RUAHA CATHOLIC UNIVERSITY

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

DEPARTIMENT OF COMPUTER SCIENCES

PROJECT PROPOSAL

DESIGN AND DEVELOPMENT OF A LOCATION BASED SERVICE (LBS) CAR WASH SERVICES APPLICATION

SUBMITTED BY

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2026

CERTIFICATION

I, Logatho Benedict Mwolokujova, certify that I have fully read this student's Proposal conducted at Ruaha Catholic University (RUCU) by HARUNI SAMSON MDAGACHULE, AMINA ATHUMANI MSEMO and SAUMU HAJI NGOMA as a partial fulfillment of requirements for the award of Bachelor of Computer Science, and I hereby recommend for its acceptance to the Ruaha Catholic University.

Supervisor's Signature: ……..…… Date: ……

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ABSTRACT

Accessing reliable car wash services in Tanzania remains a challenge due to limited digital platforms, increase of social distances, uneven service coverage, and inconsistent quality of services. This study proposes the design and development of a location-based service (LBS) car wash service application, developed using Flutter. The system allows users to locate nearby car wash stations, view real time availability, and make bookings efficiently. Car wash owners can confirm, reject, or modify bookings to optimize service delivery.

The research investigates the impact of real time availability notifications on customer booking efficiency and service accessibility. Effectiveness will be measured through successful bookings, reduced waiting time, improved customer satisfaction, and enhanced access to car wash services compared to traditional walk-in methods.

The expected outcome is a functional application tailored for the Tanzanian market that addresses current service gaps, streamlines booking processes, and enhances overall efficiency and user experience. By integrating digital solutions into the car wash industry, the system aims to improve accessibility, reduce waiting times, promote online payment methods and promote higher quality service delivery across urban areas.

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CHAPTER ONE

INTRODUCTION

1.0 Background of the study

The car wash industry in Tanzania, particularly within major urban centers such as Dar es Salaam, Arusha, Iringa, Mwanza, and Dodoma, has experienced steady growth driven by increasing urbanization, rising vehicle ownership, and expanding economic activities. Despite this growth, the majority of car wash service providers operate on a small scale basis and rely heavily on manual processes for service delivery, customer management, and daily operations. These providers often lack access to or adoption of digital technologies that could enhance efficiency and service quality.

The absence of digital tools within the car wash sector has led to several operational inefficiencies. Customers frequently waste valuable time and fuel searching for available car wash stations, often without prior knowledge of service availability, waiting times, or pricing[1]. Similarly, service providers face challenges in managing customer flow, scheduling services, tracking daily transactions, and maintaining consistent service standards. This manual and fragmented approach limits business scalability, reduces customer satisfaction, and constrains revenue growth for service providers[2].

Furthermore, the current car wash service environment in Tanzania lacks a centralized and reliable platform that facilitates interaction between customers and service providers. Unlike other service sectors that have increasingly adopted digital platforms to streamline operations and improve accessibility, the car wash industry remains largely unstructured and inconsistent[3]. This gap highlights a broader challenge in the digital transformation of small and medium enterprises (SMEs) within the service sector.

In response to these challenges, there is a growing need for a digital, organized, and reliable service platform that integrates car wash providers and customers within a single system. Such a platform would enable customers to easily locate nearby car wash stations, view service availability, and reduce unnecessary travel, while allowing service providers to efficiently manage bookings, customer flow, and operational records[4]. Addressing this gap aligns with national and global digital transformation

initiatives and presents an opportunity to enhance service delivery, operational efficiency, and overall customer experience within the Tanzanian car wash industry.

1.1 Problem Statement

Accessing reliable car wash services in Tanzania remains a significant challenge due to the limited adoption of digital platforms, uneven distribution of service providers, and inconsistent quality of service delivery. Most car wash operations continue to rely on manual processes, resulting in a lack of real time information regarding service availability, pricing, and waiting times[4], [5]. As a result, customers often experience frustration, unnecessary delays, and increased fuel consumption while searching for suitable car wash services.

From the service providers' perspective, the absence of an efficient digital booking and management system contributes to poor customer flow control, inefficient use of resources, and limited operational oversight. These challenges negatively affect service consistency, customer satisfaction, and overall business performance. Additionally, the lack of standardized digital records restricts data driven, decision making and limits opportunities for service optimization and expansion[6], [7].

Furthermore, the absence of a centralized digital platform that connects customers with car wash service providers hinders the industry's ability to modernize and scale. In an era where consumers increasingly expect convenient, technology driven services, the car wash sector in Tanzania risks remain behind other service industries that have successfully embraced digital transformation[4], [8]. This gap reveals the need for a comprehensive digital solution capable of improving accessibility, operational efficiency, service quality, and customer experience within the car wash industry.

1.2 Objectives of the study

1.2.1 General Objective

To design, develop, and evaluate a Location Based Service (LBS) car wash service application aimed at improving accessibility, efficiency, and service management within the Tanzanian car wash industry.

1.2.2 Specific Objectives

1. To design and develop a Location Based Service (LBS) mobile application that enables customers to locate nearby car wash service providers and make service bookings.
2. To assess the effectiveness of real time service availability and booking management features in improving customer booking efficiency and operational performance of car wash service providers.
3. To evaluate the overall performance of the developed application by measuring key indicators such as reduced waiting times, improved customer satisfaction, and enhanced access to car wash services.

1.3 Significance of the study

This study is significant due to its potential contribution to the digital transformation and modernization of the car wash industry in Tanzania through the development of a Location Based Service (LBS) car wash service application. The proposed mobile application addresses key challenges related to inefficiency, inconvenience, and lack of coordination between customers and car wash service providers.

For customers, the application provides enhanced convenience and accessibility by enabling users to locate nearby car wash service providers, view service availability, and book services remotely. This reduces time wastage, unnecessary travel, and fuel consumption, thereby improving overall user experience and satisfaction. The integration of online payment functionality further simplifies the service process by enabling faster, safer, and cashless transactions.

For car wash service providers, the application serves as a practical digital business tool that supports efficient booking management, improved customer flow, and better operational planning. By digitizing service requests and transaction records, service providers can optimize resource utilization, reduce congestion, enhance service consistency, and reach a broader customer base. This contributes to improved service delivery and increased competitiveness within the industry.

At the industry and national levels, the study supports ongoing initiatives aimed at promoting the digital adoption of small and medium enterprises (SMEs) in Tanzania. The introduction of a technology driven service application encourages economic

growth, improves service standards, and aligns the car wash sector with the expectations of an increasingly digitally connected population. Additionally, the study contributes to academic knowledge by demonstrating the practical application of Location Based Services (LBS) in addressing real world service delivery challenges within an urban Tanzanian context.

Overall, the study is important as it introduces a scalable, user centered mobile application that enhances service accessibility, improves operational efficiency, and modernizes a car service sector in Tanzania.

1.4 Scope of the study

This study focuses on the design, development, and initial evaluation of a Location Based Service (LBS) car wash service mobile application, with the implementation based in Iringa Town, Tanzania. The study is limited to urban settings, where internet connectivity and smartphone usage are sufficiently established to support the effective use of a mobile application. Future expansion of the application to other regions is considered beyond the scope of this study and is expected to be undertaken after all functional and technical requirements of the initial deployment have been successfully met.

The scope of the application includes core functionalities essential to car wash service delivery. These functionalities include location based discovery of nearby car wash service providers, service booking, real time notifications (such as booking confirmation, service progress, and notification when the vehicle is ready), estimated time of arrival to the service location, and basic service status updates. The application also integrates online payment functionality to enable secure and convenient digital transactions. In addition, the application will not only maintain digital records for both customers and car wash service providers, including booking history and basic transaction records, but it will also incorporate a rating and feedback system. This feature will allow customers to provide reviews and rate services, enabling car wash owners to identify areas for improvement and enhance service quality. Over time, the application will use these ratings to recommend top rated service providers to customers, thereby promoting customer satisfaction, encouraging repeat business, and supporting the growth of high quality service providers.

The target users of the application are car wash customers and car wash service owners operating within Iringa Town. From a technological perspective, the study involves the development of a cross platform mobile application using the Flutter framework, supported by a backend architecture compatible with Flutter based applications. Firebase is proposed as the backend database solution to handle authentication, real time data synchronization, notifications, and data storage.

The scope of the study excludes deployment in rural areas, logistics management such as vehicle transportation or delivery services, and hardware integrations including sensors, automated washing equipment, or Internet of Things (IoT) devices. Furthermore, the study does not address large scale commercialization, long term financial performance analysis, or enterprise level car wash operations.

1.5 Chapter Summary

This chapter has provided a comprehensive overview of the study on the design and development of a Location Based Service (LBS) car wash service mobile application in Tanzania. The background highlighted the growth of the car wash industry in urban centers and identified the key challenges faced by both customers and service providers, including inefficiency, inconvenience, and lack of coordination due to limited adoption of digital solutions.

The problem statement emphasized the negative impact of these challenges, such as wasted time, customer frustration, and operational inefficiencies for service providers, while highlighting the need for a centralized, technology driven application to improve service accessibility and management.

The chapter further outlined the general and specific objectives of the study, focusing on the design, development, and evaluation of an LBS mobile application, as well as the assessment of its effectiveness in enhancing booking efficiency, operational performance, and customer satisfaction.

The significance of the study was discussed, emphasizing its potential benefits for customers, service providers, the urban car wash industry, and the academic community. Key advantages include improved service accessibility, efficient management of

bookings, integration of secure online payments, and the introduction of a rating and feedback system to promote service quality and customer satisfaction.

Finally, the scope of the study defined the boundaries of the research, specifying that the application will be applied in Iringa Town, Tanzania, targeting urban customers and small to medium scale car wash service providers. The study covers core application features such as location based discovery, service booking, real time notifications, digital record keeping, online payment integration, and a rating system. Overall, this chapter sets the foundation for the study by clearly establishing the context, problem, objectives, expected contributions, and boundaries of the research, providing a solid framework for the subsequent chapters.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents a comprehensive review of literature relevant to the design and development of a Location Based Service (LBS) car wash service mobile application. The purpose of the literature review is to explore existing knowledge, concepts, and studies related to location based services, mobile applications, on demand service platforms, real time notification systems, customer behavior, and service management. Understanding the theoretical and empirical foundations of these areas provides a basis for the development of an effective and user centered car wash service application targeted for urban Tanzanian contexts.

The literature review is structured into thematic areas that are directly related to the study. These include an overview of Location Based Services (LBS) and Geographic Information Systems (GIS) in mobile applications, the principles and impact of on demand services, real time data usage and its effects on customer satisfaction and operational efficiency, privacy considerations in location aware services, as well as mechanisms for booking management, rating systems, and service provider management[1], [9], [10]. By analyzing prior research and existing applications, this chapter identifies best practices, challenges, and gaps that inform the current study and justify the development of a mobile application specifically targeting car wash services in urban Tanzania.

Through this review, the study highlights how LBS and GIS technologies can facilitate efficient service discovery, improve customer experience, optimize resource allocation, and enable data driven decision making for service providers. Additionally, it explores the behavioral aspects of customers interacting with on demand location based services, emphasizing privacy concerns and trust factors that influence adoption. Finally, the review examines the use of digital booking and rating systems as tools to enhance service quality and operational management, providing insights that underpin the proposed application's design[9], [11].

2.2 Empirical Literature Review

This section reviews empirical studies related to the application of Location Based Services (LBS), Geographic Information Systems (GIS), mobile devices, and on demand service platforms. The review focuses on how these technologies have been applied in service oriented mobile applications, their impact on efficiency and customer satisfaction, and existing challenges related to booking management, real time updates, privacy, and service quality evaluation.

2.2.1 Location Based Services (LBS) and GIS in Mobile Applications

Several empirical studies have demonstrated that Location Based Services (LBS), when integrated with Geographic Information Systems (GIS), play a crucial role in enabling users to discover nearby services and make informed decisions based on spatial data[12], [13]. Research indicates that LBS enhances service accessibility by providing real time location awareness, route estimation, and proximity based recommendations through mobile devices[11], [14]. In service-based applications, LBS has been shown to reduce search time and improve user convenience, particularly in urban environments where service density is high.

Studies further reveal that the integration of GIS with mobile platforms enables efficient spatial data processing, allowing applications to dynamically update service availability and geographic information[2], [15]. This approach has been widely applied in sectors such as transportation, food delivery, and accommodation services, where location accuracy and timeliness are critical[11], [16], [17]. However, existing studies also highlight challenges related to location accuracy, network dependency, and scalability in developing regions.

2.2.2 On Demand Services and Real Time Information

Empirical evidence suggests that on demand service applications rely heavily on real time information to meet user expectations for immediacy and convenience. Studies on on-demand platforms indicate that real-time updates such as service availability, estimated waiting times, and status notifications significantly improve customer satisfaction and perceived service reliability.

Research further shows that real-time notification systems enhance operational efficiency by enabling service providers to manage customer flow and allocate resources effectively[18]. In urban service environments, the use of real-time data has been associated with reduced waiting times and improved service coordination[1], [19]. Despite these benefits, empirical studies point out that many small-scale service providers in developing countries have yet to adopt real time digital solutions, leading to inefficiencies and inconsistent service delivery.

2.2.3 Customer Behavior and Location Privacy in On-Demand Services

Studies examining customer behavior in location based on-demand services indicate that perceived usefulness, ease of use, and trust significantly influence user adoption. Empirical findings suggest that while customers value convenience and personalization enabled by LBS, concerns about location data privacy and security can negatively affect acceptance.

Research highlights that transparent data usage policies, secure authentication mechanisms, and user controlled location permissions improve trust and willingness to use location aware applications[14], [20]. In developing country contexts, studies show that limited awareness of privacy protections can further influence customer behavior, emphasizing the need for applications to balance functionality with ethical and secure handling of location data[21].

2.2.4 Digital Booking Management Systems

Empirical studies on digital booking systems demonstrate their effectiveness in improving service coordination and operational efficiency. Booking management features such as scheduling, confirmation, cancellation, and rescheduling have been shown to reduce service congestion and enhance predictability for both customers and service providers[22], [23].

Research indicates that small and medium service businesses benefit from digital booking systems through improved record-keeping, better resource planning, and enhanced customer engagement[24], [25]. However, existing studies note that many

service-oriented mobile applications focus primarily on customer-facing features while offering limited functionality for service provider management.

2.2.5 Rating and Feedback Systems in Service Applications

Empirical research shows that rating and feedback systems play a significant role in influencing customer decision making in on-demand service platforms. Studies indicate that users tend to prefer service providers with higher ratings, associating them with better service quality and reliability[26], [27].

Additionally, rating systems have been found to encourage service providers to improve performance due to increased transparency and competition[28], [29]. However, empirical findings also reveal challenges related to biased reviews, lack of moderation, and limited integration of rating data into service recommendation mechanisms. In the context of car wash services, existing literature suggests that rating systems are often underutilized or poorly managed, limiting their effectiveness in improving service quality.

2.4 Related Works

Several related works have explored the use of mobile applications and Location-Based Services (LBS) to support service discovery, booking, and management across different service domains. Existing studies and applications in areas such as ride-hailing, food delivery, accommodation booking, and vehicle maintenance services demonstrate the effectiveness of LBS in improving service accessibility and operational efficiency[14], [30].

Related works in vehicle-related services show that mobile applications integrated with GIS and real-time data can significantly reduce customer search time and improve service coordination[12], [31]. Some studies have developed car service or vehicle maintenance applications that allow users to locate service centers, book appointments, and receive service updates. These applications commonly incorporate features such as location based search, booking management, and digital payments, highlighting the growing importance of on-demand service models[32], [33].

Other related studies have focused on the integration of real time notifications within mobile applications[34], [35]. Findings indicate that notifying customers about service status such as confirmation, progress updates, and completion enhances transparency and customer satisfaction. In addition, service providers benefit from improved scheduling and workload management through digital booking interfaces.

Research on rating and feedback mechanisms in service applications shows that such features influence customer choice and service quality improvement. Applications that integrate star ratings and customer reviews tend to promote accountability and competition among service providers[36], [37]. However, several related works reveal that rating systems are often treated as supplementary features rather than being fully integrated into recommendation and service selection mechanisms.

Despite these advancements, most existing applications and studies focus on large scale or well -structured service industries and are often designed for developed economies. Limited attention has been given to small scale service providers, such as car wash businesses in developing urban contexts. Furthermore, few related works address the combined use of LBS, real time booking, notifications, digital payments, and rating systems within a single application tailored specifically for car wash services in Tanzania[4], [36], [38].

2.3 Research Gap

The reviewed literature and related works reveal several gaps that justify the need for the current study. While number studies have demonstrated the effectiveness of Location Based Services and on-demand mobile applications in improving service accessibility and efficiency, there is limited research focusing specifically on car wash services within developing country contexts, particularly in Tanzania.

Most existing studies and applications emphasize customer functionalities, with insufficient focus on service provider management features such as booking control, service status updates, and digital record keeping for small scale operators[4]. Additionally, although rating and feedback systems are widely discussed in the literature, their structured application in managing service quality and influencing recommendations within car wash services remains underexplored[29], [36].

Furthermore, there is a lack of empirical studies examining the combined impact of real time availability notifications, digital booking management, and online payment integration on customer satisfaction and operational efficiency in the car wash industry[5], [39]. Privacy and trust issues related to location based on demand services are also discussed broadly in the literature, but limited work has been done to address these concerns within localized, small scale service applications.

This study seeks to address these gaps by designing and developing a Location-Based Service car wash service mobile application covering to the urban Tanzanian context. By integrating location based discovery, real time booking and notifications, digital payments, and a rating based recommendation mechanism, the study contributes practical and context specific insights that are currently missing in existing literature[4].

2.4 Chapter summary

This chapter reviewed relevant literature related to the design and development of a Location Based Service (LBS) car wash service mobile application. The review examined empirical studies on Location-Based Services and GIS in mobile applications, on-demand service platforms, real time information usage, customer behavior and privacy concerns, digital booking management systems, and rating and feedback mechanisms.

Related works were analyzed to understand existing approaches, technologies, and findings in service oriented mobile applications, highlighting both their strengths and limitations. The review revealed that while LBS based and on-demand applications have been successfully applied in various service sectors, limited attention has been given to small-scale car wash services in developing urban contexts such as Tanzania.

The identified research gaps demonstrated the need for a centralized, location-based mobile application that integrates booking management, real-time notifications, online payments, digital record keeping, and rating-based recommendations tailored for car wash services. These gaps provide a strong justification for the current study and establish a clear foundation for the methodology and system development discussed in the next chapter.

CHAPTER THREE

METHODOLOGY

3.1 Project approach

This study adopts a system development oriented project approach aimed at designing, developing, and evaluating a Location-Based Service (LBS) car wash service mobile application. The approach combines software engineering practices with applied research methods to address real world challenges in service accessibility and management within the car wash industry.

An **Agile development methodology** is employed to support iterative development, continuous testing, and regular refinement of application features based on evolving requirements. This approach allows flexibility, early identification of issues, and incremental delivery of functional components throughout the project lifecycle[40].

3.2 Project methods

The project employs several methods, tools, and techniques throughout the development process:

3.2.1 Requirement Specification

The application requirements are categorized into functional and non-functional requirements.

Functional Requirements

The application enables customers to search for nearby car wash stations using location based services, view real time availability, book service time slots, receive notifications, make online payments, and submit ratings and feedback. Car wash owners are able to register their stations, update service availability, accept or reject bookings, monitor transactions, and manage customer records.

Non-Functional Requirements:

The application is designed to be user friendly with an intuitive interface, reliable in performance, scalable to accommodate future growth, and secure to protect user data and payment information.

3.2.2 Development Tools and Technologies

- **Frontend:** Flutter framework for cross platform mobile application development (Android and iOS).
- **Backend:** Firebase services including Authentication, Firestore Database, Cloud Functions, and Cloud Messaging.
- **Database:** Firestore (NoSQL).
- **Location Services:** Google Maps API.
- **Payment Integration:** Mobile money APIs such as M-Pesa Daraja API and Tigo Pesa API.
- **UI/UX Design:** Figma.
- **Version Control:** Git and GitHub.
- **Development Environment:** Android Studio and Visual Studio Code.

3.2.3 Hardware and Software Requirements

Development machines include laptops or desktop computers with at least 8GB RAM, 256GB SSD storage, and multi core processors. Android and iOS mobile devices are used for testing application compatibility and performance. Supported development operating systems include Windows, Linux, and macOS.

3.4 Ethical Considerations

Ethical principles are observed throughout the study to ensure responsible research and development practices. User data such as personal details, location information, and payment records are securely managed using authenticated access and encrypted communication. User consent is required before collecting location data, and privacy controls are incorporated to comply with acceptable data protection standards. The application is designed to use customer ratings and feedback fairly, without manipulation or misrepresentation of service providers

3.5 Study timeline

The project is executed in four major phases as shown in Table 3.1

Phase	Description	Start Date	End Date	Duration
I	Planning & Design	Week 1	Week 4	4 Weeks
II	System Development	Week 5	Week 16	12 Weeks
III	Testing & Evaluation	Week 17	Week 20	4 Weeks
IV	Deployment & Maintenance	Week 21	Week 24	4 Weeks

Table 3.1 studying timeline

3.6 Study Budget

The estimated budget for the study is summarized in Table 3.2

No	Item Description	Cost (TZS)
1.	Play Developer Fee ($25 one-time)	60,000
2.	Apple Developer Program Fee ($99/year)	250,000
3.	Payment Gateway API (M-Pesa Daraja) fees	200,000
4.	Google Maps API Platform (usage fees)	150,000
5.	Research & Planning Internet data, printing, documentation	150,000
6.	Design & Prototyping UI/UX Software (Figma) Subscription	100,000
7.	Deployment & Testing Pre-deployment testing devices & services	165,000
8.	Unforeseen expenses (10%)	107,500
9.	Total Estimated Project Cost	1,182,500

3.7 Chapter summary

This chapter described the methodology adopted for the design and development of a Location Based Service (LBS) car wash service mobile application. The chapter outlined the overall project approach, which employed a system development oriented methodology supported by Agile principles to ensure iterative development, flexibility, and continuous improvement throughout the project lifecycle.

The research and project methods were discussed in detail, including requirement specification, development tools and technologies, and the hardware and software resources used in implementing the application. The chapter also described the functional and non-functional requirements that guided the application's design and development process.

Furthermore, the geographical scope of the study was defined, with Iringa Town selected as the pilot area for implementation and evaluation. Ethical considerations related to user data protection, location privacy, secure payment handling, and fair use of customer feedback were also addressed.

Finally, the chapter presented the study timeline and estimated project budget, outlining the phases of project execution and the resources required to successfully complete the study. Overall, this chapter provides a clear and structured framework for the development, implementation, and evaluation of the proposed LBS car wash service mobile application.

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