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## FACULTY OF SCIENCE AND INFORMATION TECHNOLOGY



## DEPARTMENT OF COMPUTER SCIENCE

**OPTION OF SOFTWARE ENGINEERING**



**DESIGN AND IMPLEMENTATION OF**

**MOBILE APPLICATION FOR**

**TRACKING THE NEAREST FUEL GAS STATIONS**

**Case study: Kigali and Musanze Districts**

A dissertation submitted in partial fulfillment of requirements for the award of a Bachelor’s Degree of Science in Computer Science, option of Software Engineering.

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# CHAPTER 1: GENERAL INTRODUCTION

This chapter focuses on the following key concepts: Background of the study, Problem statement, Objectives of the study, Research questions, Research hypotheses, Choice of study, Significance of the study, Delimitation of the study, Research methodology, Organization of study.

## Background of the study

The necessity for gasoline is critical for both personal and business transportation. With the rise of urbanization and mobility, efficiently locating the nearest fuel station has become essential, particularly in areas where stations are dispersed over considerable distances (Nurhayati et al., 2020). In Rwanda, particularly on the Kigali-Musanze route, passengers frequently encounter difficulties in identifying fuel stations, resulting in inconveniences, delays, and, in some cases, running out of petrol in unfamiliar regions. This difficulty emphasizes the necessity for a technology solution that can help customers track local gas stations in real time.

Mobile applications have become an excellent tool for resolving location-based difficulties as mobile technology and GPS (Global Positioning System) services have advanced rapidly. A mobile application with live location monitoring considerably improve convenience by allowing users to easily locate the nearest gasoline station. Furthermore, an integrated ordering system simplify the fuel purchase process by allowing customers to submit orders in advance and obtain confirmation from gas stations.

The purpose of this research is to develop and deploy a mobile application that allow users to find the nearest gasoline stations depending on their current location. The software does not only help users navigate, but it also allow them to place gasoline orders, choose their preferred payment option (including mobile money and card payments), and receive order status updates (Afyenni et al., 2020). Gas stations, on the other hand, have a web-based system that enable them to manage and confirm orders, maintain ongoing transactions, and monitor gasoline demand in response to consumer demands (Karman et al., 2020).

The significance of this study stems from its capacity to bridge the gap between fuel stations and customers by offering a seamless, efficient, and user-friendly solution. Travelers, particularly those unfamiliar with certain routes, are no longer concerned about gasoline availability because they have access to real-time information on station locations and fuel stock levels. Similarly, digital transaction management help fuel station operators improve their supply chain and customer service.

With an increased reliance on technology in a variety of industries, this study contributes to the larger field of smart mobility solutions, which aligns with Rwanda's aim of digital transformation and smart infrastructure development. This project's findings and implementation does not only benefit travelers on the Kigali-Musanze route but may also applied to other regions where petroleum accessibility remains a challenge.

## Problem Statement

Travelers frequently have difficulty identifying petrol stations, especially on long-distance routes like Kigali to Musanze. A lack of easily accessible, real-time information about fuel station locations and fuel supply may cause inconvenience, unexpected delays, and even stranded automobiles. Existing methods give static location information but do not allow for real-time tracking of fuel stock or seamless ordering and payment.

This challenge emphasizes the necessity for an integrated mobile application that not only locates nearby fuel stations but also allows users to check fuel availability, place orders, and make secure payments. In addition, gas station operators demand an efficient system to manage gasoline requests and check stock levels in real time. This project aims to increase fuel accessibility, service efficiency, and contribute to Rwanda's digital transportation transformation by addressing these gaps (OYUCU & POLAT, 2021).

## The Objective of the study

This Project includes two Objectives such as general objectives and specific objectives.

### General objective

The main objective of this study is to design and implement a mobile application that allows users to find nearby fuel stations, check fuel availability, place orders, and make secure digital payments. Furthermore, the initiative have intends to equip fuel stations with a web-based platform for managing orders, tracking fuel inventory, and improving service efficiency.

### Specific objectives

* To develop a real-time tracking system that enables users to locate the nearest fuel stations according to their present location.
* Implement a fuel ordering feature that allows users to make fuel requests directly from the mobile app.
* Integrate digital payment options like mobile money and bank card transactions to make payments easy.
* Create a web-based system for fuel stations so that orders are managed and confirmed, pending requests are tracked, and fuel stocks are monitored.
* Ensure real-time updates users can check the progress of their order to see if it is approved, pending, or canceled.
* Enhance user experience by offering an easy-to-use interface for customers and gas station owners.

## Research questions

This study aims to answer the following research questions.

* How does a real-time tracking system help user find gas stations near them based on where they are?
* How can a mobile app allow user order fuel straight from gas stations?
* What are the advantages of using digital payment methods such as mobile money and bank cards for fuel purchases?
* How does a web-based system assist fuel stations in managing orders, tracking pending requests, and monitoring fuel supply levels?
* How do real-time updates improve the user experience by displaying order status (approved, pending, or canceled)?
* What features can make the mobile app simple to use for both customers and gasoline station operators?

## Research hypotheses

This study is guided by the following research hypotheses.

A mobile application for real-time fuel station monitoring, fuel availability notifications, and digital transactions improves fuel accessibility and service efficiency for passengers. It shorten wait times, avoid fuel shortages, and increase transaction speed. Gas stations benefits from better stock management and demand forecasts. The solution improves customer happiness and promote mobile payment acceptance. Travelers in rural locations may gain the most, while gasoline stations that employ digital solutions experiences increased efficiency and profitability.

## Choice of study

This study takes the research approach mentioned below.

This study examines the usefulness of a mobile application in increasing real-time fuel station accessibility, fuel availability tracking, and digital transactions for travelers. It studied the difficulties travelers have in locating fuel stations and investigate how mobile technologies can help. Data collected through surveys and questionnaires targeted at travelers and gasoline station operators, as well as experimental testing of the application. A comparative analysis performed between app users and non-users, while statistical evaluation assess the effects on service efficiency, fuel accessibility, and user happiness.

## Significance of the study

This study is significant for the following reasons.

It improves fuel accessibility by enabling real-time tracking, fuel availability updates, and digital payment methods. Travelers benefits from fewer waits and greater convenience, while gasoline station operators are able to improve stock management and streamline transactions. The report also encourages the use of technology to improve fuel services and increase gasoline access efficiency. Its findings can be applied to other regions experiencing similar fuel availability difficulties, making it a scalable and impactful solution.

## Delimitation of the study

This study is limited to the following scope.

This research focuses on creating a mobile app for real-time fuel station tracking, fuel availability updates, and digital payments. It applies only to travelers and gasoline station operators on the Kigali-Musanze route and does not cover other fuel stations in the country. The study looks at user experience, service efficiency, and fuel accessibility, but it ignores technical app development beyond functionality testing.

## Research Methodology

This study employs a research approach to assess the effectiveness of a mobile application.

Surveys and questionnaires have been used to collect data from travelers and gasoline station operators along the Kigali-Musanze route in order to identify issues in locating and managing fuel supplies. Additionally, the mobile application have been tested experimentally to determine its usability, functionality, and real-time tracking efficiency. Participants have been chosen at random, so that the study give a wide range of information about fuel accessibility and mobile app adoption.

After data collection, statistical analysis have been carried out to assess improvements in service efficiency, transaction convenience, and user happiness. To determine the system's effectiveness, a comparison analysis of app users and non-users performed. For cross-platform development, the mobile application use Flutter (Dart programming language), Firebase for real-time database management, and Google Maps API for position tracking. A web-based dashboard for fuel station operators have been built in PHP with Laravel on the back end and HTML, CSS, and JavaScript on the front end. The system also include mobile payment options such as mobile money and bank card transactions to improve customer convenience and accessibility.

## Organization of study

This study is made up of five chapters as follows:

Chapter 1. General Introduction, covers the background, problem statement, objectives research questions, significance, choice of the study.

Chapter 2. Literature Review, explores key concepts, theories, and existing research related to technology-driven solutions, real-time tracking, digital transactions, and service accessibility.

Chapter 3. Research Methodology, explains the research design, data collection methods, sampling techniques, and analysis process

Chapter 4. System Design and Implementation, focuses on designing, developing, and testing a functional system, detailing its architecture, features, and usability.

Chapter 5. Conclusion and Recommendations, summarizes findings, evaluate the system’s impact, and provides suggestions for improvements and future research.