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Cameroon

**FACULTY OF ENGINEERING AND TECHNOLOGY**

**DEPARTMENT OF COMPUTER ENGINEERING**

**SRS Document for Road Sign and Road State Mobile Notification Application**

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**CEF440:Internet Programming and Mobile Programming**

**GROUP 22**

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**1. Introduction**

**1.1 Purpose**

#### This document defines the functional and non-functional requirements for the Road Sign and Road State Mobile Notification Application, a mobile application that provides real-time road sign alerts and road condition updates to drivers in Cameroon. **The document serves as a reference for stakeholders, to ensure the project aligns with their needs.**

#### **1.2 Scope**

The app will:

- Deliver real-time road sign and hazard alerts via GPS.

- Allow drivers to submit crowdsourced reports (e.g., potholes).

- Integrate verified road data from government sources (where available).

**1.3 Definitions**

- Crowdsourced Data: User-submitted reports (e.g., road hazards).

#### - Firestore: Firebase’s NoSQL database for real-time data storage.

**2. Overall Description**

**2.1 Product Perspective**

- Integrations:

-Firebase Services: Authentication, Firestore (database), Cloud Functions.

-Third-Party APIs: OpenWeatherMap (weather), Mapbox (geolocation).

- User Interface:

- Flutter-based UI with voice alerts and minimalistic design.

- Communication:

- REST APIs for crowdsourced data submission.

#### **2.2 User Classes and Characteristics**

1. Drivers and Road Users

- Characteristics:

- Primary users of the mobile application.

- Use the app to:

- Access road sign explanations.

- Receive real-time road condition alerts (traffic, accidents, weather).

- Submit reports (e.g., potholes, road closures).

- Customize notifications for specific routes/areas.

- Varying levels of tech literacy.

- Require offline access to road sign directories.

- Need location-based alerts and map overlays (e.g., Google Maps integration).

2. Transport Authority Personnel

- Characteristics:

- Secondary users with administrative privileges.

- Responsibilities include:

- Validating and moderating user-submitted reports (e.g., verifying pothole claims).

- Analyzing aggregated data (e.g., accident hotspots, frequent road issues).

- Require tools for data visualization and export (e.g., CSV/PDF reports).

1. The Development Team

- Characteristics:

- Technical users responsible for system maintenance.

- Tasks include:

- Managing user accounts and permissions.

- Monitoring API integrations (weather, traffic cameras, mapping services).

- Ensuring system security and data encryption.

- Troubleshooting performance issues (e.g., latency, downtime).

4. Third-Party Services

- Characteristics:

- External systems integrated into the app for functionality:

- Mapping APIs ( Mapbox) for geolocation and route overlays.

- Weather APIs (OpenWeatherMap) for real-time hazard alerts.

- Traffic Data Providers (e.g., traffic camera feeds).

**2.3 Operating Environment**

- Platforms: Android 8.0+, iOS 12+ (built with Flutter).

- Backend: Firebase (Authentication, Firestore, Cloud Storage).

**2.4 Design Constraints**

-Regulatory Compliance: Compliance with Cameroon data privacy laws.

-Government Data: No public API exists in Cameroon; data will be manually digitized from official road safety manuals.

- Assumptions:

- Government road data is available in digitized formats (e.g., PDFs, spreadsheets).

- 90% of surveyed users own smartphones (confirmed via Task 2 report).

**2.5 Tech Stack:**

- Frontend: Flutter (Dart).

- Backend: Firebase (Firestore, Cloud Functions, Authentication).

- APIs: Mapbox (geolocation), OpenWeatherMap.

1. **System Features and Requirements**
   1. **Functional Requirements**

Functional Requirements

1. Road Sign Directory

- Display detailed information (text + visuals) about common road signs in Cameroon.

- Allow users to search or filter signs by category (e.g., warning, regulatory).

2. Real-Time Road Condition Alerts

- Push notifications for traffic congestion, accidents, weather hazards, or road closures.

- Customize alerts based on user-selected routes or geographical areas.

3. Map Integration

- Overlay road signs and condition alerts on a map interface.

- Integrate with navigation apps (e.g., Google Maps) to display alerts during route guidance.

4. User Reporting System

- Allow drivers to submit reports (e.g., potholes, accidents) via text, photos, or voice.

- Tag reports with location data and timestamps.

5. Notification Customization

- Let users define preferences (e.g., alert types, frequency, routes).

6. Historical Data Access

- View past alerts and user-submitted reports with filters (date, location, severity).

7. API Integration

- Fetch real-time data from traffic cameras, weather services, and crowdsourced reports.

8. User Authentication

- Optional sign-up/login to save preferences and report history.

**3.2 Non-Functional Requirements**

Non-Functional Requirements

1. Usability

- Clean, responsive UI optimized for mobile devices.

- Minimal learning curve (intuitive navigation for drivers of all tech levels).

2. Performance

- Real-time alerts delivered with <5-second latency.

- Smooth integration with third-party APIs without app lag.

3. Reliability

- High uptime (≥99%) for critical features like alerts and map overlays.

- Accurate data validation for user reports (e.g., location verification).

4. Compatibility

- Support Android and iOS devices (versions within the last 3 years).

- Seamless integration with Google Maps and similar platforms.

5. Security

- Encrypt user data (e.g., location, reports) during transmission and storage.

- Secure API keys and third-party service integrations.

6. Scalability

- Handle simultaneous users during peak traffic hours ( rush hour).

- Efficient database management for growing crowdsourced reports.

7. Offline Functionality

- Basic access to road sign directory without internet.

8. Data Privacy

- Anonymize user-submitted reports unless opted in for attribution.

9. Localization

- Support multiple languages (e.g., English, French) for broader accessibility in Cameroon.

1. **Data Requirements**

**4.1 Data Models**

- Road Sign Data (stored in Firestore): This data will be stored in json format, and will contain specific information about each road sign such as; sign\_id, sign\_type, image\_url, location.

-User Report: This data will also be stored in json format, and will contain specific information about each Report such as; report\_id, user\_id, report\_type, votes. The “votes” are a method of validating the user’s report, where another user can “upvote” or “downvote” the report, inorder to give a measure of credibility to the content of the report. This would serve as a solution for the lack of trust in crowd sourced data.

**4.2 Data Storage**

- Firestore: NoSQL database for user profiles, road signs, and reports.

- Cloud Storage: Host road sign images and user-submitted photos.

**5. System Attributes**

- Availability: Firebase guarantees 99.95% uptime.

- Maintainability: Modular Flutter code with Riverpod state management.

**6. Compliance Requirements**

- Adhere to Cameroon’s Data Protection Law (2021).

- Ensure road sign data aligns with Ministry of Transport standards.

1. **References**

- Cameroon Road Safety Guidelines (Ministry of Transport).

- Survey Data (57 responses from drivers in Buea/Douala).