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FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTER ENGINEERING

MOBILE APPLICATION DEVELOPMENT

CEF 440

TASK 2 REPORT:

ROAD SIGN AND ROAD STATE NOTIFICATION MOBILE APP

REQUIREMENT GATHERING

Presented by:

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I- INTRODUCTION

In today's fast- growing world, road safety and awareness are of paramount importance. With the increasing number of vehicles on the road, it has become essential to have real-time information about the road state and road signs to ensure a safe and efficient journey.

Definitions:

Road State and Road Sign Notification Mobile App: A smartphone application designed to assist drivers by providing real-time updates about road conditions, hazards, and road signs. It utilizes GPS, crowdsourced data, and image recognition technologies to keep drivers informed and safe during their journeys.

Requirements Gathering: The process of capturing, analyzing, and documenting the needs, desires, and expectations of stakeholders for a software project. It's a crucial phase in the software development life cycle (SDLC) as it serves as the foundation for the subsequent stages. Effective requirements gathering ensures that the final product meets the needs of its users, is delivered within the specified time frame, and remains within the allocated budget.

The purpose of this document is to define and elaborate on the needs and expectations of stakeholders for this project.

II- STAKEHOLDER IDENTIFICATION

II.1 Definition

Stakeholders are individuals or groups who are impacted by or can influence the outcome of the project. They bring diverse perspectives and hold a vested interest in the requirement elicitation of the project and its outcome, helping in crucial decision-making, as their needs and concerns can help identify risks and opportunities.

II.2 Stakeholders classification

The stakeholders for this system can be classified as follows;

a. Internal Stakeholders

An internal stakeholder is a person, group, or company that is directly involved in the project. The different internal stakeholders for this system are as follows:

- ***Project team:*** These will be involved in the actual work of the project including the project development process.

- ***Data providers:*** These are the entities responsible for providing road sign and road state data.

- ***Road infrastructure bodies:*** This involves governmental bodies concerned with road construction and maintenance as they shall help in providing data updates on changes and additions on road infrastructure.

b. External Stakeholders

External stakeholders are individuals not directly concerned in the project development process but who will be impacted by the activities, decisions and outcomes.

- ***End users:*** These are the individuals for whom the software will be developed and who will use it to receive real-time road status and road sign notifications. They include:
  - Vehicle owners
  - Pedestrians
  - Transport agencies
  - Passengers

- ***Potential Investors:*** These are individuals or organisations who might find interest in contributing financially to the development of this project. Some of these potential investors are as follows:
  - Private companies (Travelling agencies, Taxi renting companies, etc...)
  - Government owned companies

III- REQUIREMENT GATHERING TECHNIQUES

Requirement gathering techniques are crucial in software development to ensure that the final product meets the needs and expectations of stakeholders. This goes beyond features, delving into stakeholder needs through various tools. This ensures everyone understands what's needed, reducing mishaps and setting the stage for a valuable end product. The different methodologies used in this project are as follows;

III.1 Surveys

This is a data collection method used to gather information from a sample of people or entities, used to gather feedback. For the purpose of this project, a survey was carried out for stakeholders such as drivers and passengers in order to access their needs and expectations towards the application. This was done using a ***google form.*** Other tools used for surveys include Survey Monkey, Type form, and others.

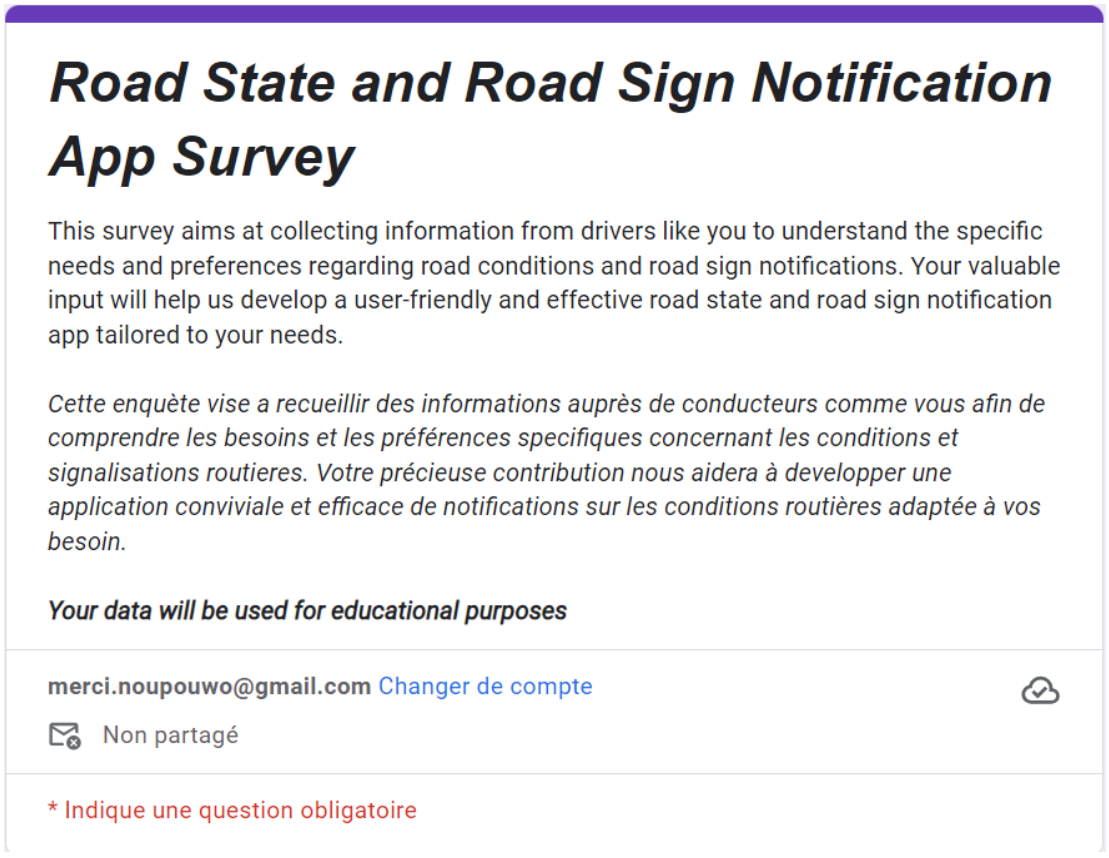


Figure 1: Survey form extract

Click here to access the form.

III.2 Interviews

This is another method of gathering requirements which involves questioning concerned individuals to get more information about their needs regarding the system. For this system, software engineers and some vehicle owners were interviewed and were able to provide us with insights on some technical and system requirements. The information gathered here will be discussed in the subsequent topics

III.3 Reverse Engineering

This involves evaluating and understanding strengths, and weaknesses of existing systems providing similar solutions. After these study, we came out with two main existing solutions;

- *Google maps*
- *Waze app*

The results related to this study will be discussed in the subsequent topics.

III.4 Other Techniques

Other requirement gathering techniques which could be used for gathering requirements for the purpose of this project are as follows:

1. **Document Analysis**

   This technique involves reviewing existing documents, such as business processes, system manuals, or reports to extract requirements and understand the current system. This can help shed light on user needs and project requirements.

2. **Workshop and Focus Groups**

   These are collaborative sessions where stakeholders come together to discuss project goals, brainstorm ideas, and define requirements.

3. **Observation**

   This technique involves Observing users in their natural environment to understand their workflow, challenges, and needs. This can provide valuable insights into the requirements.

4. **Card Sorting**

   This technique helps identify how users categorize information. Participants sort cards with different functionalities or features into categories that make sense to them, revealing their mental models and expectations for information organization within the product.

IV- REQUIREMENT GATHERING RESULTS

After these requirement gathering techniques were carried out, the requirements were extracted from the stakeholders' feedbacks. This extraction was done following the steps elaborated below;

IV.1 Raw Data Assessment

Here, ***google forms*** was used to generate statistics about each response from stakeholders' feedback as seen on the figures below:

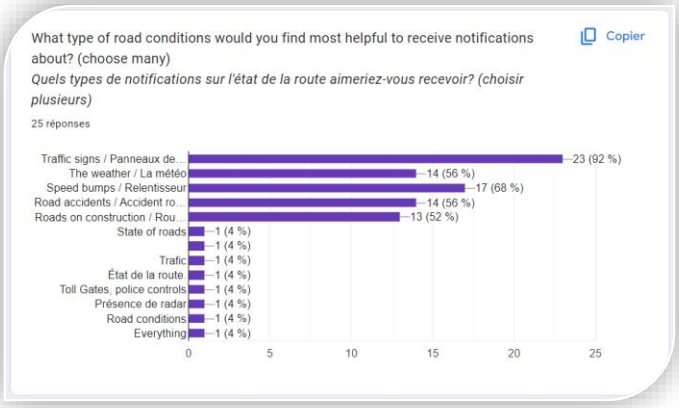


Figure 2: Google form statistics-1

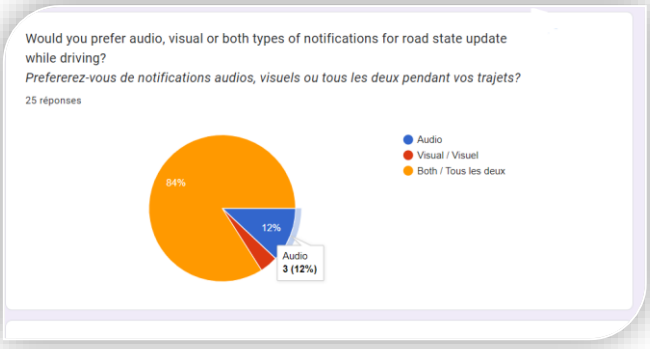


Figure 3: Google form statistics-2

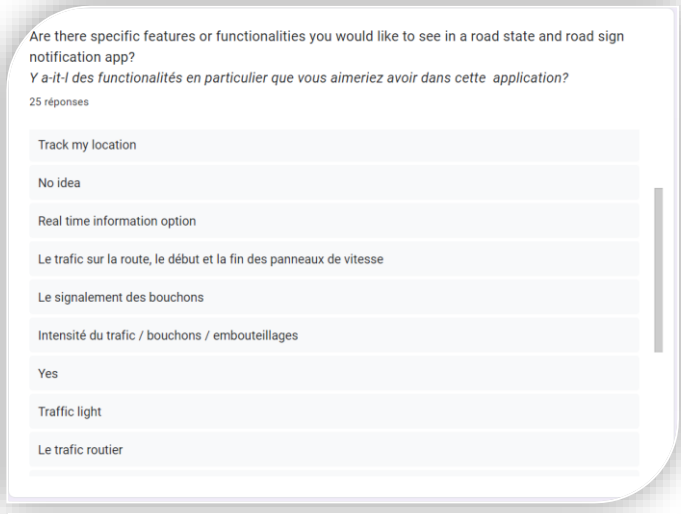


Figure 4: Google form statistics-35

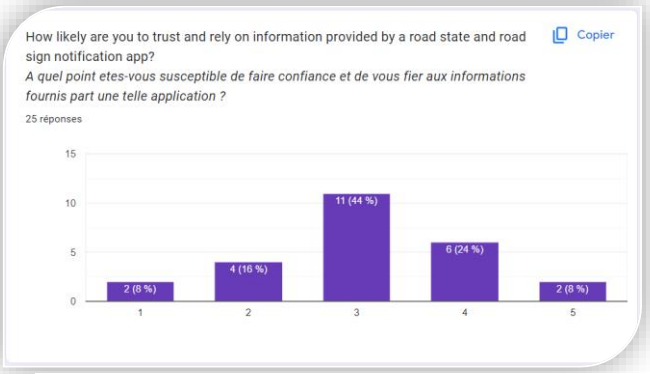


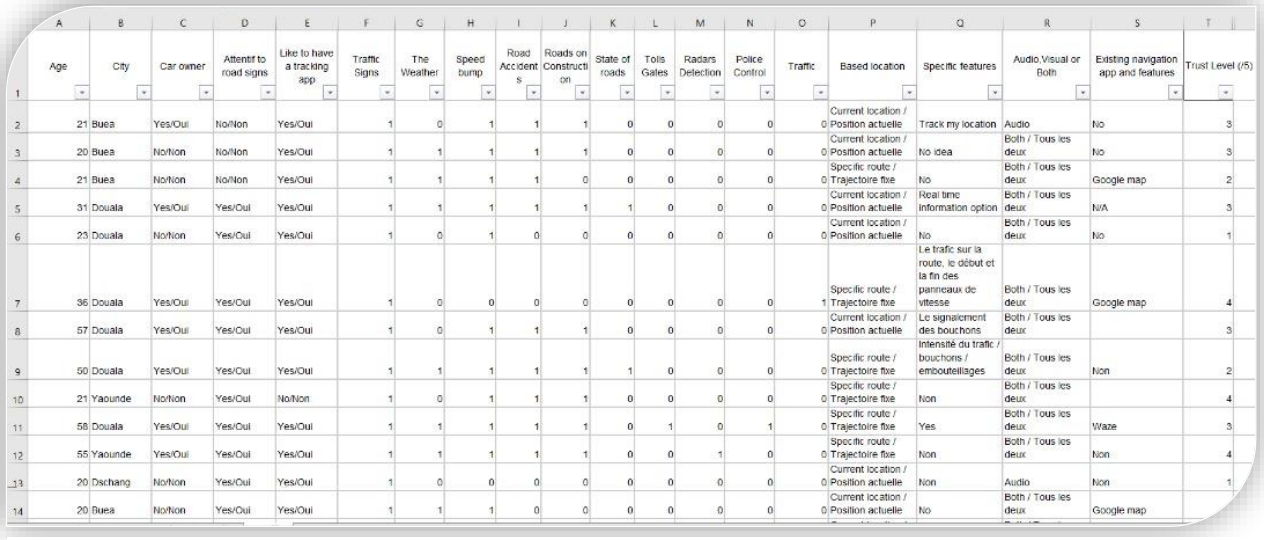
Figure 5: Google form statistics 4

From these statistics, we can see stakeholders' preferences and recommendations for the system.

IV.2 Data Cleaning and visualization:

The raw data obtained from google forms was exported to Microsoft Excel and cleaned to ease visualization and extraction of relevant requirements.

Following are figures illustrating data cleaning process and the final visualization output;



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
1	Age	City	Car owner	Attentif to road signs	Like to have a tracking app	Traffic Signs	The Weather	Speed bump	Road Accidents	Roads on Construction	State of roads	Tolls Gates	Radars Detection	Police Control	Traffic	Based location	Specific features	Audio,Visual or Both	Existing navigation app and features	Trust Level (/5)
2	21	Buea	Yes/Oui	No/Non	Yes/Oui	1	0	1	1	1	0	0	0	0	0	Current location / Position actuelle	Track my location	Audio	No	3
3	20	Buea	No/Non	No/Non	Yes/Oui	1	1	1	1	1	0	0	0	0	0	Current location / Position actuelle	No idea	Both / Tous les deux	No	3
4	21	Buea	No/Non	No/Non	Yes/Oui	1	1	1	1	0	0	0	0	0	0	Specific route / Trajectoire fixe	No	Both / Tous les deux	Google map	2
5	31	Douala	Yes/Oui	Yes/Oui	Yes/Oui	1	1	1	1	1	1	0	0	0	0	Current location / Position actuelle	Real time information option	Both / Tous les deux	N/A	3
6	23	Douala	No/Non	Yes/Oui	Yes/Oui	1	0	1	0	0	0	0	0	0	0	Current location / Position actuelle	No	Both / Tous les deux	No	1
7	36	Douala	Yes/Oui	Yes/Oui	Yes/Oui	1	0	0	0	0	0	0	0	0	1	Specific route / Trajectoire fixe	Le trafic sur la route, le début et la fin des panneaux de vitesse	Both / Tous les deux	Google map	4
8	57	Douala	Yes/Oui	Yes/Oui	Yes/Oui	1	0	1	1	1	0	0	0	0	0	Current location / Position actuelle	Le signalement des bouchons	Both / Tous les deux		3
9	50	Douala	Yes/Oui	Yes/Oui	Yes/Oui	1	1	1	1	1	1	0	0	0	0	Specific route / Trajectoire fixe	Intensité du trafic / bouchons / embouteillages	Both / Tous les deux	Non	2
10	21	Yaounde	No/Non	Yes/Oui	No/Non	1	0	1	1	1	0	0	0	0	0	Specific route / Trajectoire fixe	Non	Both / Tous les deux		4
11	58	Douala	Yes/Oui	Yes/Oui	Yes/Oui	1	1	1	1	1	0	1	0	1	0	Specific route / Trajectoire fixe	Yes	Both / Tous les deux	Waze	3
12	55	Yaounde	Yes/Oui	Yes/Oui	Yes/Oui	1	1	1	1	1	0	0	1	0	0	Specific route / Trajectoire fixe	Non	Both / Tous les deux	Non	4
13	20	Dschang	No/Non	Yes/Oui	Yes/Oui	1	0	0	0	0	0	0	0	0	0	Current location / Position actuelle	Non	Audio	Non	1
14	20	Buea	No/Non	Yes/Oui	Yes/Oui	1	1	1	0	0	0	0	0	0	0	Current location / Position actuelle	No	Both / Tous les deux	Google map	

Figure 6: Data cleaning

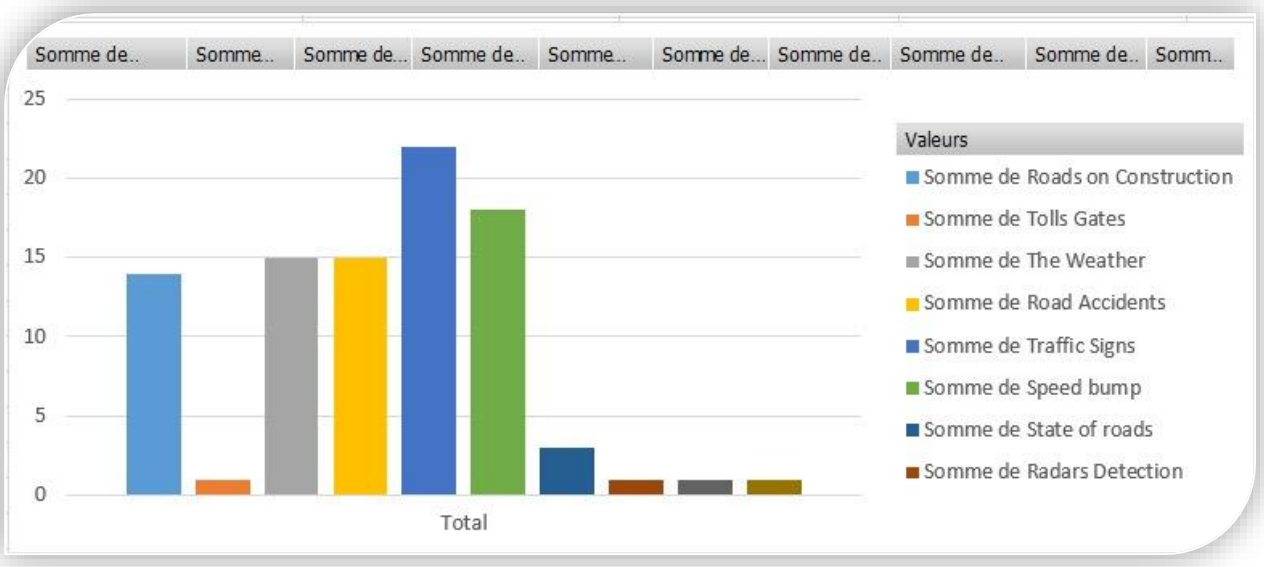


Figure 4: Data visualisation

This clearly visualisable data will help in organizing and prioritizing the gathered requirements based on these statistics. These prioritized requirements are discussed in the subsequent topic.

V- COLLECTED SPECIFICATIONS

V.1 Requirements from Survey

Following are the set of functionalities gathered from concerned individuals:

1. **Road Sign Notification:** This involves providing users with road signs position along their trajectory.

2. **Weather Related Hazards**: Providing users with notifications concerning upcoming or ongoing hazards related to weather.

3. **Real Time Traffic Updates:** Providing users with real time notification about traffic on specific routes.

4. **Notification Preferences:** Providing users with the ability to customize notifications with respect to their needs and preferences.

5. **Route Redirection:** Involves providing users with best routes based on their traced routes.

6. **Voice Support:** This involves providing users with voice alongside visual support as driving while using the phone is **dangerous**.

7. **Tracking User's Location:** This involves knowing the exact position of a user for a better user experience.

8. **User Login and Logout:** Ability to create and authenticate users which might help in keeping track of data related to specific users (Example: Frequently accessed locations.

9. **Multilanguage Support**: This involves providing users with multiple languages depending on their preferences.

10. **Dashboard Monitoring:** Providing users with ability to view a summary of their journeys while the app management team will be able to view and monitor users utilizing the app.

V.2 Requirements from Existing solutions

Following are additional requirements gathered from existing solutions (Google Maps and Waze app);

1. **Police Control Positions**: The users know where all police controls are located and therefore can get prepared for any situation.

2. **Toll Gates positions:** With users knowing tolls gates positions, they can get prepared so as to avoid wastage of time and therefore cause traffic.

3. **Radar Positions:** Knowing radar positions help users avoid over speeding in certain zones and therefore reducing the risk of accidents.

4. **Real Time Speed Counter:** Users are notified if they are exceeding normal speed and the application assist in speed counting.

5. **Share Location from the App:** Users have the possibility to share their locations with other users, facilitating direction.

6. **Defined Frequently Accessed Locations:** Users have the possibility to define the locations they access more frequently therefore avoiding therefore avoiding them from inputting it all time.

7. **Plannify a Trajectory:** Notifies users on when to leave for a planified journey depending on a specified arrival time and real time traffic.

8. **Road State Update Permission:** Here, the user is able to upload data about road states to keep other users informed (Police controls, Accidents, Blocked Roads).

V.3 Technical Requirements from Interviews

Following are technical requirements gathered from interviewing software engineers about possible technologies related to this project:

a. Front-End Technologies

- **React Native**: This framework can be used due to its cost effectiveness and smaller time to develop, its performance which is very good and also because it can be used to develop simpler to complex applications.

- **Flutter:** Flutter with its excellent performance, highly customizable UI with smooth components makes it a good option to develop such an application.

- **Kotlin:** Its excellent native performance and excellent UI&UX for each platform makes it a good candidate for this task.

- **Python:** A programming language that fits on all sides of an application, and where the complexity is reduced makes it a good option in this situation.

b. Back-End Technologies

- **Node.js:** It uses non-blocking I/O architecture, which makes it efficient and suitable for real time applications.

- **Express.js:** It is used to build a single page, multipage and hybrid web applications.

- **Django:** It is a high-level python web framework that encourages rapid development and clean, pragmatic design.

- **Spring boot:** It is an open-source tool that makes it easier to use java-based frameworks to create microservice and web applications.

c. Database Technologies

- **MySQL:** It is a relational database management system developed by Oracle that is based on structured query language.

- **MongoDB:** It makes it easy for developers to store structured or unstructured data. It uses a JSON-like format to store documents.

- **PostgreSQL:** It is an advanced enterprise-class open-source relational database that supports both SQL and JSON querying.

- **Firebase:** It is a cloud-hosted NoSQL database that lets organizations store and synchronize data in real time across all of their users' devices.

VI- CONCLUSION

Requirement gathering isn't a shopping list; it's detective work. By using surveys, interviews, and more, user needs were uncovered and a blueprint built for a correct beginning in the software development process. This ensures everyone's on the same page, minimizing mishaps and setting the stage for a valuable end product. In our consequent presentations, we shall elaborate more on the analysis of requirements thereby coming out with a final requirement specification document.

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