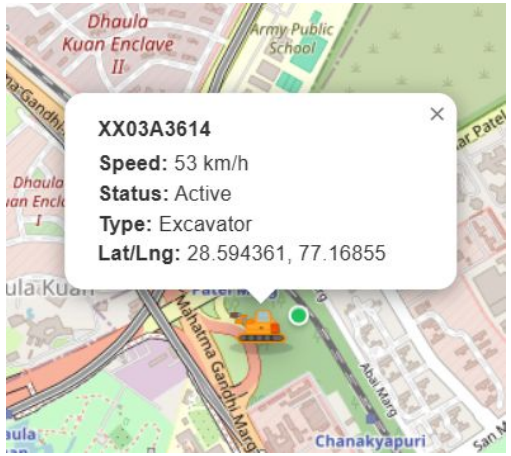
Introducing **MARG**: A unified GPS platform that gives governments real-time for efficient operations

- MARG delivers real-time fleet intelligence, ingesting 50,000+ GPS & shipment events/day through **RESTful APIs** and a **Kafka pipeline** processing 1M+ location updates/day with 99.99% uptime, offering **ETAs**, stoppages, speed analytics, historical paths, **geofenced** overlays, and 7 smart alerts.
- **Role-based access** with page and group-specific permissions ensures secure data control, while **vendor, customer, and vertical-based vehicle grouping** allows efficient filtering and visibility management, supported by 70% faster MySQL queries through Drizzle ORM indexing for real-time operations.
- Seamless management tools such as **bulk Excel upload/edit/delete**, multi-select actions, light/dark mode, and **5 exportable report types** with filter-based Excel exports empower data-driven planning, smooth fleet administration, and reliable end-to-end trip coverage.

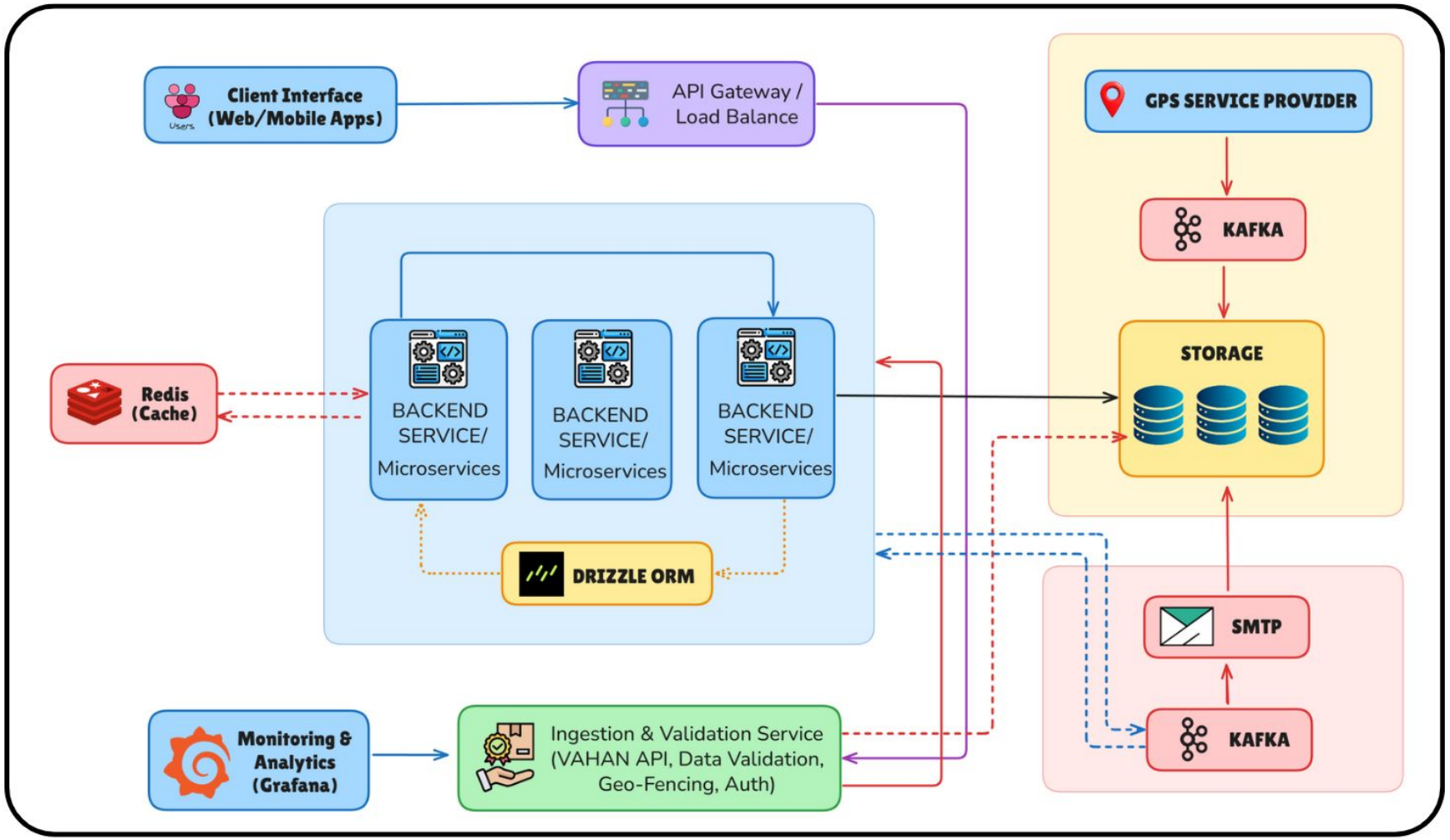
MARG is a unified GPS platform transforming government logistics with real-time tracking, predictive analytics, and seamless data integration, enabling smarter, more transparent operations. It offers multiple features like:

- Smart Geofence Engine
- 7- Smart Alerts
- Historical Trail Playback
- Advanced Dashboards
- Role based Access
- 5 Reports Export
- Bulk & Smart Utilities
- Email Notifications & Alerts





TECHNICAL APPROACH



FEASIBILITY AND VIABILITY

Feasibility

Robust Architecture

- RESTful APIs
- Kafka pipeline
- MySQL (Drizzle ORM)

High Scalability

- Handling 1M+ location updates/day with 99.99% uptime

Cloud Ready Deployment

- Containerized for rapid deployment

Seamless Integration

- Govt TMS
- ERP
- IT infra

Access Control

- Role-based permissions enable custom user hierarchies.

Potential Challenges & Risks

Data Privacy

- Ensuring data privacy
- Compliance with govt norms (IT Act, CERT-In)

System Integration

- Integration complexity with legacy vendor systems

Infra & Cost Barriers

- High upfront setup cost and infra readiness

Adoption Resistance

- Pushback from staff & operational stakeholders

Connectivity Issues

- Possible network latency in remote or low-connectivity areas

Strategies to Overcome

Change Management

- Training, capacity-building workshops & phased rollouts

Data Security & Compliance

- End-to-end encryption, anonymization & role-based access controls

Connectivity Resilience

- Edge caching & offline sync for remote regions

Cost & Infra Optimization

- Public-private partnerships for infra support & cost sharing

Legacy System Integration

- Middleware APIs & adapters for compatibility

IMPACT AND BENEFITS

IMPACTS

Operational Teams	• Real-time fleet intelligence • Geofenced alerts • Bulk utilities for scheduling and reporting.	• Improves on ground visibility • Reduce idle time & stoppages. • Cuts manual work
Management	• Kafka-based data pipeline • Group-based vehicle segmentation • Advanced dashboards	• Enables 99.99% uptime • Helps track KPIs at vendor/customer levels • Highlight bottlenecks
Drivers & Ground Staff	• Real-time speed & stoppage alerts • Digital Workflow	• Enhance accountability • Reduced confusion via automated notifications
Partners & Vendors	• Transparent dashboards • Excel-based exports • REST APIs	• Ensure trust in delivery SLAs • Reporting becomes collaborative and simple

BENEFITS

Social	• Safer Roads • Driver Wellbeing • Stronger Public Trust	• Via smart alerts & speed monitoring • Reduces manual reporting • Reliabile service delivery
Economic	• Lower Operational Cost • Faster Decision Making • Scalable Platform	• Optimized routing & vehicle grouping • Real time data • Handles 1M+ updates/day
Environmental	• Reduce Carbon Emissions • Lower Vehicle Deployment • Efficient Resource Use	• Through Geofencing & stoppage analytics • Optimized trip scheduling
Technological	• Real time data streaming • Cloud-based dashboards • Secure digital transformation	• Via Kafka pipelines • For anytime, anywhere visibility • Using role based access

RESEARCH AND REFERENCES

- **Real-Time Fleet Tracking Systems**
  - Demonstrates improved operational efficiency through GPS-based vehicle monitoring.
  - References: ResearchGate: Fleet Management with GPS
- **Event Streaming with Apache Kafka**
  - Kafka enables reliable, low-latency processing of large-scale logistics data streams.
  - References: Confluent: Kafka in Transportation
- **Predictive ETA and Route Optimization**
  - ML-powered ETA prediction improves delivery accuracy and reduces idle time.
  - References: IEEE: ETA Prediction Models
- **Geofencing & Location Analytics**
  - Research on using geofences for automated event triggers and compliance monitoring.
  - References: Esri — Geofencing & Real-time Tracking
- **Digital Infrastructure for Smart Governance**
  - Examines how unified digital platforms improve government efficiency and transparency.
  - References: UN E-Government Survey