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**CEF440: INTERNET PROGRAMMING(J2EE) AND
MOBILE PROGRAMMING PROJECT REPORT**

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CHAPTER ONE: GENERAL INTRODUCTION

1. Background and Context of the Study

Road traffic accidents (RTAs) present a significant global challenge, causing substantial morbidity, mortality, and economic losses. The World Health Organization's global status report on road safety 2023 shows that the number of annual road traffic deaths has fallen slightly to 1.19 million. The report shows that efforts to improve road safety are having an impact, and that significant reductions in road traffic deaths can be made if proven measures are applied. Despite this, the price paid for mobility remains too high. Road traffic injuries remain the leading killer of children and young people aged 5-29 years. More than half of fatalities occur among pedestrians, cyclists and motorcyclists, in particular those living in low and middle-income countries. Urgent action is needed if the global goal of at least halving road traffic deaths and injuries by the year 2030 is to be achieved [1].

This project focuses on Cameroon, a central African nation where road safety is a growing concern. Cameroon's road infrastructure faces several complexities including inadequate road maintenance, poor road signage, insufficient real-time traffic information, and a high incidence of road traffic accidents (RTAs). Though specific statistics regarding RTA rates in Cameroon require further research, the broader African context suggests a pressing need for improved road safety measures [2]. Factors contributing to RTAs in the region include:

- **Driver behaviour:** Dangerous driving practices, such as speeding and disregarding traffic signs, are frequently cited as causes of accidents [3].
- **Road infrastructure:** Inadequate Road maintenance, lack of sufficient signage, and poor road design can create hazardous conditions [3].
- **Limited technological intervention:** Existing road safety measures often rely on static signage, which may be missed or misinterpreted by drivers, and lack real-time updates on road conditions [3].

These factors contribute to a significant public safety issue, highlighting the need for technological solutions to improve road safety and awareness.

2. Problem Statement

The project addresses the challenge of insufficient driver awareness of road signs and real-time road conditions in Cameroon poses significant safety risks, exacerbated by the lack of dynamic, real-time information systems. Traditional static signage and limited communication channels fail to provide timely updates, leading to potentially dangerous situations such as abrupt reactions to unexpected road signs or hazardous conditions. This problem results in drivers being unaware of crucial road signs, potential hazards like construction zones or accidents, and facing delays due to unanticipated traffic congestion. Consequently, this issue contributes to increased road traffic accidents (RTAs), economic losses, and disruptions in transportation networks.

3. Objectives of the Study

This project aims to design and implement a "Road Sign and Road State Mobile Notification Application" specifically tailored for Cameroon's road networks. The project's objectives are:

3.1 General Objective

To design and implement a mobile application that effectively delivers road sign information and real-time road state updates to drivers in Cameroon, enhancing road safety and reducing the occurrence of RTAs.

3.2 Specific Objectives

- Develop a user-friendly mobile application with an intuitive interface for accessing road sign information and road condition updates.
- Create a comprehensive database of road signs on major highways in Cameroon, providing users with instant access to their meanings and significance.
- Integrate real-time data sources, including traffic cameras, weather sensors, and crowdsourced reports, to provide timely updates on traffic congestion, accidents, weather hazards, and road closures.
- Implement customizable notification settings, allowing users to personalize the types of alerts they receive based on their preferences and travel routes.
- Ensure seamless integration with popular navigation systems and mapping platforms for convenient access within existing navigation applications.

4. Proposed Methodology

The project will follow a systematic development process encompassing the following stages:

- **Requirement analysis:** Conducting thorough research on road safety challenges in Cameroon, existing road signage systems, and user needs. Gathering data on road signs (location, type, meaning), mapping data, traffic information, and weather data in Cameroon.
- **Application design:** Developing a user-centered design for the mobile application, focusing on intuitive navigation, clear information display, and optimal usability. Designing a database to store road sign information, real-time traffic updates, and road condition reports.
- **Database development:** Creating a comprehensive database of road signs in Cameroon, ensuring accuracy and completeness of information.
- **Data integration:** Establishing connections with real-time data sources to provide up-to-date information on road conditions.

- **Application development:** Implementing the application using appropriate programming languages and frameworks, ensuring compatibility with popular mobile platforms. Developing the mobile application with features for GPS location tracking, customizable notifications, and integration with navigation systems.
- **Testing and evaluation:** Conducting rigorous testing of the application's functionality, usability, and performance. Feedback will be gathered from users to refine the application.
- **Deployment and maintenance:** Launching the application to the public and providing ongoing maintenance and updates. Creating an intuitive user interface optimized for ease of use while driving.

5. Significance of the Study

This project holds significant value for Cameroon and other nations facing similar transportation challenges. It has the potential to enhance road safety by addressing the critical issue of inadequate driver awareness and modernizing transportation infrastructure. By providing real-time information and improving communication between drivers and the road infrastructure, the mobile application can contribute to:

- **Improved driver behaviour:** The application can promote responsible driving practices by providing clear information about road signs and regulations.
- **Enhanced travel efficiency:** Real-time updates on traffic and road closures can help drivers plan their routes more effectively, reducing travel time and congestion.
- **Economic benefits:** Reducing RTAs can lead to significant cost savings associated with medical expenses, property damage, and lost productivity.
- **Reduced RTAs:** Timely alerts and increased awareness of road conditions can help drivers make informed decisions and avoid dangerous situations, leading to a decrease in accidents.

This aligns with initiatives to upgrade Cameroon's transport sector with advanced technology, offering drivers more control over their journeys, boosting confidence, and reducing stress.

6. Scope of the Study

The scope of this study encompasses the development of a mobile application tailored for use in Cameroon, concentrating initially on major highways and urban areas. Data collection will involve official government sources, collaboration with pertinent agencies, and utilization of crowdsourced information. Future iterations may extend the application's coverage to include a broader road network, contingent upon the successful implementation of the initial phase.

7. Delimitation of the Study

The project will not encompass the development of hardware infrastructure, such as road sensors or cameras. It will rely on existing data sources and publicly available information for real-time updates on road conditions (although future iterations could incorporate these).

8. Definition of Keywords and Terms

- **Road traffic accident (RTA):** An accident that occurs on a public road involving at least one vehicle in motion.
- **Mobile application:** A software application designed to run on smartphones and other mobile devices.
- **Real-time data:** Information that is delivered immediately after collection, reflecting current conditions.
- **Crowdsourcing:** Obtaining data or information from a large group of people, typically via the internet.
- **Navigation system:** A system that provides directions and guidance to travellers.

CHAPTER TWO: REQUIREMENT GATHERING

This is the process of collecting and documenting the needs and expectations of the system from various stakeholders. The goal of this research was to identify the user and system requirements that could be incorporated into the system. The requirements have been classified into two groups: **functional** and **non-functional** requirements and categorized into two groups the **admin** (system admin and transportation authorities) and **user** (driver).

Before diving into specific requirements, let's define the different groups of requirements:

- **Functional Requirements:** These describe what the system should do. They define the specific features and functionalities of the application.
- **Non-Functional Requirements:** These describe how the system should behave. They address aspects like performance, security, usability, and reliability.

1. Requirements Gathering Activities

Requirement Gathering Activities was limited to only using brainstorming and existing documentation, the following activities are explained below:

- **Brainstorming Sessions:** Group gathering to brainstorm ideas for features, functionalities, and potential challenges.
- **Studying Existing Documentation:**
 - **Cameroon Road Safety Reports:** Analysing reports from crowdsourced data to understand accident statistics, common road hazards, and existing road signage practices providing valuable insights about the country's road safety landscape. This road safety country data, available on the Road Safety Facility website, presents information on all pillars of road safety, including management, roads, speed, vehicles, road users, and post-crash care. It offers an overview of the current status for each country and region, along with extensive information on key risk factors, issues, and opportunities [2].
 - **Mobile App Market Research:** Researching existing road safety and navigation apps globally (e.g. Here WeGo) [4] and within Cameroon to identify best practices and potential shortcomings to improve upon.

2. Requirements Categorization

2.1 Functional Requirements for User (Driver)

Functional Requirement	Description
View Road Signs	Access a database of common road signs in Cameroon with clear explanations of their meaning and implications.
Receive Real-time Alerts	Get notifications about road hazards, accidents, weather conditions, and road closures based on location and preferences.
Report Incidents	Ability to report accidents, road hazards, or faulty road signs to the application.

Customize Notifications	Choose specific types of alerts and set notification preferences for specific areas or routes.
Integrate with Navigation	Seamless integration with popular navigation apps to display road sign information and alerts within the navigation interface.
Real-time Road Sign Recognition	Detect and interpret road signs (speed limits, warnings, and directions) using the device's camera.
Road Condition Alerts	Notify about accidents, traffic jams, road construction, potholes, weather hazards, road closures, etc.
Location Tracking	Use GPS to determine the driver's position and provide relevant alerts.
Voice Notifications	Provide audio alerts for important updates to minimize distraction.

2.2 Non-Functional Requirements for User (Driver)

Non-Functional Requirement	Description
Responsiveness	Fast sign recognition and alert generation.
Accuracy	Reliable road sign detection and interpretation, accurate road condition reports.
Usability	Intuitive interface, easy navigation, minimal driver interaction required.
Offline Functionality	Store basic road sign data and provide limited functionality when internet connectivity is poor.
Performance	Fast loading times and real-time updates are crucial for safety and effectiveness.
Accessibility	The app should be accessible to users with disabilities, including visual and auditory impairments.

2.3 Functional Requirements for admin

Functional Requirement	Description
User Management	Create, edit, and manage driver accounts.
Road Sign Database Management	Add, edit, remove road signs, and their associated meanings.
Reporting	Generate reports on system usage, popular routes, frequent hazard locations.
System Updates	Ability to push updates to the mobile application (new signs, bug fixes, etc.).
Manage Road Sign Database	Add, update, and remove road sign information within the app database.
Publish Road State Updates	Ability to send real-time alerts to users about accidents, road closures, and other critical information.
Analyse User Reports	View and analyse incident reports submitted by users to identify problem areas and improve road safety.
Data Analytics	Access data and generate reports on user behaviour, app usage, and incident reports to improve road safety strategies.

2.4 Non-Functional Requirements for admin

Non-Functional Requirement	Description
Security	<ul style="list-style-type: none">• Protect user data and system against unauthorized access.• Robust security measures to protect user data and prevent unauthorized access to the system.
Scalability	<ul style="list-style-type: none">• Handle increasing users and data volume.• The system should be able to handle a growing number of users and data volume efficiently.
Maintainability	Easy to update and fix issues.

Reliability	Ensure the system is consistently available and functions reliably with minimal downtime.
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3. Additional Considerations

- **Multilingual Support:** Ensure the app is available in both English and French, catering to Cameroon's bilingual population.
- **Community Features:** Implement features that enable users to share information and updates within the app, fostering a community-driven approach to road safety.
- **Gamification:** Consider incorporating gamification elements like rewards and points to incentivize safe driving behaviour and active participation in reporting.
- **Educational Content:** Include a section dedicated to road safety rules and regulations specific to Cameroon, enhancing users' knowledge and awareness.
- **Partnerships:** Collaborate with emergency services, towing companies, and other relevant entities to provide additional assistance and support to users in need.
- **Monetization Strategies:** Explore sustainable funding options such as in-app advertising, premium features, or partnerships to ensure the app's longevity and effectiveness.

References

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