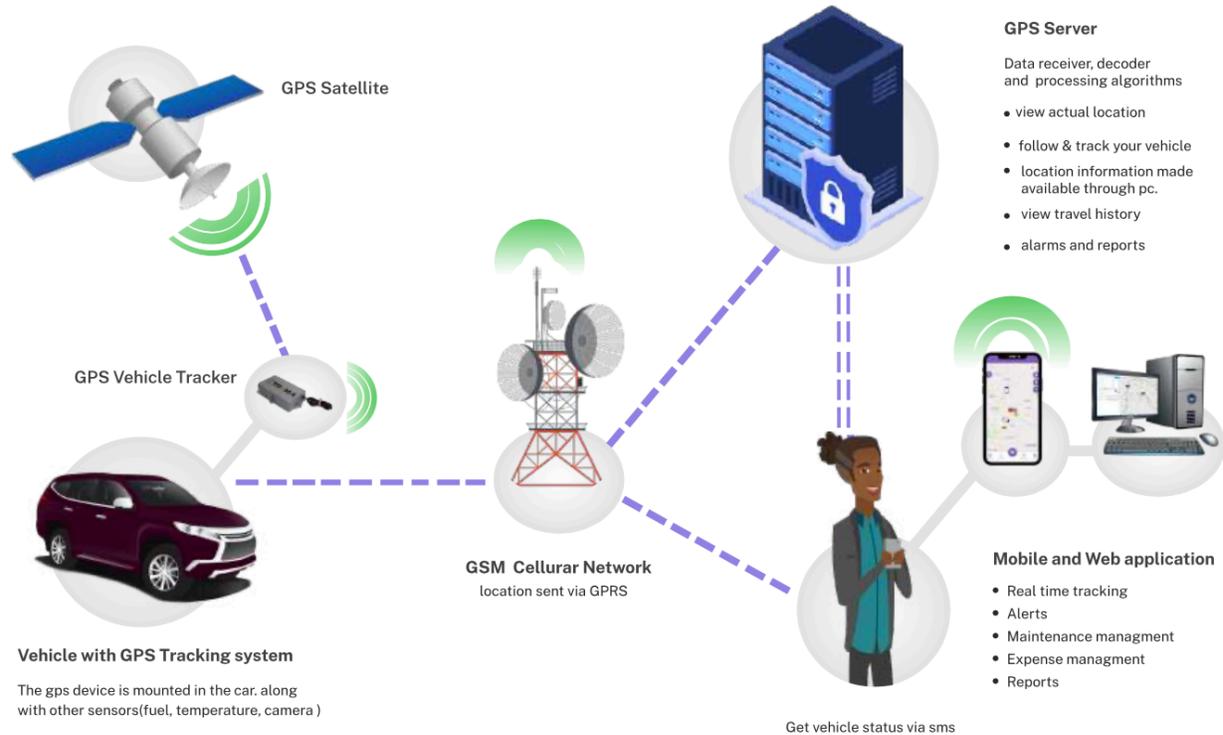


VEHICLE TRACKING AND FLEET MANAGEMENT SYSTEM

TECHNICAL ARCHITECTURE



The VEHICL TRACKING AND FLEET MANAGEMENT SYSTEM consists of three major parts- Electronic Tracking Hardware and sensors, mounted into the vehicle and sends **Encrypted** real-time GPS information to the server for processing, Central Processing Server, with the software to decodes the GPS coordinates and stores data into database. End user interfaces such as web application and mobile application for the users.

Real time web application and internet of things technologies bind these three elements together to bring live action from the subject to the vehicle located anywhere anytime

HARDWARE AND SOFTWARE SPECIFICATIONS

A fully developed GPS tracking system with the following descriptions:

SERVER/BACKEND

The tracking system with high performance and stability on windows and Linux server hosted on MoD premises. The system shall be fully owned by MoD therefore, we will provide a custom developed system.

DATABASE

SQL Relational Database

WEB INTERFACE

The software shall have a modern fully-featured web interface with both Desktop and mobile friendly layouts. Moreover, the software will support multiple browsers including but not limited to Google Chrome, Internet explorer, Mozilla Firefox both old and new versions.

MOBILE APPS

The platform will also have both IOS and Android mobile apps to ease communication with drivers and authorized personnel to request vehicles, get reports and notifications. The Following features shall be realized on the mobile app.

Requesting Vehicles:

Through standard procedure, an employee (a requester) is to create a vehicle requirement in the system. He should be able to specify the type and class of vehicle and whether he/she needs a driver for that vehicle or not, including the purpose of the request.

Assigning Vehicle:

The fleet manager in the RDF's Logistic Unit is to assign available vehicles to the open requirements. The system is to support him with a graphical interface. After assigning, the requester should automatically receive a confirmation via e-mail/outlook or other available and integrated platform

Vehicle Handling:

During issuing the vehicle to the requester mileage and time of issue should be entered. When the vehicle is returned the mileage and time of return should also be entered. If there had been problems with the vehicle or there is a damage this should be entered via a notification.

API FOR INTEGRATION WITH RDF LOGISTICS MANAGEMENT DEPARTMENT

The application will have Application Programming Interface for easy integration with third party applications (Any system or application that RDF might need to consume the vehicle tracking data).

PROTOCOLS

The system supports multiple protocols and different types of devices(Trackers from multiple vendors). At the moment the system support 178 protocols and if necessary other protocols can be developed.

The platform will have the capacity to connect

1. People
2. Vehicles
3. Drivers
4. Mobile assets
5. All kind of sensors that are compatible with the GPS devices

It will be able to report data collected from the GPS devices and sensors in real-time basis

SENSORS

The system should be able to accept all type of sensors to capture different data from the vehicle such as **Fuel Level, Engine Temperature, Door Opening/Closing signal** etc.

FEATURES

a. Live tracking

You can view your devices in real-time with no Delay. The response should be in less than 5 seconds. The tracking software has various mapping options, including road maps and satellite imagery.

The server can handle a wide variety of sensors and additional information supplied by the GPS units.

- I. Real-time Map based details of the vehicle location.
- II. Status of the vehicle (moving, fixed).
- III. Details of the drivers.
- IV. Detailed itinerary of the vehicle.
- V. Vehicle's movement details in terms of time and space details (all points to be marked on the map).

b. Alerts

The tracking software provides instant web notifications along with support for emails and SMS. This allows for external alerting in case of harsh driving behavior like **OVERSPEEDING, FUEL THEFT, HARSH BRAKING, HARSH CORNERING, HARSH ACCELERATION, MAINTENANCE EVENTS, GEO-FENCING**, and many more types of alerts.

c. REPORTS/ HISTORY ON THE VEHICLE

The tracking software supports multiple reports including but not limited to

LOYAL ROOTS TECHNOLOGIES

- Location history
- Trip
- Chart
- Summary reports
- Device health report etc.

The reports can be viewed directly in the web or mobile app and also export and download in Excel, PDF or html file. The history can also be projected on the map providing visual representation of the trip history(PLAYBACK).

d. Geofencing

For your valuable vehicles, the system allows you to set designated boundaries. Alert alarm is initiated if boundary is crossed.

e. Drivers management using RFID Reader

The Vehicle Tracking System is to be integrated with the RDF Logistic Management platform for fleet management purposes. The iButtons will help the management to know who is driving the vehicle and when.

f. Routing

The system also allows you to set predefined routes for your vehicles to be alerted of deviations. This way, you can reduce operating costs and ensure that drivers are sticking to the task.

g. Fuel monitoring & Predictive maintenance

This system also allows you to monitor your fuel on any device with an installed sensor and be reminded of tires change, engine oil, etc.

h. Control

Reduce vehicle fleet cost with dedicated reports on driving behavior, driver's fuel consumption rating, and increase productivity and safety in your fleet operations.

i. Harsh behavior alerts

with this feature, you can be informed of a potential risk before it happens using a GPS receiver and a microcontroller.

j. CAMERA/MEDIA TOOL

The software/web and mobile app both have the tool to capture images from the GPS tracker which has a camera attached.

k. Camera/DVR Tool

If the GPS tracker does not support camera or you want to connect any other camera in the car, no matter which GPS you are using, this tool might be handy. Once IP camera or Cameras are connected in the car, GPS coordinates will be matched with camera by the closest available data and time.

l. Tools

The system shall have tools that will be used to create and manage alerts/notifications, geofences, POI(points of interests), Routes, send commands to the GPS trackers, generate reports and many more.

m. Maintenance tool

This tool will be used to setup vehicle maintenance schedule and setup reminders to remind when the next vehicle service is due.

n. Digital Expense logbook

You will now be able to keep track of your expenses through a digitized logbook directly integrated in the system.

For fleet operation, the system should be able to check and document consumption data, which are to include the upload of externally recorded refueling data. With the asset life-cycle management's full functional scope should be available, fleet management will have to allow streamlined preventive and malfunction-based maintenance within the work order cycle, offers should illustrate or include parts catalogs or data for component planning and e-procurement or integrated refurbishment of spare parts

o. Automated backup

The system should provide an automated scheduled backup feature. All the data should be backed up to avoid data loss.

p. Automated reports

various critical reports shall be set up into the system which will be scheduled and generated then send to emails and SMS of specified people.

q. Fully secure

Various security mechanism like SSL certificate shall be applied on both the server and application level to make sure that the system is accessible by authorized persons only. The Vehicle Tacking System's Security should include at least the following components: alert for sensors malfunction or damage, high level communication security and encrypted data exchange (communication security and transmission security is paramount) and Role-based access to information must be supported

r. No down time/ No Deletion

The system should always be accessible and working. No downtime and no data should be deleted in the database.

OVERALY MAPS

The platform will host overlay maps for all the 30 Rwandan districts displaying Operational map for Rwanda, the system should accept variable map types such

INSTALLATION, TRAINING COMMISSIONING AND MAINTENANCE

A copy of source codes and documentation shall be handled to RDF for full ownership.

The system shall be installed in RDF servers and maintained for a period of 3 years.

At the beginning 30 days training shall be offered to the principal users of the platform and multiple sessions both (physical and online) will be provided as through a period of 3 years.

All the rights to control the system shall be owned by the RDF.

METHODOLOGY &TIMELINES

The whole system will be developed and the devices will be installed within a period of 115 days as described in the table below:

No	Activity	Time (Days)
1	Customizing the system we have to match with the requirements of RDF	20
2	Developing iButton and vehicle dispatch module	15
3	Installation of the system on RDF Servers	5
4	Installation of the GPS devices in the 1313 automobiles(Vehicles and motorcycles)	60
5	Testing and training users	15
Total		45

Ordering and shipping devices will take 20 days, this will be done concurrently with activity 1, and 2.