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Internet Programming and Mobile Programming

Department: Computer Engineering

Faculty Of Engineering and Technology

TASK 3

Road Sign and Road State Mobile Notification Application

System Requirement Specification Document

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Group 14

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1. Introduction

Requirement Analysis: From the requirements collected, they were meticulously analyzed to ensure clarity, consistency, completeness, and feasibility. Here, conflicting or ambiguous requirements were identified and resolved through discussions with stakeholders. The goal was to create a well-defined set of requirements that accurately reflects what the system needs to achieve.

A vital outcome of requirement analysis is a Software Requirements Specification (SRS) document. The SRS document serves as a blueprint for the development team, outlining the functional and non-functional requirements, system interfaces, data needs, and any constraints identified during the analysis phase.

This document serves as the Software Requirements Specification (SRS) for the Road Sign and Road State Mobile Notification Application.The Application is designed to improve driver awareness and safety by providing real-time notifications about road signs and road state information directly to their mobile devices.

1.1. Purpose

The primary purpose of this SRS document is to:

- Clearly define the functionalities, features, and technical requirements of the Application.
- Establish a common understanding among all stakeholders involved in the development and deployment of the Application, including developers, designers, testers, and end-users.
- Act as a reference point for the design, development, testing, and implementation phases of the project.

1.2. Intended Audience

This document is intended for a broad range of stakeholders who play a role in the Application's lifecycle. This includes:

- **Developers**

- **Designers**
- **Testers**
- **End-Users**

1.3. Intended Use

This SRS document serves as a roadmap for the successful development and deployment of the Road Sign and Road State Mobile Notification Application. It is intended to be used for the following purposes:

- Guiding development efforts by outlining the functionalities and technical specifications the application needs to fulfill.
- Facilitating communication and collaboration among stakeholders by providing a shared understanding of the project requirements.
- Establishing a baseline for testing and ensuring the final product meets the defined requirements.

1.4. Product Scope

This SRS document defines the scope of the initial development phase for the Road Sign and Road State Mobile Notification Application. The scope encompasses the following functionalities:

- Real-time delivery of notifications about relevant road signs and road state information in the driver's vicinity.
- Support for permanent and temporary road signs, including stop signs, yield signs, speed limits, lane closures, and detours.
- Initial development targeting a specific mobile platform (e.g., Android or iOS).
- Optional functionalities for offline use, potentially involving a pre-loaded local database of common road signs for a specific geographic area.

This defined scope ensures a focused development effort on core functionalities while allowing flexibility for future enhancements based on project evaluation and user feedback.

1.5. Definitions and Acronyms

This section provides a list of key terms and acronyms used throughout the SRS document.

- **GPS:** Global Positioning System
- **UI:** User Interface
- **UX:** User Experience
- **API:** Application Programming Interface

2. Overall Description

The Road Sign and Road State Mobile Notification Application is a mobile application designed to enhance driver awareness and promote safe driving practices. It leverages a smartphone's GPS functionality to provide real-time notifications about relevant road signs and road state information in the driver's vicinity.

Key Functionalities:

- Real-time notifications for road signs and state information
- Supported information includes permanent and temporary signs, speed limits, traffic conditions, and weather

2.1. User Needs

The target users of this application are drivers who want to improve their awareness of road conditions and signage. The application addresses the following user needs:

- **Increased Situational Awareness:** Drivers often miss or forget road signs, especially when unfamiliar with an area. The application provides timely alerts about upcoming signs, reducing the risk of overlooking crucial information.

- **Enhanced Safety:** By prompting drivers about upcoming stop signs, yield signs, or speed limit changes, the application can help them adjust their behaviour accordingly, promoting safer driving practices.
- **Improved Navigation:** Real-time traffic and weather information can help drivers navigate more effectively by allowing them to avoid congested areas or adjust their routes based on weather conditions.

2.2. Assumptions and Dependencies

This document makes the following assumptions:

- Users possess smartphones compatible with the chosen mobile platform.
- Users are willing to grant the application permission to access their location data via GPS.
- A reliable data source exists for road sign information.

The application has the following dependencies:

- **Mobile Operating System:** The application relies on a functional mobile operating system to run on user devices.
- **GPS Functionality:** The core functionalities depend on the smartphone's GPS capabilities to determine the user's location.
- **Data Source:** The application requires access to a source of road sign information, either a pre-loaded local database or a real-time data feed from government agencies or third-party services.

This overall description, along with the outlined user needs and assumptions/dependencies, provides a foundational understanding of the Road Sign and Road State Mobile Notification Application. The subsequent sections of the SRS document will delve deeper into the specific functionalities, technical requirements, and any limitations associated with the system.

3. System Features and Requirements

This section outlines the functionalities, interfaces, and performance characteristics of the Road Sign and Road State Mobile Notification Application.

3.1. Functional Requirements

Functional requirements refer to the specific behaviors, features, and capabilities a software system must possess. They define what the software should do, how it should perform certain tasks, and how it should respond to user interactions. Functional requirements are derived from the needs and expectations of stakeholders and serve as the foundation for designing, implementing, and testing the software. They provide a clear roadmap for development teams to build a solution that meets the intended purpose and functionality.

3.1.1. User Requirements

These requirements capture the desired functionality from the end user's perspective. They outline the features, interactions, and user interface elements that enable users to accomplish their tasks effectively. User requirements consider the user experience, usability, and accessibility aspects of the software system.

1. **Real-time GPS Location Tracking:**
    - Defines functionalities for the application to utilize the device's GPS to determine the user's location.
    - Display user's location on a map and overlay upcoming road signs and real-time road state information.
2. **Offline Functionality:**
    - Develop functionalities that allow the application to use historical data to provide basic information even without an internet connection. This could involve storing essential road sign data for specific areas (pre-downloaded maps with key road sign locations).
3. **Authentication and User Management**
    - Defines functionalities for user login, account creation, and profile management within the application.
4. **Customizable Notifications**
    - Provide timely alerts for upcoming road signs and significant changes in road state.
    - A clear description of the road sign and road state.

- Defines functionalities for users to personalize notification preferences (sound, distance thresholds).

5. **Multilingual support for a wider user base**

3.1.2. Data Requirements

Data requirements refer to the specifications for how data is handled within a system.

1. **Real-time Traffic Information:**
    - Defines functionalities for the application to retrieve and integrate real-time traffic data to provide users with up-to-date information.
2. **User-Generated Road Sign Reports:**
    - Defines functionalities for users to report road sign issues, road state or missing information within the application.
3. **Data Management and Verification:**
    - Defines functionalities for managing and verifying the accuracy of data used by the application.

3.2. External Interface Requirements

External Interface Requirements define how a software system interacts with external entities, acting as gateways for communication and data exchange. These external entities can be various systems, devices, or services that the software needs to connect with to function effectively.

1. **Mobile Operating System:**
    - The application shall adhere to the development guidelines and APIs provided by the chosen mobile operating system. This ensures compatibility and proper functioning of the application on user devices.
2. **Data Source Interface:**
    - The application shall interact with real-time feed using a compatible interface. This involves data streaming protocols for receiving real-time traffic and road state information from external services.

3. **User Authentication Service:**
    - Since the application implements user accounts and requires login functionality, it will interface with an external authentication service (e.g., Firebase Authentication, AWS Cognito). This would involve using the service's APIs for user registration, login, and profile management.
4. **Integration with existing navigation apps**
    - The app would act as a data provider, sharing real-time and pre-downloaded information (road signs, traffic congestion, accidents) from the navigation app through an API .

3.3. System Features

1. **Home Screen:**
    - This will be the application's main landing page, displaying the user's current location and providing an overview of upcoming notifications.
2. **Notification Center:**
    - This dedicated section allows users to view past and upcoming notifications. It may include details like:
        - Type of road sign or road state information (stop sign, speed limit, traffic congestion).
        - Distance to the upcoming sign or hazard.
        - Time remaining before encountering the sign/hazard.
3. **Settings:**
    - This section allows users to personalize their experience and notification preferences. It may include options for:
        - Enabling/disabling notification sounds.
        - Setting distance thresholds for alerts (e.g., receive alerts only for signs within a specific distance).
        - Managing offline functionalities
4. **Route Planning Integration:**

- If the application expands beyond just notifications, it could integrate with mapping services to provide users with route planning functionalities that consider real-time traffic information and road sign locations.

5. **User Reporting:**
    - This feature allows users to report missing or incorrect road sign information or potential hazards on the road. This contributes to improving the data accuracy and promotes a community-driven approach.

3.4. Non-Functional Requirements

1. **User-Friendly Interface**:
    - The application should have a clean, responsive, and intuitive interface optimized for use on smartphones and tablets.
2. **Performance:**
    - The application should provide timely updates on road conditions and should not cause significant battery drain.
3. **Reliability:**
    - The application should provide accurate information and notifications based on the user's location and preferences.
4. **Information Accuracy:**
    - This is a critical non-functional requirement. The application should strive to provide users with the most reliable and up-to-date information possible. This could involve:
    - **Data verification processes:** Implementing mechanisms to verify the accuracy of data received from external sources (road sign databases, traffic feeds).
    - **User-generated feedback:** Encouraging users to report any discrepancies or missing information they encounter.
    - **Data source reliability:** Selecting reputable sources for road sign data and real-time traffic information.
5. **Security:**

- User data, especially GPS location data, should be securely stored and transmitted.
- Strong authentication and authorization mechanisms are imperative to prevent unauthorized access
- Regular security audits and adherence to industry standards are essential for vulnerability mitigation.

6. **Scalability**:
    - The architecture should scale horizontally to accommodate growing traffic and data.
    - Load balancing and scalable database infrastructure ensure optimal performance under varying workloads.
7. **Maintainability**:
    - A well-structured, documented codebase facilitates ongoing maintenance and updates.
    - Automated testing ensures changes don't introduce issues. Streamlined deployment and rollback procedures minimize downtime.
8. **Compatibility**:
    - The application must be compatible with popular mobile platforms like iOS and Android.
9. **Regulatory Compliance**:
    - Compliance with privacy regulations like GDPR, CCPA, or HIPAA is essential. Adherence to industry standards such as ISO 27001 and legal requirements for data retention and breach notifications must be maintained.

3.5. Prioritize Requirements

Given our limited time constraints, and resources, and low budget. Here is the suggested prioritization of the requirements:

High Priority (Must have): These are critical for the basic functionality of the application and should be developed first.

1. **Authentication and User Management**:
    - Security is paramount, and the system needs to protect user data from the get-go.
2. **Real-time GPS Location Tracking**:
    - Core feature for a location-based application.

3. **User-Friendly Interface**:
    - Essential for user adoption and usability.
4. **Compatibility**:
    - Ensuring the app works on both iOS and Android platforms will maximize its user base.
5. **Information Accuracy:**
    - This is a critical non-functional requirement. The application should strive to provide users with the most reliable and up-to-date information possible.

Medium Priority (Should have): These features are important but not critical for the initial launch. They can be developed once the high-priority requirements are met.

1. **Real-Time Data Integration**:
    - While important, this can initially be simulated or pared down to a few key data sources due to resource constraints.
2. **Customizable Notifications**:
    - Basic notifications should be in place first, with customization options added as time allows.
3. **Multilingual support for a wider user base**

Low Priority (Could have): These are desirable features that could enhance the application but are not necessary for the initial launch. They can be added if time and resources allow.

1. **Performance**:
    - While important, performance optimizations are often something that can be improved iteratively after the main features have been developed.
2. **Scalability**:
    - Start with a basic working model, optimize for scalability as user base grows.
3. **Maintainability**:
    - Good development practices should be followed from the start, but major refactoring can be done after the initial launch if necessary.

Future Considerations (Won't have this time): These are aspects that are recognized as valuable but won't be implemented in this development cycle due to constraints.

1. **Regulatory Compliance**:
    - While important, comprehensive compliance may be beyond the scope of the initial 10-week timeline. Basic data protection measures should be implemented, and full compliance should be a goal for future development cycles.

4. Conclusion

The successful implementation of the mobile application is expected to have several positive outcomes and impacts:

- Improved road safety by providing drivers with real-time information about road signs and hazards.
- Enhanced traffic management through timely notifications about traffic congestion, accidents, and road closures.
- Reduction in travel time and fuel consumption by suggesting alternate routes based on real-time traffic conditions.
- Increased driver satisfaction by providing a more informed and stress-free driving experience.
- Potential for future integration with emerging technologies, such as vehicle-to-infrastructure communication and augmented reality.

In conclusion, these requirements will guide the design and implementation of the Road Sign and Road State Mobile Notification Application. Further requirements may emerge as the project progresses and will be incorporated into the project plan accordingly.

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