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Ministère de l'enseignement supérieures

Université de Buea

Faculty of Engineering and Technology

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01/04/2025

Car Diagnostic System Requirement Gathering Phase

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Table of Contents

ABSTRACT

Many car owners do have dashboard which informs them of the state of their car and engine sound which can also inform them, but many fail to understand these signs and in case of car failure run directly to the mechanic who usually overcharge them for very basic fault. Our project aims at creating a mobile app that will help car owners and drivers have a better understanding of car dashboard signals and engine sounds. For this project we are following the software development life cycle (SDLC) and presently we are on the requirement gathering phase. This report presents a comprehensive overview of the requirement gathering process for the Car Diagnostics System that will be developed by Group 21 under the supervision of Dr. Nkemeni Valery. The objective is to understand user needs and expectations to guide the system's design and development. Using multiple data collection techniques surveys, interviews, brainstorming, and reverse engineering the team gathered data from potential users (car owners and drivers) and also from mechanics and car sellers to have a better understanding of how deep the car owners are informed. The report also discusses data cleaning procedures and assesses user reluctance, providing mitigation strategies to enhance user acceptance.

I- INTRODUCTION

Requirement gathering is a critical initial phase in software development. It involves identifying the needs and expectations of stakeholders to ensure the final product aligns with user demands. For the Car Diagnostics System, a mobile application designed to help drivers and car owners diagnose vehicle issues, thorough requirement gathering was essential to capture relevant functionalities and user concerns. This report details every step of this task, from stakeholder identification to data interpretation and user behaviour analysis.

Objectives

General objective

- The objective of this phase was to collect requirements from stakeholders in order to come out with possible features that will be useful to stakeholders.

Specific objectives

- Identification of stakeholders
- Use requirement gathering techniques to collect data from stakeholders
- How data gathering and data cleaning was done
- User reluctance assessment.

Before diving into the main parts of this report we will outline the purpose of our app or project,

PURPOSE OF THE PROJECT

To empower non-technical car owners with an accessible, user-friendly tool for early fault detection and maintenance guidance. The goal is to reduce maintenance delays, lower repair costs, and extend vehicle lifespan by making diagnostics more intuitive and less reliant on expensive tools or mechanic visits.

II- STAKEHOLDER IDENTIFICATION

Stakeholders are individuals or groups who have an interest in or are affected by the project. Identifying them ensures that all perspectives are considered during development.

Key stakeholders identified:

- **Project Group Members (Group 21):** Developers responsible for brainstorming and building the system.
- **Supervisor (Dr. Nkemeni Valery):** Provides academic and technical guidance.
- **Primary Users:** Car owners and drivers – individuals who will use the app to diagnose vehicle issues.
- **Secondary Users:** Potential commercial partners or mechanics who may engage with the system in future iterations.

Understanding the needs of each stakeholder group was essential for gathering accurate and useful requirements.

III- REQUIREMENT GATHERING TECHNIQUES

Various techniques where used in order to gather data these techniques include;

- **Surveys (Google Forms)**

  Google forms where distributed to car owners and drivers to gather general preferences and expectations.

  The questions in the google form where divided into the understanding of dashboard and sounds, how the car owner deals with faults and how the user will likely want the app to be, it includes questions such as

  How often do you encounter user dashboard lights? , which type of sounds do you usually encounter? , what features will you find valuable in the app?.

  The link to the google form is given below.

  https://docs.google.com/forms/d/e/1FAIpQLSc20DZV1lbdaAXh8MsZrjEWrBnSeWgLu5tUGIwc8kn3nemZKA/viewform?usp=dialog

- **Questionnaires**

  Questionnaires were given to targeted users in Molyko and Mile 17 areas to collect responses about their vehicle diagnostics habits.

  Questionnaires were also given to mechanics who are potential stakeholders. This questionnaires contained questions such as what is the most common problem these cars have. What percentage of car owners and users do understand dashboard lights?

  The reason we interviewed mechanics was to know how often owners bring their cars to the mechanics and how deep is their understanding of car repairing from the point of view of the repairers.

- **Stakeholder Interviews**

  This was done in two phases. First, an interview with Dr. Nkemeni Valery to understand academic expectations and to know exactly what is expected from the project, and second, among group members, each group member came with its idea from the way he/she understood the project and the possible features the app can have.

- **Brainstorming Sessions**

  Internal team discussions to generate ideas.

- **Reverse Engineering**

  Analysis of existing car diagnostic apps. Some existing car diagnostics app include;

  FIXD, Torque Pro, and Dash Command to identify common features and best practices and to understand how they came up with the app from the deployment phase right up to the brainstorming phase.

These methods ensured a multi-dimensional understanding of user requirements.

IV- DATA GATHERING

After using all the techniques sited above, data gathering was done and the following are the key findings that was obtained;

- **Demographics:** Most respondents were aged 18–34, with balanced gender representation.
- **Vehicle Ownership:** Majority of users owned vehicles, indicating a direct need for diagnostics.
- **Dashboard Light Experience:** Many users encountered warning lights they couldn't identify.
- **Diagnosis Habits:** Most relied on mechanics, but showed interest in mobile app-based diagnostics.
- **Desired Features:** Users requested dashboard light recognition, repair suggestions, maintenance logs, sound analysis, and offline functionality.
- **Common Car Issues:** Engine sounds (knocking, hissing, grinding) were commonly reported.
- **Maintenance Reminder Preferences and Logging:** Users wanted push notifications and in-app reminders for maintenance alongside with options for logging maintenance history.
- Some existing Systems includes:
  FIXD
  Dashboard Warning Lights App

Skoda Sound Analyser
CarDiag
Torque Pro
Dash Command.

V- Data Cleaning

To ensure accuracy and reliability, the collected data was cleaned. Cleaning involves:

- **Removing duplicate or incomplete responses**
- **Correcting inconsistent formatting**
- **Filtering irrelevant entries**
- **Organizing responses by category (e.g., features, concerns, demographics)**

Clean data enabled the team to derive meaningful insights and prioritize features based on user demand.

After the data cleaning done, we came out with key features based on users' expectation, stakeholders' expectation, existing system features and brainstorming. The key features are;

- Dashboard scanning
- Dashboard light, sign and icon recognition
- Dashboard warning and meaning explanation
- Repairs recommendation and tutorials
- Basic car, dashboard and repairing lessons
- Experts' advice
- Offline functionalities
- Sound recognition
- Suggestion of experts

- Suggests mechanics based on users location
- Maintenance reminders through texts, and notifications
- Diagnostic history and activity history
- Suggests nearby garage based on users location
- Severity indicator
- Multilingual support
- Text-based search
- And manual Input for unrecognised lights.

VI- User Reluctance Assessment

Understanding potential resistance helps to improve system. The table below shows some user concerns and how we plan to go about it

User Concerns	**Mitigation Strategy**
Fear of incorrect diagnosis	Include disclaimers and encourage users to consult professionals
Privacy concerns (audio, camera)	Use on-device processing, request permissions transparently, display privacy policy
Unfamiliarity with technology	Simple user interface, use on boarding guides and visual tutorials
App size and data usage	Enable offline functionality and use lightweight machine learning models

VII- CHALLENGES ENCOUNTERED

During our requirement gathering and data cleaning we encountered various challenges such as

- **Difficulty reaching a broad sample size of car owners:**

Most of the car owners where either too busy or not willing to answer our questions. The few we got was as a result of insisting and pleading convincing them of the importance of the surveys and excessive sharing of the google forms.

- **Some users were reluctant to complete surveys**
  Saying the app will be completely useless or that the app might never be hosted.
- **Diverse user expectations made prioritization challenging:**
  Prioritizing features based on user expectation was a little difficult because of the diverse user expectation and suggestions.
- **Interpreting technical needs from non-technical users**

VIII- CONCLUSION

The requirement gathering phase provided a strong foundation for the Car Diagnostics System. Through effective stakeholder engagement, data collection methods, and careful interpretation, the team identified essential user needs and potential barriers to adoption. The insights gained will guide the application's design and ensure it is user-friendly, practical, and aligned with real-world automotive diagnostic challenges. Addressing user concerns proactively will also improve trust, usability, and long-term adoption of the system.

IX- APPENDIX

1) PICTURES AT A MECHANIC WORKSHOP

2) PICTURES OF THE GROUP ON THE STREET OF MOLYKO TO INTERVIEW CAR OWNERS

3) PICTURES OF THE GROUP AT MILE 17 TO INTERVIEW DRIVERS