BUSITEMA UNIVERSITY FACULTY OF SCIENCE AND EDUCATION

PARKING RESERVATION SYSTEM

CASE STUDY: MASESE PARK, JINJA CITY.

By

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DECLARATION

I, **KAGOYA DIANA**, with registration number BU/UP/2023/1486 hereby declare that this project report is original and has not been published or submitted for any other degree award to any other university before.

Sign: .....

Date: 24th/08/2026

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APPROVAL

This is to acknowledge that this project report is for KAGOYA DIANA Registration number BU/UP/2023/1486. It was done under my supervision and was completed successfully.

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DEDICATION

First and foremost, I thank the Almighty God who has enabled me to complete this report with all the divine wisdom and sound mind.

I then dedicate this report to the most wonderful woman in the world, my mum, MRS KYONDERE DAMALIE**,** my daddy MR. KYONDERE SANDE DAVID, and my loving two brothers Afande Simon and Ord.Emma, sisters Ruth, Cathy Viola and my one sibling Esther. Thank you so much for the support and may the Almighty reward you abundantly.

I also dedicate this report to my dear supervisors Dr. ANGOLE RICHARD and Dr. MUSANA EDDIE who guided me throughout the process of making this report successfully. Thank you so much sir for imparting knowledge in me.

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ABBREVIATIONS.

CPU Central Processing Unit

CSS Cascading Style Sheete

DFD Data Flow Diagram

ERD Entity Relationship Diagram

GUI Graphical User Interface

HTML Hyper Text Markup Language

PHP Hypertext Processor

RAM Random Access Memory

RAD Rapid Application Development

SQL Structured Query Language

UI User Interface

UPS Uninterruptible Power Supply

ABSTRACT

The increasing demand for effective monitoring and evaluation of a parking Reservation System has highlighted the limitations of traditional manual processes that rely on physical bookings. At Masese Park, this approach has been associated with inefficiencies such as loss or damage of records, incomplete entries, delayed supervisor feedback, and difficulties in consolidating data for assessment and getting booking areas. To address these challenges,

this study deployed a web-Based Parking Reservation System aimed at providing a centralizes, automated, and user-friendly platform for recording, monitoring, and evaluating parking activities. The project employed the Rapid Application Development (RAD) methodology, which facilitated iterative prototyping and active involvement of stakeholders throughout the development cycle. Data requirements were gathered through interviews, literature review, and observation, ensuring that the system reflected both user needs and institutional requirements. The system was designed using Unified Modelling Language (UML) strategies to capture system processes, user interactions, and data flows in a structured manner. The implementation phase utilized HTML, CSS, JavaScript for developing interactive user interfaces, PHP, and MySQL for backend services. These were chosen for their interoperability, scalability, and suitability for web-based deployment. Following development, the system underwent testing and validation involving users (Drivers) and coordinators at Masese Park. The results demonstrated that the system effectively met its objectives by enabling digital logging of users and admins activities and ensuring real-time accessibility of records. Overall, the system successfully demonstrated the potential to replace manual parking activities at Masese Park with an automated solution that enhances accountability, reduces administrative workload, and improve he overall quality of internship monitoring and evaluation.

This project therefore contributes both a practical tool and a methodological framework for institutions seeking to modernize parking management processes.

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

The rapid growth of urban populations and the increasing number of vehicles have created significant challenges in parking management across many cities worldwide (HA Halim, 2024)Efficient parking systems are essential for ensuring smooth transportation, reducing congestion, and improving urban mobility. However, many urban areas still rely on traditional parking management methods that are often inefficient, time-consuming, and inconvenient for drivers.

The urban landscape of Masese Park Jinja City, Uganda, characterized by its bustling streets and growing population, is symbolic of many contemporary cities worldwide. Amidst this urban growth, the challenge of parking management has become increasingly pronounced. Masese Park, situated within this dynamic environment, serves as a pivotal hub for vehicle parking, accommodating the needs of residents, commuters, and businesses alike.

In Jinja city, particularly in areas such as Masese Park, the demand for parking spaces continues to rise due to increased commercial activities, population growth, and urban development. Drivers frequently experience difficulties in locating available parking spaces, which leads to traffic congestion, unnecessary fuel consumption, environmental pollution, and loss of productive time. The lack of real-time information about parking availability further worsens the situation and results in poor utilization of existing parking facilities. HA Halim (2024)

However, the traditional methods of parking management employed at Masese Park have shown signs of strain under the weight of mounting demand.(Mohamed et al., 2021) The absence of a streamlined system for parking allocation often results in inefficient utilization of space, exacerbating issues such as congestion and frustration among drivers. Additionally, the lack of real-time information on parking availability further compounds the challenges faced by both users and operators.

This study therefore focuses on the design and development of a Parking Reservation System for Masese Park in Jinja City. The proposed system aims to provide drivers with the ability to easily locate, reserve, and pay for parking spaces using their mobile devices. By introducing a digital parking management platform, the study seeks to reduce congestion, improve parking space utilization, and enhance the overall parking experience for users while supporting smarter urban mobility solution.

With the advancement of mobile technologies and smart systems, digital solutions have emerged as effective tools for addressing urban parking challenges. Parking Systems have the potential to transform parking management by providing real-time information, enabling advance reservations, and allowing secure digital payments. Such systems not only enhance convenience for drivers but also improve efficiency in the management of parking facilities.

Against this backdrop, this research endeavours to delve into the details of parking management at Masese Park. By examining the existing challenges and opportunities, as well as the technological landscape, the study aims to lay the groundwork for the development and implementation of a Parking Reservation System tailored to the specific needs of this parking facility. Through this endeavour, there search seeks to not only address immediate concerns but also contribute to the broader discourse on urban mobility and smart city solutions.

1.2 Problem statement

Parking congestion in urban areas, including Masese Park Jinja City, creates multiple challenges that affect daily life and urban operations. The scarcity of available parking spaces forces drivers to circle repeatedly, exacerbating traffic congestion on and around Jinja City.(Donald Shoup, 2021)This prolonged driving increases fuel consumption, leading to higher levels of air pollution and greenhouse gas emissions, which harm the environment. Furthermore, the time wasted searching for parking frustrates drivers and passengers, reducing productivity and urban accessibility. Local businesses near the city also suffer, as the difficulty in finding parking discourages customers, resulting in decreased foot traffic and economic losses. (Pawar et al., 2021)The lack of an efficient parking management system worsens these issues, highlighting the urgent need for a streamlined solution.

A Parking Reservation would address these problems by enabling users to reserve parking spots in advance, reducing congestion, minimizing environmental impact, and improving the overall mobility experience at Masese Park, Jinja City. The absence of real-time parking information further compounds these challenges, as drivers lack visibility into available spaces, leading to inefficient use of existing parking infrastructure.(Pawar et al., 2021) This inefficiency often results in unauthorized parking or overcrowding in certain areas, creating safety hazards and is rusting urban operations.

Additionally, the stress and inconvenience of finding parking negatively impact the user experience, particularly for drivers and passengers with tight schedules. By implementing a Parking Reservation System, Masese park can optimize parking allocation, provide real-time updates on availability, and enhance safety and convenience.(Donald Shoup, 2021) This solution will not only alleviate congestion but also promote a more sustainable and efficient urban environment, aligning with broader goals of improving urban mobility and reducing environmental impact.(Pawar et al., 2021).

1.3 Objectives of the study

1.3.1 Main Objective

To develop a parking reservation System for securing day and night parking in Masese Park, Jinja City aiming to improve parking efficiency and user satisfaction.

1.3.2 Specific Objectives

1. To review the literature and determine the requirements for the parking reservation System.
2. To design a parking reservation System with a user-friendly interface.
3. To implement the parking reservation System.
4. To test and validate the parking reservation System to ensure its efficient and reliable.

1.4 Significance of the Study

The need for a Parking Reservation System in Jinja City is evident due to the persistent challenges of parking congestion, which contribute to traffic delays, environmental degradation, and economic inefficiencies. (Sinaga et al., 2023)The current lack of a digital parking management system results in drivers wasting time searching for parking, increased vehicle emissions, and reduced customer visits to local businesses. These issues hinder the city's mobility and economic growth, particularly in busy commercial areas. Upon successful completion of the study, the Parking Reservation System will offer several benefits such as; enable drivers to reserve parking spots in advance, provide real-time parking availability updates, offer a secure and convenient payment method, enhancing user trust and accessibility, a user-friendly interface tailored to the needs of Masese Park Jinja City's drivers, ensuring ease of use for diverse populations.(HA Halim, 2024).

The study will also be significant to future researchers by providing a reference framework for the design and implementation of Parking Reservation Systems in urban areas. The findings, system design, and implementation strategies documented to the existing body of knowledge on smart parking management and intelligent transportation systems. Future researchers can use the results of this study as a foundation for developing more advanced parking solutions, integrating emerging technologies such as Artificial Intelligence (AI), Internet of Things (IoT), and automated vehicle tracking systems. Additionally, the study will provide empirical data that can support further investigations into reducing traffic congestion, improving urban mobility, and enhancing environmental sustainability in cities similar to Jinja City.

1.5 Scope of the Study

1.5.1 Content Scope

The Parking Reservation System was focused on providing a comprehensive digital platform for drivers in Jinja City to book, secure day and night parking spots. The system allowed users to view real- time parking availability, reserve spots, and make payments via mobile money. It will include a database of parking locations, integrating both public and private parking facilities in Jinja City. The system will feature a user-friendly interface built; it will incorporate secure authentication to protect user data and transactions. A dashboard for parking operators will enable real-time monitoring of bookings and space availability. The System will prioritize usability, security, and scalability to meet the needs of Jinja City's diverse driver population.

1.5.2 Geographical Scope

The study was conducted at Masese Park in Jinja City, Uganda, focusing on secure day and night parking facilities in commercial and public areas. The findings and solutions developed will be applicable to other urban centers facing similar parking challenges.

1.5.3Time Scope

The study was conducted over a period of three months, from 1 march 2026 to 30th may 2026.

CHAPTER TWO:
Literature Review

2.1 Introduction

A Parking Reservation System is a digital system designed to help drivers locate, reserve, and pay for parking spaces using their smart phones. The system integrates real-time data, GPS mapping, and payment gateways to simplify the parking process, reduce congestion, and improve urban mobility. It operates through a user-friendly mobile interface that allows users to view available parking spots, make bookings in advance, and navigate directly to the reserved location. On the management side, administrators can monitor space utilization, generate reports, and optimize resource allocation (Shihao et al., 2025) This chapter reviews the related literature on automated sales and inventory systems, with a particular focus on parking management solutions. It presents relevant information from previous studies as discussed in journals, text books and web sources. Parking management in urban and sub urban settings is a critical issue that affects traffic flow, urban planning, and the daily lives of residents and visitors. This literature review examines the existing challenges in parking management, explores how a parking reservation System can address these challenges, discusses the features and functionalities to be integrated into such an application, and outlines the potential benefits of its implementation.(Sinaga *et al*., 2023)

2.2 Analysis of different kinds of System

According to (Donald Shoup, 2021), there are different advantages of sales but explains the main advantage as seen below;

A business organization can generate revenue from a variety of sources, including operating income from sales royalties, dividend and interest income from financial assets it owns, pay-out from insurance policies, rental income and capital gains from the sale of owned properties. However, even where organizations derive little or no taxable income directly from operations stemming from sales such as an investment company, they must still generally have some sort of sales effort to generate investment revenue to fund their investments in income-producing assets. For example, a limited partnership must often engage in a concentrated sales effort to recruit more limited partners.

2.3 Existing Challenges in Parking Management

Parking management faces multi-faceted challenges that vary depending on the location and infrastructure of the parking facilities. Common challenges include:

Limited Parking Supply: Urban areas often struggle with a shortage of available parking spaces relative to the number of vehicles seeking parking. This scarcity leads to competition for spots, congestion, and frustration among drivers,

Inefficient Space Utilization: Many parking facilities do not efficiently utilize their available space. Poor layout designs, lack of dynamic allocation systems, and in adequate signage contribute to underutilized spaces and uneven distribution of parking demand (Donald Shoup, 2021), Traffic Congestion: Circling for parking contributes significantly to urban traffic congestion. Studies indicate that a substantial portion of traffic in urban centres is caused by drivers searching for parking, leading to increased emissions and wasted fuel(Hampshire and Shoup, 2018), Manual and Semi-Automated Systems: Traditional parking reservation and management systems often rely on manual or semi-automated processes. These systems can be slow, prone to errors, and lack the flexibility to adapt to changing demand patterns.(F Donald Shoup - 2018, 2018), User Perceptions and Adoption: Research indicates varying levels of user satisfaction and adoption rates of parking Reservation System. While younger, tech-savvy demographics tend to embrace these technologies more readily, older demographics and those less familiar with smartphone technology may exhibits lower adoption rates(Sinaga, 2023) Understanding user perceptions and addressing usability issues are essential for increasing adoption rates and maximizing the app's effectiveness.

2.4 Addressing Challenges with a Parking Reservation System

A Parking Reservation System offers several potential solutions to the challenges faced in parking management:

Real-Time Availability Information: Systems can provide users with real-time information about available parking spots. This feature reduces the time spent searching for parking and helps optimize the use of existing parking resources (F Donald Shoup - 2018, 2018).

Reservation Convenience: Users can book parking spots in advance using the app, ensuring guaranteed access to a spot upon arrival. This reduces uncertainty and improves the overall experience for drivers (Sinaga, 2023), Optimized Space Utilization: By enabling dynamic

pricing and allocation strategies, the app can optimize the utilization of parking spaces. This includes maximizing revenue generation for parking operators and ensuring efficient use of limited resources (Jakhar *et al*., 2025), Traffic Flow Management: Apps can provide navigation tools that guide users directly to their reserve d parking spots. This minimizes circling and congestion around parking facilities, improving overall traffic flow in urban areas (F Donald Shoup - 2018).

2.5 Features and Functionalities of a Parking Reservation System.

Key features that should be integrated into a Parking Reservation System include:

Real-Time Spot Availability: Providing users with up-to-date information on available parking spots within a specific area or facility, Reservation and Payment Integration: Allowing users to easily book and pay for parking spots through the System, using secure payment gateways and options for multiple payment methods, Navigation and Guidance: Offering turn-by-turn navigation to guide users to their reserved parking spots, using GPS and mapping technologies, User Feedback and Support: Including features for users to provide feedback on their parking experience and access customer support for assistance or inquiries, Integration with Existing Infrastructure: Ensuring compatibility with existing parking management systems and infrastructure to facilitate seamless operation and data sharing (Donald Shoup, 2021).

2.6 Potential Benefits of Implementing the Parking Reservation System.

Implementing a Parking Reservation System can yield significant benefits for both users and parking facility operators:

Improved User Experience: Enhanced convenience and reduced stress associated with finding parking spots, leading to higher user satisfaction and loyalty, Increased Efficiency: Optimized use of parking spaces, reducing idle times and maximizing revenue potential for parking operators, Environmental Impact: Reduced emissions and fuel consumption from decreased circling and congestion, contributing to environmental sustainability goals(Donald Shoup, 2021), Data-Driven Insights: Access to data analytics and reporting capabilities that provide insights into parking patterns, demand trends, and user behaviour. This data can inform future planning and decision-making for urban mobility, Revenue Generation: Potential for increased revenue through higher occupancy rates, premium pricing or peak times, and additional services offered through the system(Pradhan, 2025).

2.7 User Perceptions and Adoption

The adoption of parking systems is influenced by various factors, including user perceptions, technological readiness, and the perceived benefits versus costs. Research indicates that younger demographics and tech-savvy users are more likely to adopt these technologies, while older demographics may require additional support and education.

2.8 Challenges and Considerations

Despite the potential benefits, implementing a Parking Reservation System comes with challenges that need to be addressed:

Security and Privacy Concerns: Ensuring robust data security measures to protect user information and payment details from cyber threats and breaches, Integration Complexity: Compatibility with existing parking infrastructure, systems, and regulations may pose integration challenges that require careful planning and execution(Dr. Jatin Jakhar, 2025), User Education and Engagement: Overcoming resistance to change and educating users about the benefits and functionalities of the app to encourage adoption and usage, Regulatory Compliance: Adhering to local regulations and legal requirements governing parking operations, data privacy, and payment processing (Pradhan, 2025).

2.9 Future Directions and Emerging Technologies

Future research in the field of parking Reservation Systems should explore emerging technologies and trends, such as: Artificial Intelligence (AI)and Machine Learning: Predictive analytics for parking demand fore casting and dynamic pricing strategies.

Internet of Things (IoT): Sensors and smart parking meters for real-time data collection and management, Block chain Technology: Secure and transparent transactions for payment processing and data sharing (Pradhan, 2025), User-Cantered Design: Continuous improvement of app usability and accessibility to cater to diverse user demographics and preferences.

CHAPTER THREE:
METHODOLOGY

3.1 Introduction

This chapter presents the methods and procedures that were followed in the design and development of the proposed Parking Reservation System. It describes the research design, system development, methodology, data collection techniques, system design tools, and testing strategies that guided the successful completion of the project.

3.2 Research Design

The study adopted a System Development Research Design, which involves identifying a real-world problem, analysing it, and developing a technological solution to address it. This design enabled the researcher to collect relevant data, design system requirements and implement a functional prototype that solves the identified parking challenges. Both qualitative and quantitative methods were used to collect and analyse data from different stakeholders such as drivers, parking attendants and administrators.(Sinaga et al., 2023).

3.3 Area of Study

The study was conducted at Masese Park Jinja City, particularly focusing on the parking areas around. This area was selected because of the increasing number of vehicles and the resulting parking congestion, which often leads to time wastage and traffic disorder. The users involved in the study include businessmen, customers and visitors frequently use parking facilities. The findings from this study were used to design and develop a parking reservation System that can be customized for other institutions with similar parking challenges.(Sinaga et al., 2023)

3.4 Target Population

The target population consisted of the following groups at Masese Park

- Staff involved in managing parking reservations and billing and drivers who utilize the parking facilities.

3.5 Sampling

Sampling Method

The following sampling methods were used in the study;

Purposive Sampling: This method was used to select drivers and system administrators with specific knowledge and experience in parking management operations. Their input was used to gather in-depth, context-specific requirements during the system design and development phase.

Simple Random Sampling: This method was applied to randomly select drivers and cashier who frequently use parking facilities. This method ensured that every user had an equal chance of being selected, which provided a representative sample for the testing and validation phase of the system, ensuring it met the needs of the broader user population as shown in the table below.

Table 1: Expected Sample Distribution

Target Population	**Sampling method**	**Sample Size**
Manager	Purposive	3
Cashier	Purposive	2
Drivers	Random sampling	5

The sample included managers because they supervise the parking operations and understood the system requirements. Cashiers or attendants were included because they handle payments and manage parking entries.

This distribution ensures that the study collects reliable information from all stakeholders involved in the parking system.

3.6 Data Collection Methods

To ensure that the system requirements are well understood, data was collected from potential users and stakeholders using the following methods:

Interviews: Interviews were conducted with manager, cashier, and drivers to obtain first hand information about existing challenges in parking management.

Questionnaires: Structured questionnaires were distributed to a sample of drivers to gather data about their experiences, preferences, and expectations regarding the parking reservation system.

Observation: Direct observation was carried out at parking areas to understand congestion patterns, space utilization, and booking challenges.

Document Review: Analysis and Design of Information System for Parking Management journals, was reviewed to identify best practices and gaps that the proposed system will address.(Jakhar et al., 2025)

3.7 System Development Methodology

The system was developed using the Rapid Application Development (RAD) methodology to design and develop the parking reservation system. This methodology is suitable because it allows continuous user involvement, flexibility in handling changing requirements, and incremental development, where the system is built and improved through iterative phases.(Nik Mustapa and Mustapa, 2020).

Planning Phase: The objectives, scope, and requirements of the Parking system was defined. This phase involves consultations with potential users and stakeholders to identify system needs and expected outcomes.

Analysis Phase: The existing parking management problems was analysed, and user requirements were gathered using questionnaires, interviews, and observation. The functional and non-functional requirements were documented.

Design Phase: System modelling was carried out to represent the structure and flow of data within the system. Tools such as Dataflow Diagrams (DFDs), Entity Relationship Diagrams (ERDs), and Use Case Diagrams were used. The user interface and database schema were also designed during this stage.(Pradhan *et al*., 2025)

Implementation Phase: The system was implemented in the following phases:

1. System Setup: This phase involved preparing the development environment necessary for building the Parking Reservation System. Development tools such as Visual Studio 2022 were installed and configured. The required programming frameworks and libraries were also set up to support system development. In addition, a local server environment and the database management system MySQL was configured to enable system testing and data management during development.

2. Frontend Development**:** This phase involved designing and developing the user interface of the system. The interfaces allowed users to register, log in, check available parking spaces, reserve parking spots, and view reservation details. The system dashboard was designed for administrators to monitor parking activities, manage parking spaces, and

generate reports. The interface was designed to be simple, clear, and user-friendly for all system users.

3.Database Development: During this phase, the database structure of the Parking Reservation System was designed and implemented. Tables were created to store important information such as user accounts, parking spaces, reservations, payments, and system administrators. Relationships between tables were defined to ensure efficient storage, retrieval, and management of data. The database supported real-time updates of parking availability and reservation records.

3.7.1 System Design Tools

The following tools were used during the design stage of the system:

Unified Modelling Language (UML): UML diagrams were used to visually describe the structure and behaviour of the system. The diagrams help developers and stakeholders understand how the system works before implementation, examples include:

- Use Case Diagrams – show interactions between users and the system such as booking a parking slot, making payment, and managing parking spaces.
- Class Diagrams – illustrate system classes such as User, Reservation, Parking Slot, and Payment, and how they relate to each other.
- Sequence Diagrams – show the order of interactions when a user reserves a parking space.

Data Flow Diagrams (DFD): DFDs were used to show how data moves through the system. They illustrate how users input data, how it is processed, stored in the database, and how results are produced.

Entity Relationship Diagram (ERD): ERDs were used to design the database structure. They show entities such as, Users, Vehicles, Parking Slots, Reservations, Payments and the relationships between them. Flowcharts were used to represent the step-by-step process of the parking reservation process, including registration, booking, and payment confirmation.

3.7.2 System Development Tools

The development of the system involved the following tools and technologies:

Programming Languages, SQL – used for managing and querying the database. Development Environment, Microsoft Visual Studio – used for coding, debugging, and building the application.

Database Management System, MySQL – used to store and manage system data such as users, parking spaces, and reservations.

Server Environment, XAMPP – used as a local server environment for testing the system and managing the database.

3.7.3 Hardware Requirements

The following hardware was used during system development and testing, Laptop or Desktop Computer, Internet connection for system updates and database access

3.7.4 System Testing

The developed system was tested to verify its functionality and performance:

Unit Testing: Each module was tested individually to ensure correct functionality.

Integration Testing: The interaction between modules (app, database, API) was verified.

System Testing: The complete system was tested to ensure that it meets all functional requirements.

User Acceptance Testing (UAT): Selected users tested the system and provide feedback for final improvements.

System Integration: In this phase, all components of the system, including the user interface, backend services, and database, were integrated to work together as one complete system. Testing was conducted to ensure that the reservation process, parking availability updates, and user management functions operate smoothly. Any identified errors were corrected to ensure the system performs efficiently before deployment.

Testing Phase: Various testing methods such as unit testing, integration testing, and user acceptance testing were conducted to ensure that the system functions correctly and meets user expectations.

Deployment Phase: Users were trained and guided on how to use the system effectively.

Maintenance Phase: After deployment, the system was monitored and maintained regularly to fix bugs, improve performance, and update features based on user feedback.(Jakhar *et al*., 2025)

3.7.5 Ethical Considerations

All data collected from participants were treated with confidentiality and used solely for academic and system development purposes. Participants were informed about the purpose of the study and their consent was to be obtained before any data collection.

CHAPTER FOUR:
FIELD STUDY AND SYSTEMS DESIGN

4.1 Introduction

This chapter presents the results from the field study conducted in Jinja City regarding the proposed Parking Reservation System. The chapter describes the background information of the current parking management system and the new system requirements gathered during the study, including functional and non-functional requirements. It also explains the design of the proposed system, covering the system architecture, context diagram, data flow diagram, entity relationship diagram, and use case diagram.

4.2 Background Information of the Current System

The current parking management system in Jinja City is largely manual and uncoordinated. Drivers search for parking spaces physically without any digital guidance or reservation mechanism. The following problems were identified during the field study:

Difficulty in locating parking spaces. Drivers spend a lot of time moving around looking for available parking spaces, especially during busy hours in commercial areas.

Traffic congestion caused by parking search. Vehicles moving slowly while searching for parking contribute heavily to traffic congestion within the city.

No real-time parking information. Drivers have no way of knowing whether parking spaces are available before reaching a parking area.

Lack of advance booking services. The current system does not allow drivers to reserve parking spaces before arrival, resulting in competition for limited spaces.

Manual fee collection and management**.** Parking attendants collect fees manually, which can lead to delays, loss of records, and revenue leakages.

Poor security and vehicle monitoring. There is limited monitoring of parked vehicles, increasing risks of theft and vehicle damage.

No centralized parking records. The current system does not maintain proper digital records of parking usage, payments, or customer history.

Environmental pollution. Vehicles moving around searching for parking consume extra fuel and increase carbon emissions.

4.3 System Study and Analysis

The study was carried out in Jinja City, and the main purpose of the study was to identify the challenges faced by drivers while searching for parking spaces and the difficulties encountered by parking operators in managing parking activities manually. The study involved examining the existing parking management practices to determine their strengths and weaknesses. Information was gathered using semi-structured interviews and questionnaires administered to drivers, parking attendants, and parking managers. The

collected data were analysed to provide the basis for designing the proposed Parking Reservation System.

4.3.1 Findings from Interviews and Questionnaires

Findings from Driver Questionnaires

A total of 10 drivers responded to the questionnaire. The survey aimed to understand current parking challenges, parking habits, technology readiness, and desired system features. The findings are presented below:

Current methods of finding parking spaces, when asked how they currently locate parking spaces in Jinja City, most drivers reported physically driving around until they find an empty spot.

Out of the 10 respondents, 3 drivers (30%) said they rely entirely on physically searching for parking spaces. Five drivers (16.7%) reported asking parking attendants for help, while three drivers (10.0%) stated they usually park far away and walk to their destinations. The remaining drivers (6.6%) said they depend on friends or family for parking guidance.

Challenges faced while parking, Drivers were asked about the major challenges they face while parking in town. The responses revealed several significant problems.

Other challenges included poor security for parked vehicles, lack of clear parking information, and long walking distances after parking.

Use of digital parking services, Regarding the use of digital systems for parking, the majority of drivers reported that they do not currently use any parking application.

Out of the 10 respondents, 3 drivers (7%) stated that they have never used a parking application before.

Only seven drivers (23.3%) reported having experience with digital payment or navigation applications related to transport services.

Technology access and readiness, Drivers were asked about smartphone ownership and their readiness to use a mobile parking reservation application.

Five drivers (50%) reported owning smartphones with internet access. Two drivers (16.7%) said they share smartphones with family members, while three drivers (10.0%) reported using only basic phones.

When asked to rate how easy it would be to use a parking reservation application on a scale of 1 (Very Difficult) to 5 (Very Easy), the responses showed positive readiness toward digital adoption. Eleven drivers (36.7%) rated it as “Very Easy,” ten drivers (33.3%) rated it as “Easy,” five drivers (16.7%) were neutral, and four drivers (13.3%) rated it as “Difficult.” The average rating was 3.9 out of 5, indicating moderate to high readiness for the proposed system.

Most common parking difficulties, drivers were asked to identify the parking issue they experience most frequently.

Lack of parking spaces was the most cited problem, mentioned by 5 drivers (5.0%). One driver stated, *"Parking spaces are always full during working hours."*

Traffic congestion was mentioned by eight drivers (26.7%). Another respondent explained, *"Too many cars searching for parking create unnecessary traffic."*

Poor security for parked vehicles was cited by four drivers (13.3%), while high parking costs were mentioned by three drivers (10.0%).

Perceived helpfulness of parking reservation services,

Drivers were asked to rate how helpful they would find a system that allows them to reserve parking spaces in advance.

Ten drivers (33.3%) rated the feature as "Extremely Helpful." One respondent stated, *"It would save a lot of time."*

Nine drivers (30.0%) rated it as "Very Helpful," while eight drivers (26.7%) rated it as "Moderately Helpful." Only three drivers (10.0%) rated it as "Slightly Helpful." No respondent rated it as "Not Helpful." The average rating was 4.0 out of 5, showing strong interest in the proposed system.

Desired features in the parking reservation system, Drivers were asked what features they would like to see in the proposed system.

The most requested feature, mentioned by eight drivers (26.7%), was real-time parking availability updates. One driver stated, *"I want to know where spaces are free before reaching town."*

Six drivers (20.0%) requested advance parking reservations. Another respondent explained, *"Booking before leaving home would help a lot."*

Other desired features included mobile payment integration, GPS navigation to parking areas, parking fee transparency, and security alerts for parked vehicles.

Findings from Interviews with Parking Operators and Managers, A semi-structured interview was conducted with parking attendants and parking managers to understand current parking management practices and desired system features.

Current parking management practices and limitations, Parking operators explained that parking management is currently handled manually. Drivers pay cash directly to attendants, and space allocation is done physically. The operators noted that there is no proper tracking of available parking spaces, payments, or vehicle records.

Desired dashboard information, Parking managers indicated that the most useful information on a digital dashboard would include the number of available spaces, daily revenue reports, vehicle parking history, and alerts when parking areas become full.

Preferred notification methods**,** Parking operators preferred SMS alerts and in-app notifications for informing drivers about parking reservations, payment confirmations, and parking time reminders.

Common parking challenges observed, Parking attendants stated that drivers frequently become frustrated due to limited parking spaces, traffic congestion, and unclear parking guidance.

Most important system feature, the operators identified real-time parking availability tracking as the most important feature because it would reduce congestion and improve parking efficiency.

Desired system improvements, the managers emphasized that the system should be simple, affordable, secure, and easy for both drivers and parking attendants to use.

4.3.2 Strengths of the Current System

Simple to operate, the current parking system is easy to understand because it relies on manual processes familiar to both drivers and parking attendants, Low operational costs, the manual system does not require expensive hardware, software, or internet infrastructure, Human interaction, Drivers can directly communicate with parking attendants for assistance and guidance, Works without internet connectivity, the current system can operate even in areas with poor network access, Minimal technical skills required, Parking attendants do not require advanced computer skills to manage parking activities manually.

4.3.3 Weaknesses of the Current System

- No real-time parking information. Drivers cannot know whether parking spaces are available before arriving at parking areas.
- Traffic congestion. Vehicles searching for parking contribute significantly to congestion within the city.
- No advance reservation mechanism. Drivers cannot reserve parking spaces before arrival.
- Manual payment management. Cash-based fee collection can lead to revenue losses and poor record management.
- Poor security monitoring. There are limited tracking and monitoring of parked vehicles.
- No centralized data storage. Parking records are not properly stored for future analysis and decision-making.
- Time wastage. Drivers spend excessive time searching for parking spaces.
- Environmental pollution. Additional vehicle movement while searching for parking increases fuel consumption and air pollution.

4.4 System Requirements.

System requirements define what the system must do and how well it must perform to meet the needs of end users. They were categorized into functional and non-functional requirements as described below;

4.4.1 Functional Requirements.

Functional Requirements

- User Registration and Login: The system shall allow users to create accounts and securely log into the system using their credentials.
- View Available Parking Slots: The system shall enable users to view available parking spaces in real time before making reservations.
- Booking and Reservation of Parking Spaces: The system shall allow users to reserve and book parking slots according to their preferred time and location.
- Payment Integration: The system shall support digital payment methods to enable users to pay parking fees electronically.
- Booking Confirmation and Notifications: The system shall provide booking confirmations and send notifications or alerts related to reservations and payments.
- Admin Management of Parking Slots and Users: The system shall allow administrators to manage parking spaces, monitor bookings, and control user accounts within the system.

4.4.2 Non-Functional Requirements

- Usability: The system must have simple and user-friendly interface that is accessible to users with minimal technical knowledge.
- Security: Secure authentication and payment handling
- Performance: The system should load quickly and handle concurrent submissions, especially during booking periods. Real-time responses for example, Fast booking and real-time updates.
- Reliability: The system must prevent double booking
- Scalability: The system should support many users

4.5 System Design

Based on the gathered requirements, the system was designed following the development approach described earlier in chapter 3.

4.5.1 System Architecture

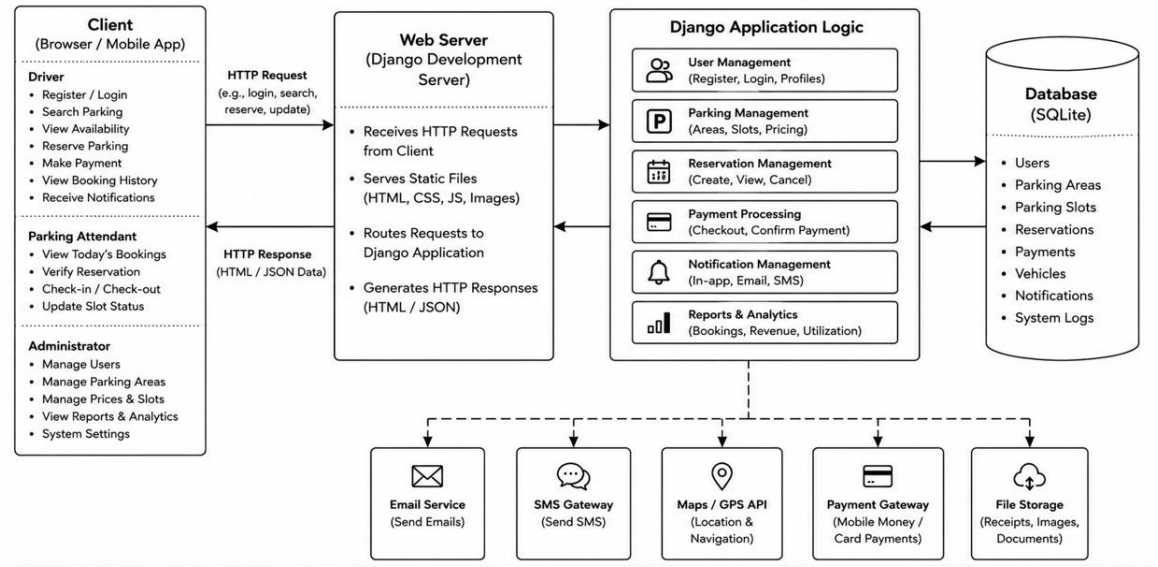

Figure 1 System Architecture

The system architecture of the Parking Reservation System describes how the different components of the system interact to provide parking reservation services to users. The architecture is designed to support communication between drivers, parking attendants, administrators, and the central database through a mobile or web-based application. The system follows a client-server architecture, where users access services through client applications while data processing and storage are handled on a centralized server.

4.5.2 Context Diagram

Context diagram.

This is the highest level of data flow diagram that defines the scope of the system and provides an "outward" looking view from the system, shows system boundaries and interaction with external entities. The context diagram also shows other subsystems or group of people that interact with the system and the main flows of data. It has data flows and processes as shown below;

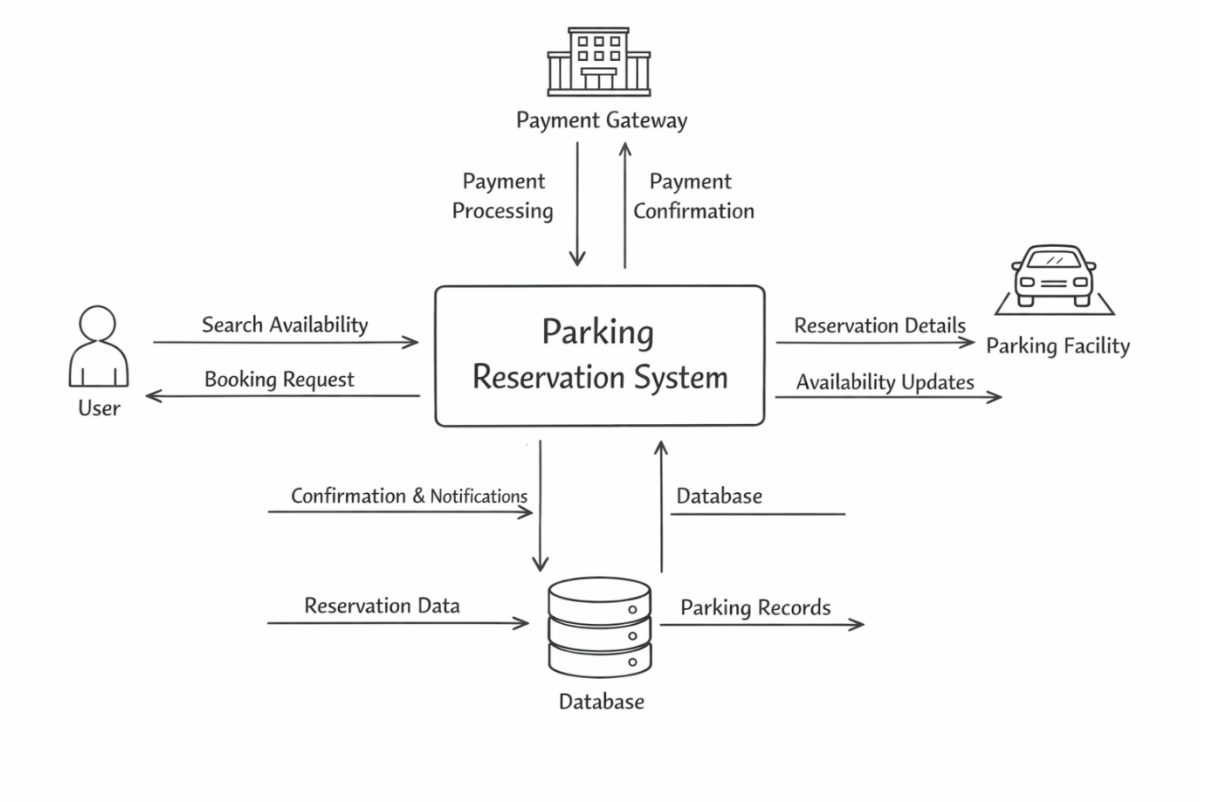

Figure 2 Context Diagram.

The process modelling began with a context diagram that represented the parking reservation system as a single process, showing, there are three external entities interacting with the system, the diagram shows how data flows between the system and external users without showing internal processes.

4.5.3 Data Flow Diagram

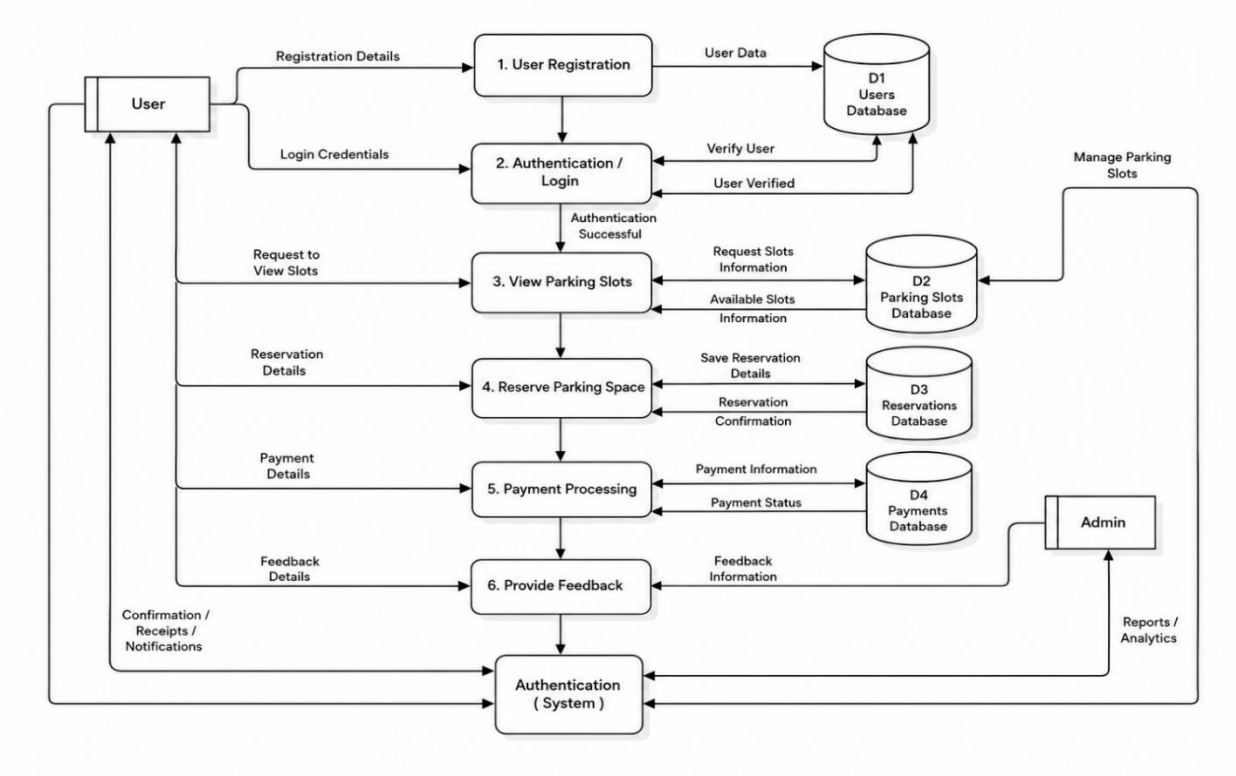

Figure 3 Data flow diagram

The data flow diagram for the Parking Reservation System illustrates how information moves between users, administrators, processes, and databases within the system. The process begins when a user registers by providing personal details, which are stored in the Users Database. After registration, the user logs into the system through the authentication process, where login credentials are verified. Once authenticated, the user can view available parking slots retrieved from the Parking Slots Database and proceed to reserve a parking space. The reservation details are then stored in the Reservations Database, after which the user makes payment through the payment processing module, and the payment records are saved in the Payments Database.

The system then sends confirmations, receipts, and notifications back to the user. Additionally, users can provide feedback to the administrator, while the admin manages parking slots, monitors reservations, and accesses reports and analytics for efficient system management.

4.5.4 Use case diagram

Use case diagrams, A use case diagram is a visual representation of the interactions between users and a system, showing how users interact with the system to achieve specific system objectives. A use case typically includes actors, use cases and relationships between actors and use cases.

Use Case diagram for the Users.

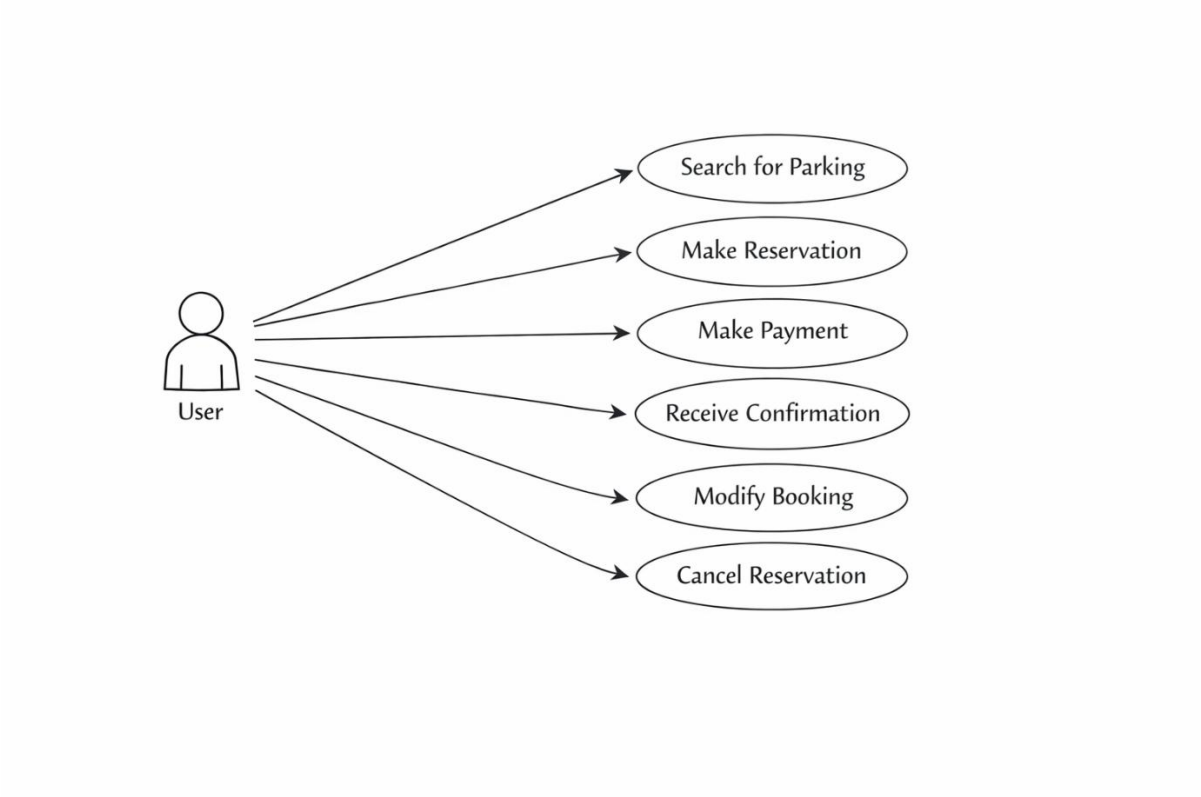

Figure 4 Users Diagram.

Use Case Diagram for the admin

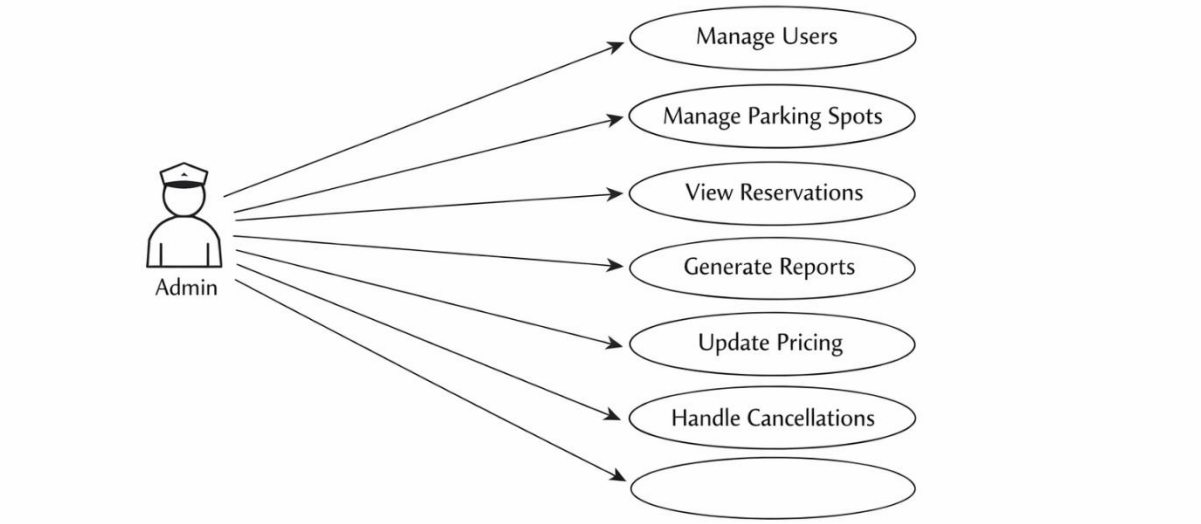

Figure 5 Admin Diagram

User case table.

Table 2 User case table

Use Case	Actor	Description	Preconditions	Postconditions
Register	User	Allows a new user to create an account	User has not registered	User account is created
Login	User	Authenticates user into the system	User must have an account	User is granted access
Search Parking Slot	User	Enables user to search for available parking spaces	User is logged in	Available slots are displayed
Book Parking Slot	User	Allows user to reserve a selected parking slot	User is logged in and slot is available	Slot is reserved for user
Make Payment	User	Enables user to pay for booked parking slot	Slot is booked	Payment confirmation is issued
View Booking Status	User	Allows user to check booking and payment status	User has an active booking	Booking status is displayed

Admin Use Cases

Table 3 Admin table

Use Case	Actor	Description	Preconditions	Postconditions
Manage Parking Slots	Admin	Add, update, or remove parking slots	Admin is logged in	Parking slot data is updated
Generate Reports	Admin	Produces system reports on usage, bookings, and payments	Admin is logged in	Report is generated and available

4.5.5 Entity Relationship Modelling

The Entity Relationships Diagram is a graphical representation of the relationship between the entities and attributes within the database of the system. It is used to design, understand and document the structure of a database highlighting the connections between the different entities. The entities about the data include, User, Parking Slot, Reservation, Payment, Admin

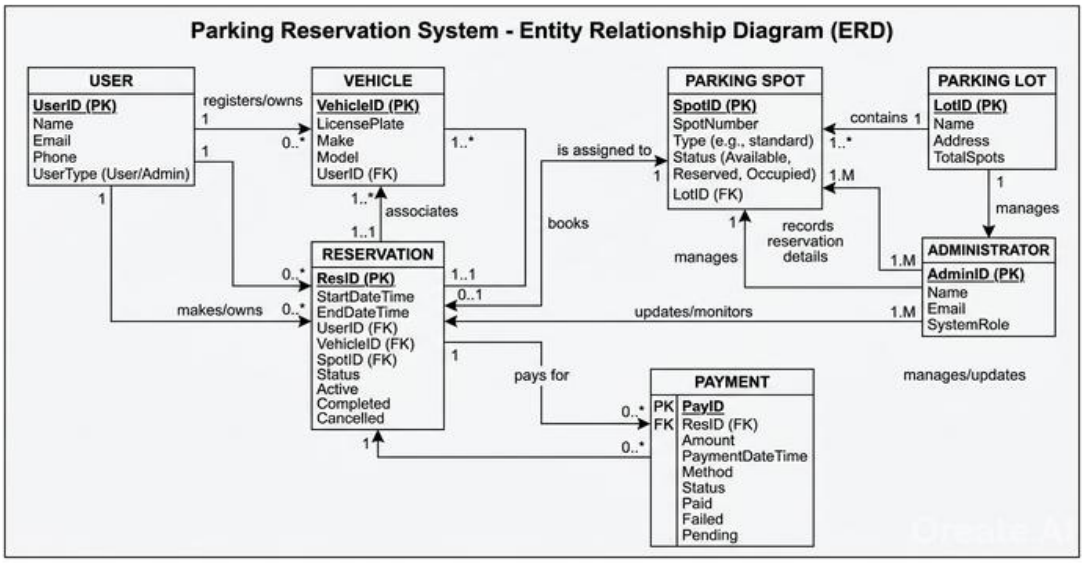

Figure 6 Entity Relationship Diagram.

4.5.6 Process Description

Process 1.0: Booking Management

This process captures user booking details and stores reservation information in the booking records data store.

Description, this process allows users to log into the system and retrieve their account details. The user can then search for available parking slots and make a reservation. The system captures booking details such as selected slot, date, and time. The booking is then stored in the Booking Records data store and linked to the respective user's profile. The system also generates a booking confirmation for the user.

Process 1.1: Select Parking Slot

Allows a user to choose an available parking slot for a specific date and time.

Description, this process receives the parking request from the user, including preferred date and time. The system retrieves available parking slots from the Parking Slots data store and displays them to the user. The user then selects a suitable slot. The output of this process is the selected parking slot along with its availability details.

Process 1.2: Make Reservation

This is the final process in booking management where the user confirms and submits the reservation.

Description, the process receives the selected parking slot from Process 1.1 and user details. The user confirms the booking by providing necessary information. The system then generates a complete reservation record, including booking ID, slot details, and time. This information is stored in the Booking Records data store, and a booking confirmation is sent to the user.

Process 2.0: Payment Processing

This process handles payment transactions for parking reservations.

Description, the system receives payment details from the user after a booking is made. It sends a payment request to the external Payment System for authorization. Once the payment is processed, a confirmation is sent back to the system. The system then stores the payment details in the Payment Records data store and generates a receipt for the user. This receipt serves as proof of successful payment.

Process 3.0: Parking Administration

This process manages parking operations and system monitoring.

Description, the process allows the admin to manage parking slots, pricing, and monitor system activities. It receives updates from the admin such as adding, removing, or modifying parking slots and pricing structures. It also retrieves booking and payment data to generate reports. The outputs include updated parking slot information and system reports for administrative purposes.

Process 3.1: Manage Parking Slots

This process allows the admin to control parking slot availability.

Description, the admin inputs slot details such as slot number, availability status, and pricing. The system updates this information in the Parking Slots data store. This ensures

that users always access accurate and up-to-date parking availability when making reservations.

Process 3.2: Generate Reports

This process produces system reports for monitoring and decision-making.

Description, the system retrieves data from Booking Records and Payment Records data stores. It processes this data to generate reports such as daily bookings, revenue summaries, and slot utilization. These reports are then provided to the admin for analysis and decision-making.

4.5.7 Data Flow Definitions

Key data flows include:

Booking Details**;** Data submitted by the user when making a parking reservation. This includes information such as selected parking slot, date, time, duration of parking, and user identification details.

Payment Information; Details provided by the user to complete a transaction. This includes payment method (e.g., mobile money), transaction amount, and payment reference details used by the system to process and verify payments.

Payment Confirmation; A response generated by the Payment System after processing a transaction. It includes transaction status (successful or failed), confirmation message, and transaction ID, which is used to update the system records.

Parking Slot Information; Data related to parking slots including slot number, availability status, location, and pricing. This information is managed by the admin and accessed by users when making reservations.

Reports Data; Generated system data summarizing activities such as bookings, payments, and parking slot usage. These reports are accessed by the admin for monitoring and decision-making.

User Credentials; Login details such as username and password used by users and admins to access the system securely.

4.5.8 User Design and Prototyping Outcomes.

Low-Fidelity Design, Paper Prototyping Process: Initial sketches were hand-drawn and presented to students and supervisors for early feedback. These included:

Sign up and Login pages, Parking slot search and booking interface, Vehicle registration and user profile management pages, Payment initiation and confirmation screens, Admin dashboard for managing parking slots and reservations

Interface Sketching: The paper sketches helped visualize; Navigation structure of the parking reservation system, Parking slot selection and availability display layout, Booking form layout (date, time, vehicle details), Payment form and confirmation flow, Admin control panel for slot allocation, updates, and monitoring

High Fidelity Prototyping, using feedback from the low-fidelity stage, high-fidelity interactive prototypes were developed using mockflow.com and implemented using HTML, CSS, and JavaScript for frontend. The backend was built using PHP and MySQL.

The prototype was tested with a small group and validated through user acceptance testing (UAT), confirming that it addressed major concerns raised in the analysis phase.

CHAPTER FIVE:

SYSTEM IMPLEMENTATION AND TESTING

5.1 Introduction

This chapter emphasizes the actual system implementation. The system was transformed from user requirement into a workable product. The purpose of system implementation was to make sure that the correct application is delivered to the end users. Besides that, this chapter also emphasizes on how the testing is done to confirm whether it meets user requirements.

5.2 System Implementation

5.2.1 Interface Design

The front end of the system was developed using HTML, CSS, JavaScript, and Bootstrap for enhanced responsiveness and styling. It provides an interactive interface for drivers and admins to interact with the system. The key interfaces implemented include

Sign Up Page

A simple sign-up page where users/admins register by providing their personal information after which they get credentials to log into the system.

Figure 7 Sign Up Page.

Login/Sign in Page

A simple login form where users provide their login credentials which consist of the telephone number and password to access the system. This is used by all the users to log into the system.

Figure 8 Login page

User Dashboard

After successful login, the user accesses a dashboard where they can read instructions on how to work with the system, book for a parking place, unbook, contact admins and also receive a payment receipt after paying.

Figure 9 Uses Dash board.

Parking Zones.

This page contains information for the two parking zones at Masese Park.

Figure 10 Parking Zones.

Book Parking Lot Parking

This page contains information that allows users to book for a parking space.

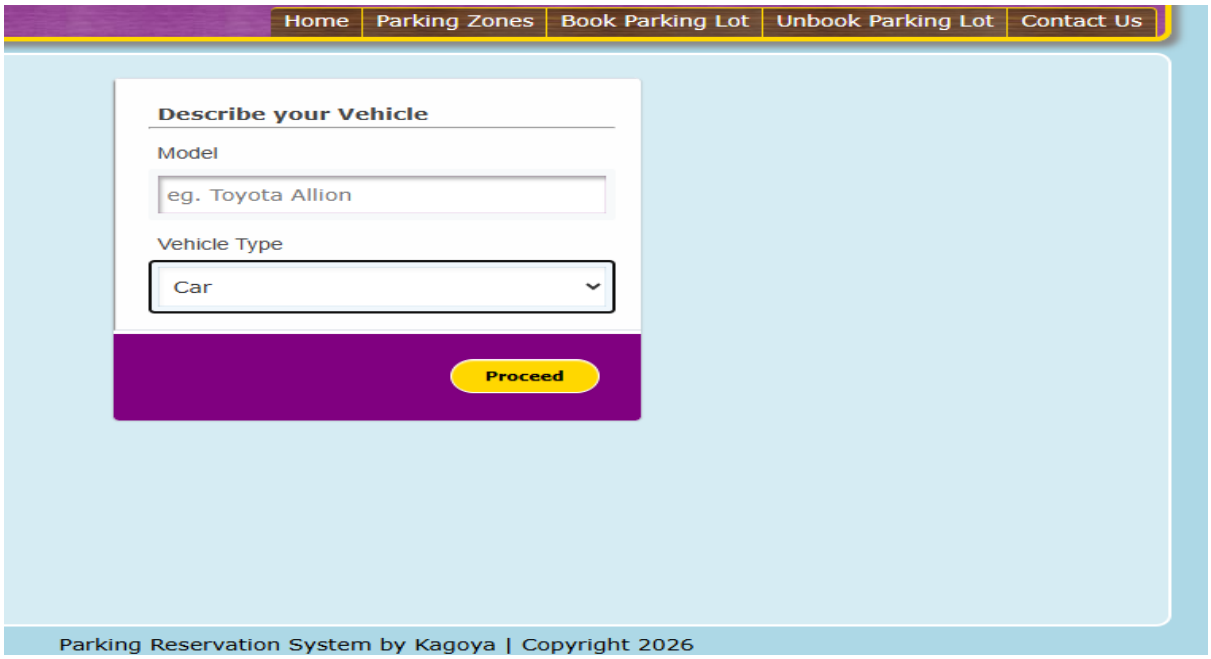

Figure 11 Booking for a parking lot.

Un Booking Lot Page

This page contains information that allows users to unbook**.**

Figure 12 Un booking.

Contact Us Page

This page contains a form where a user fills in his/her credentials seeking for assistance from the supervisors.

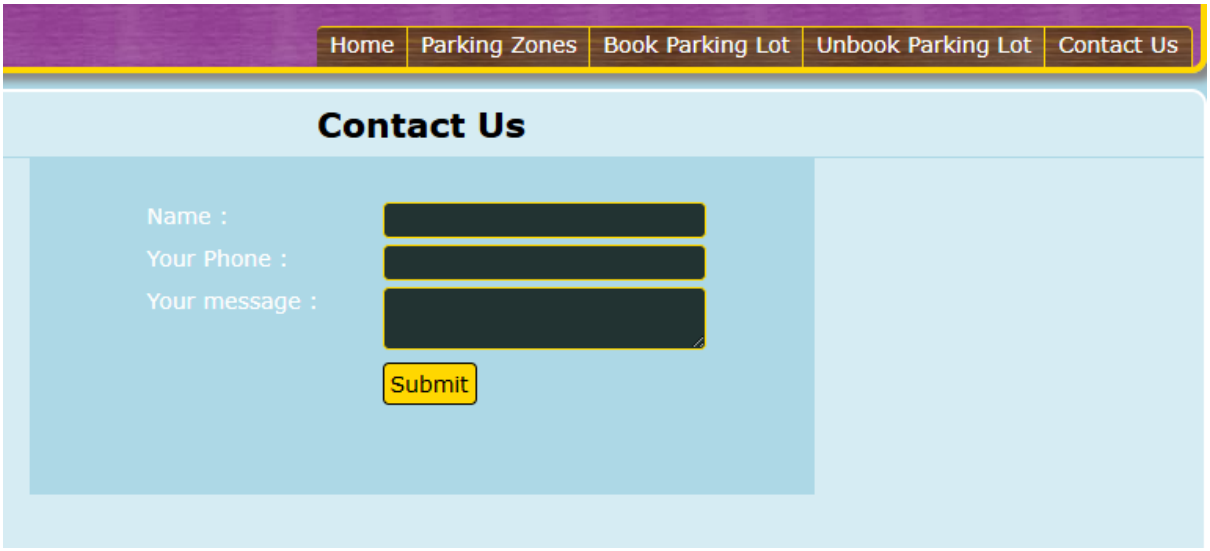

Figure 13 Contact Us Page.

Administrators Dash Board.

After successful login, the admin accesses a dashboard where he/she can view users, bookings, Transactions, Messages and also manage Admins can add supervisors and assign them to different places basing on the location, view the scores and access the parking reservation system daily report submitted by other supervisors.

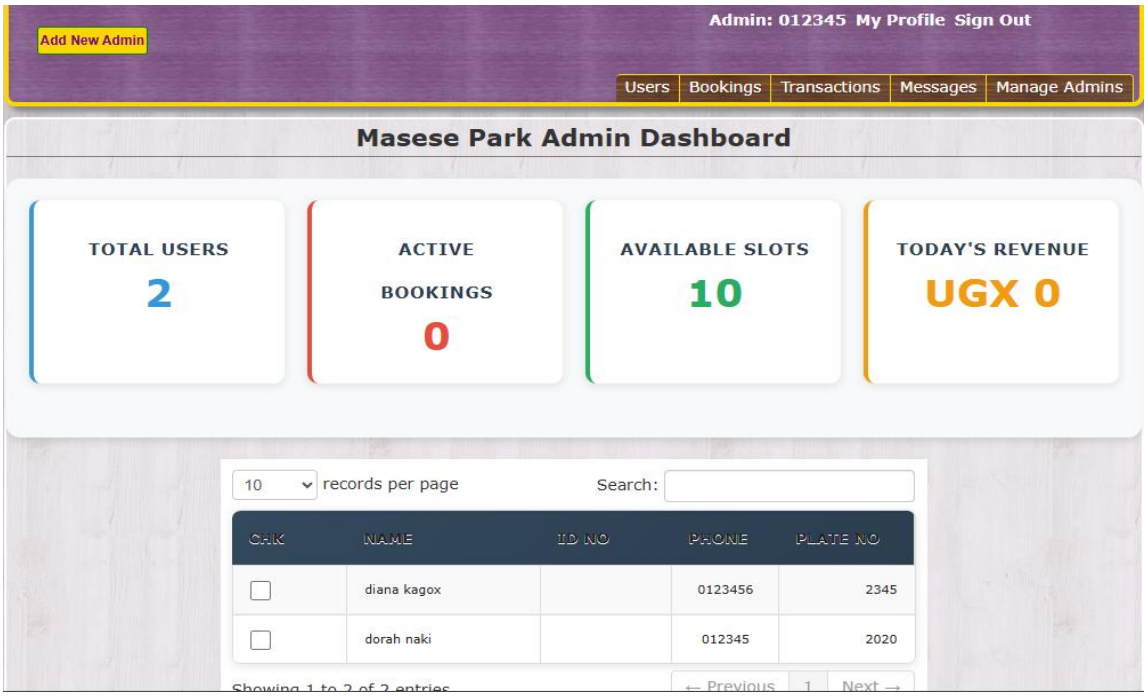

Figure 14 Admin dash board

User

This page shows the booked places with in the different booking lots, manages all system users (drivers, admins) it adds new users, edit user details, delete users, and view user

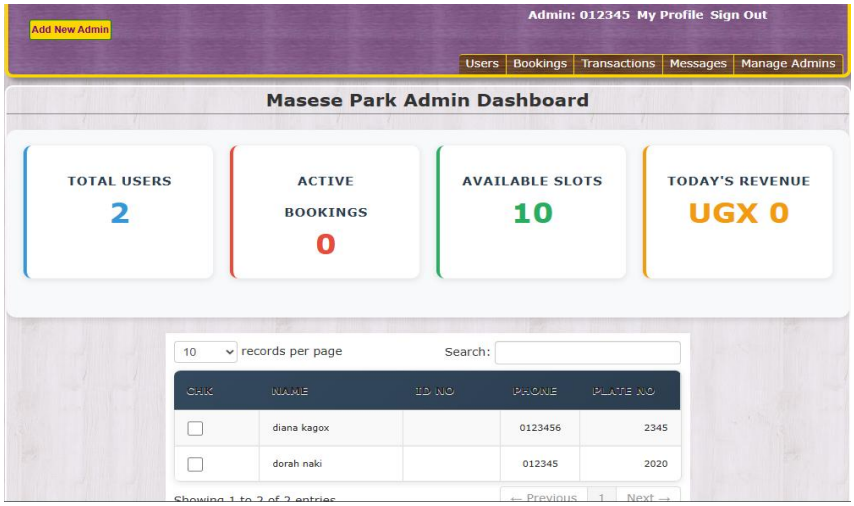

Figure 15 Users

Bookings

This page handled all parking reservations made in the system, it views booking records, approve or reject bookings, monitor parking slot allocation and tracks booking history.

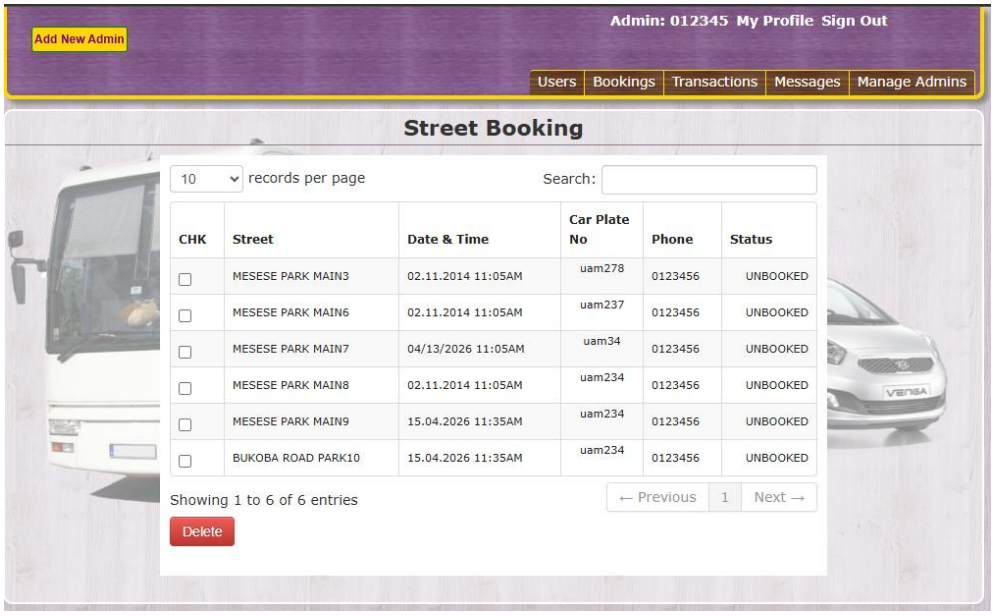

Figure 16 Bookings page

Transactions

This page manages all financial activities related to bookings which includes payment records, transaction history, verification of mobile money payments and also revenue tracking.

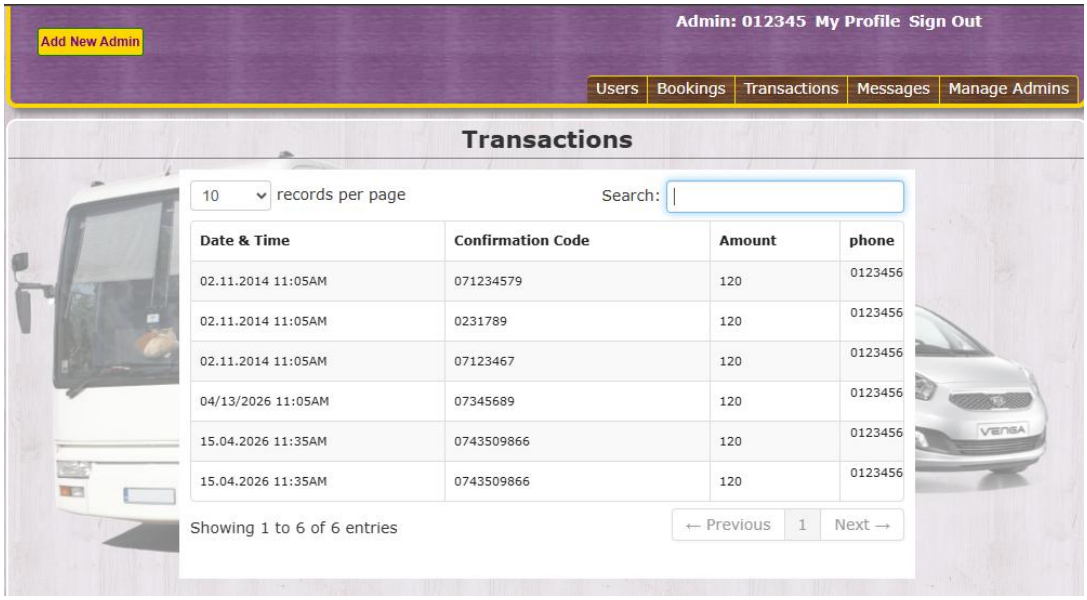

Figure 17 Transaction page.

Messages

This message supports communication within the system its functions include view messages from users, send notifications or alerts, and also responds to user inquires.

Useful for system updates, booking confirmations, and issues resolution.

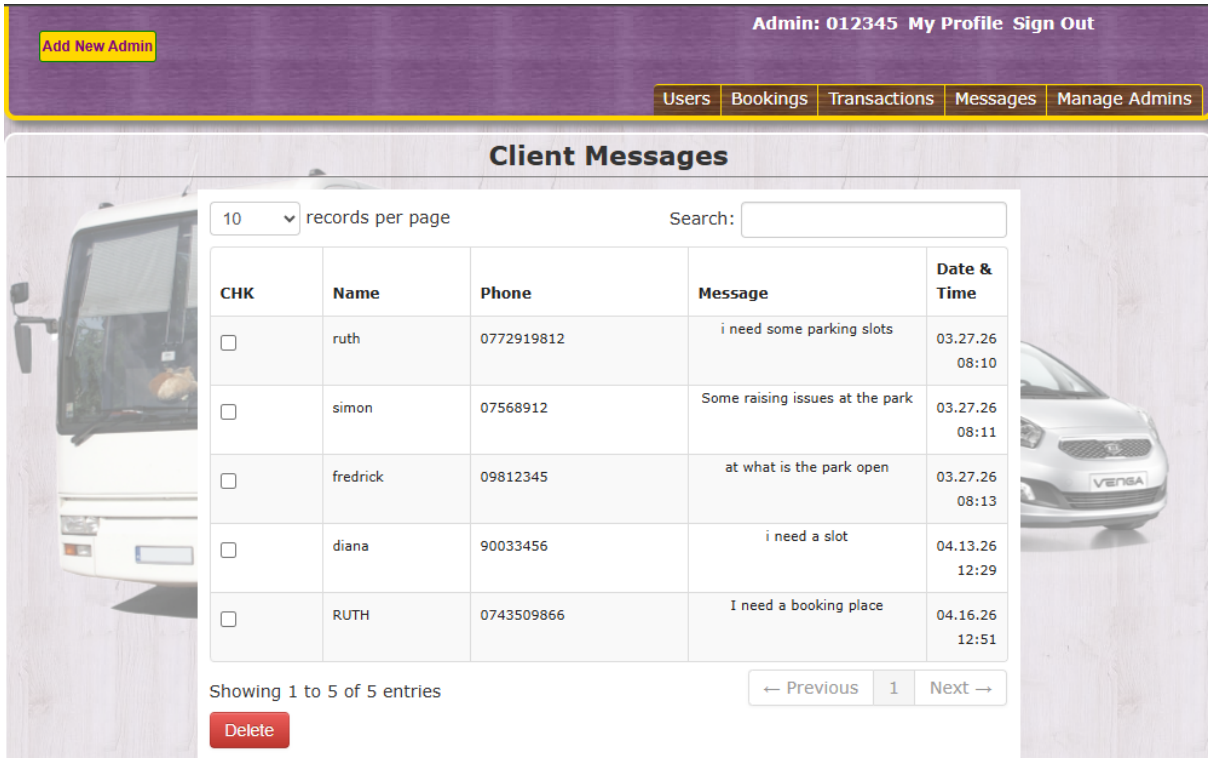

Figure 18 Messege Page.

Manage Admins

This page controls administrative access, it allows adding new administrators, editing admin roles and permissions, removing admin accounts.

It also ensures proper role-based access control with in the system.

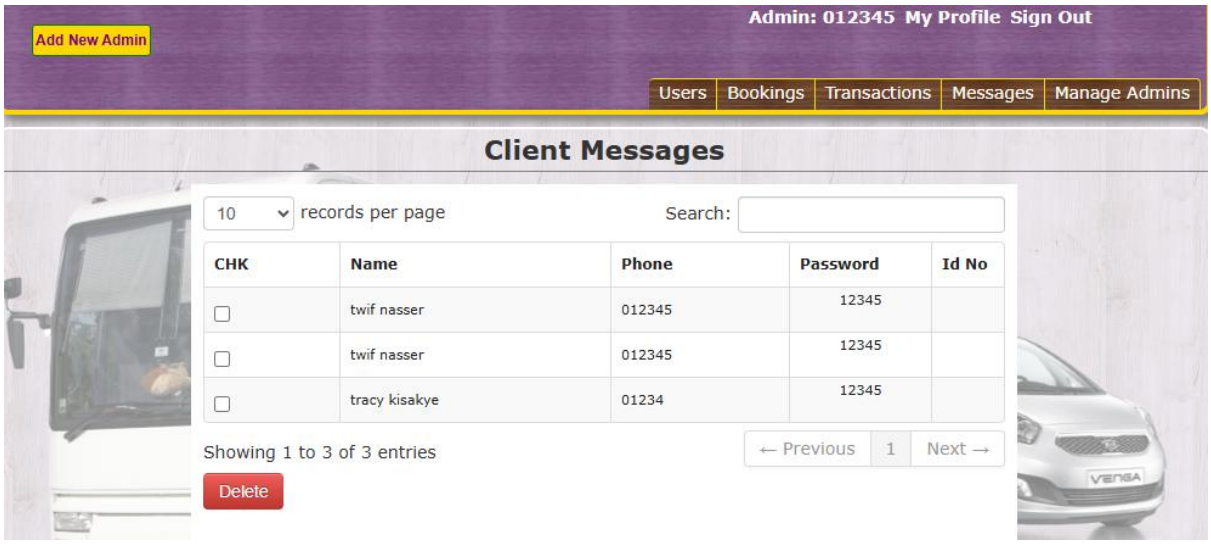

Figure 19 Admins page

Daily Report

This page showed the bookings made daily by the clients.

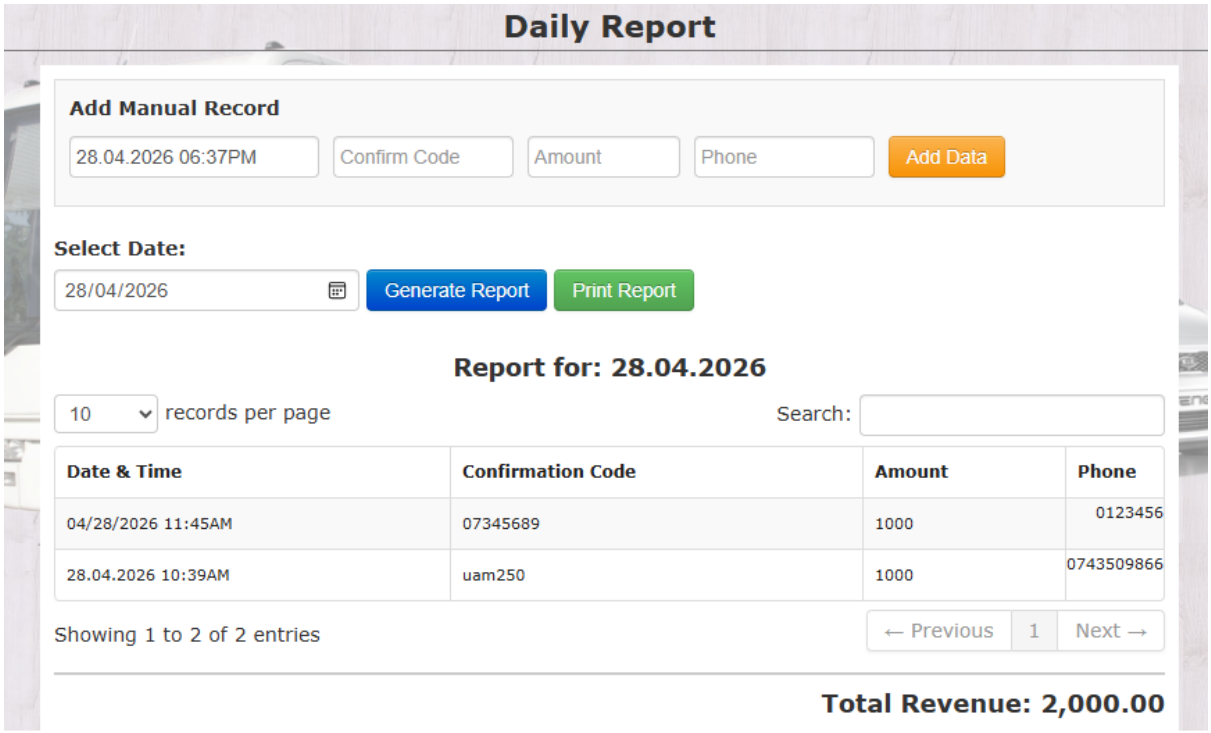

Figure 20 Daily Report

Finally, the admin Dash board serves as the central control panel of the parking reservation system. It provides administrators with tools to manage users, bookings, transactions, communication, and system access, ensuring efficient system monitoring and control.

5.2.2 Data Storage.

Data was stored using PHP for server-side scripting and MySQL for database management. The system manages data storage, user authentication, report uploads, and parking records.

Database Design.

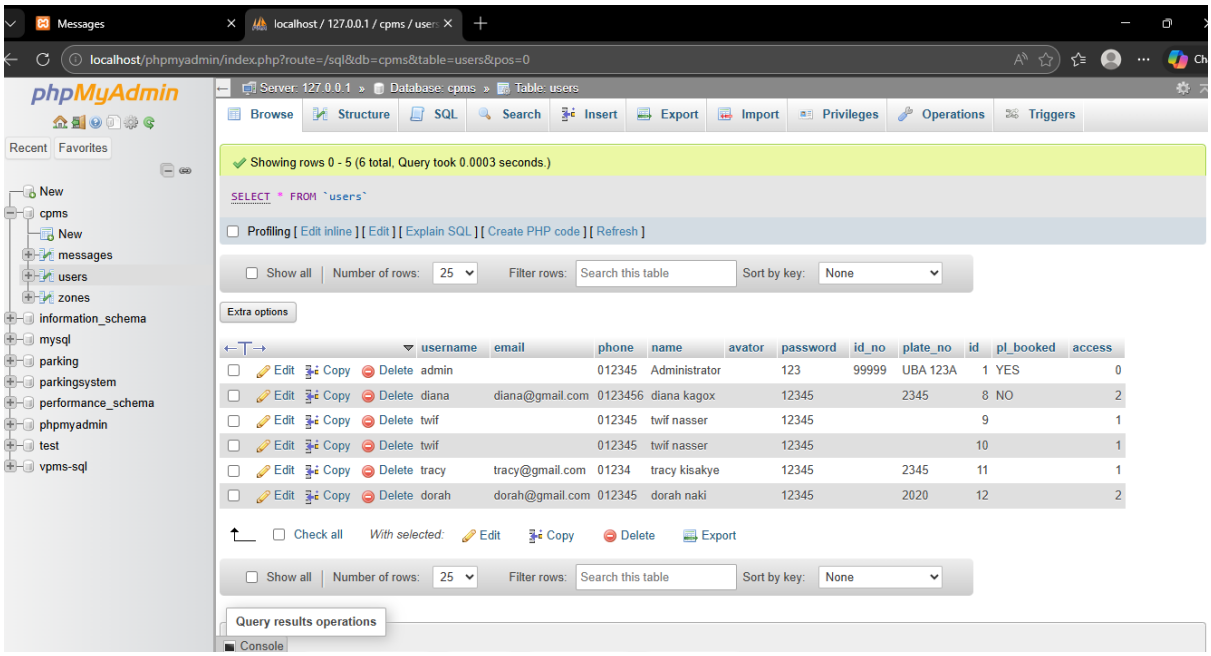

Figure 21 Database Design.

5.3 System Testing

To ensure the system meets its functional and non-functional requirements, several testing methods were conducted:

5.3.1 Unit Testing

Each module was tested independently to verify that it functions as expected. This included:

Testing the login process with valid and invalid credentials.

Figure 22 Invalid testing.

Testing functionality with valid and invalid file formats.

Testing activity submissions.

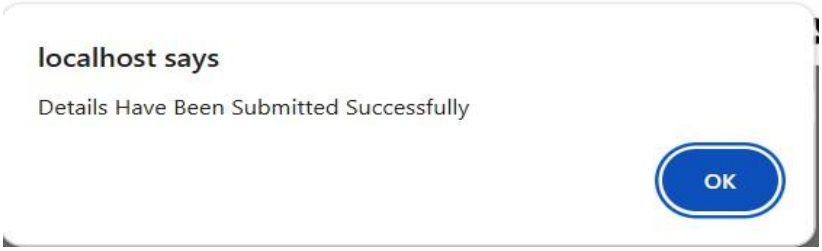

Figure 23 valid testing.

5.3.2 Integration Testing

After all pages were validated, they were integrated and tested to ensure seamless data flow and interaction among pages of the system, such as ensuring assumptions appear correctly on the admin's dashboard.

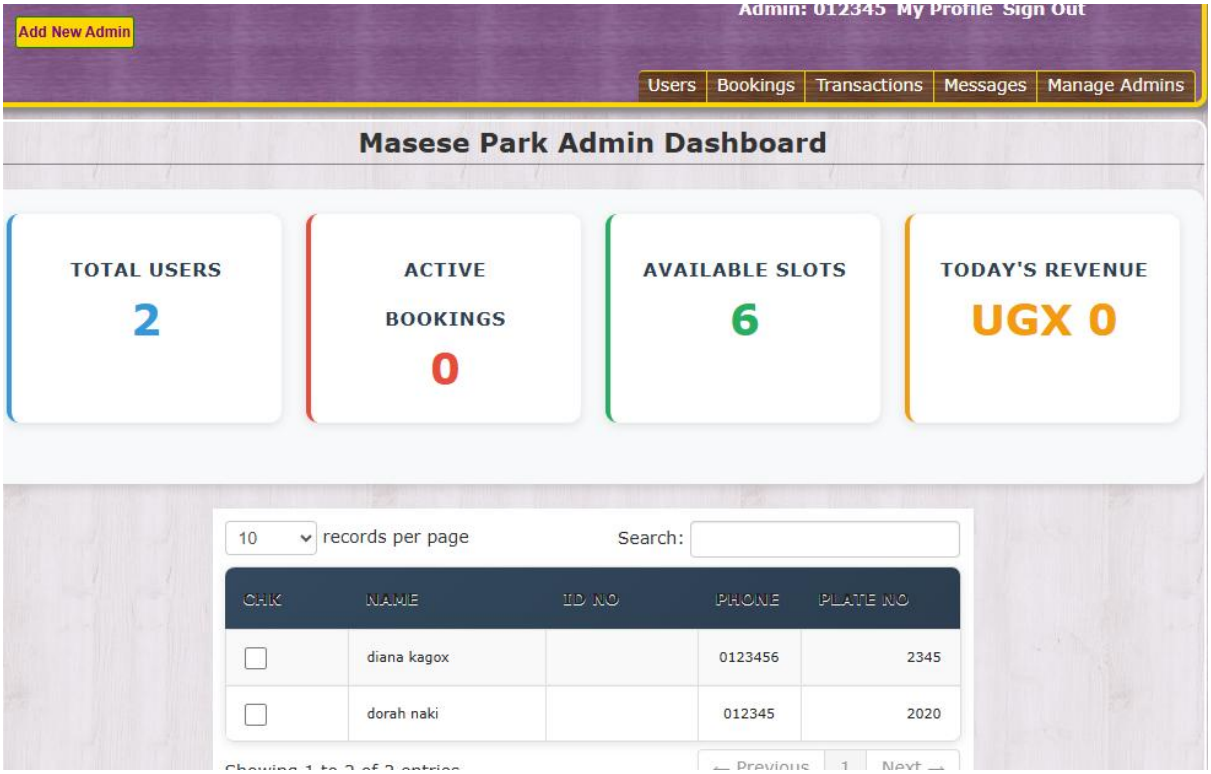

Figure 24 Integration testing

5.3.3 Functional testing

The entire Parking Reservation System was tested in an environment simulating real-world operations. This ensured that all modules function correctly, interact properly, and meet user requirements. The testing covered the following key areas:

- User Management (Registration, Login, Logout), The system was tested to ensure users (drivers, and administrators) can successfully:
- Register new accounts, Log in using valid credentials, log out securely Invalid login attempts were also tested to confirm proper error messages are displayed.
- Parking Slot Booking and Reservation, the booking module was tested to verify that, Users can view available parking slots, Users can reserve a parking space successfully, the system prevents double booking of the same slot, booking details are stored and displayed correctly
- Payment and Transactions Processing, the system was tested to ensure: Payments via mobile money (e.g., MTN and Airtel) are recorded correctly, transaction records are generated and stored, Payment status(successful/failed) is updated accurately

- Booking Management (Admin Functions), Administrative functionalities were tested to confirm: Admins can view all bookings, Approve, cancel, or modify reservations, monitor parking slot usage, Manage users within the system
- Notifications and Messages, the communication module was tested to verify that: Users receive booking confirmations, Notifications are sent for successful or failed transactions, Admins can send and receive messages
- Report Generation and Viewing, the system was tested to ensure: Booking and transaction reports can be generated, Reports display accurate and up-to-date information, Admins can view and analyse system activity
- Error Handling and System Validation, the system was tested for robustness by: Entering invalid data (e.g., wrong login credentials, incomplete booking forms), Attempting unauthorized actions, Ensuring appropriate error messages are displayed, verifying that the system prevents crashes and maintains stability.

5.3.4 Validation of the System

Validation of the system was done in order to confirm whether the system met its intended requirements and functionalities as intended.

It involved a series of evaluations to ensure that the system is correct, consistent, complete, traceable and secure. Functional validation was done in order to test the system's core functionalities and ensure they meet the specified requirements.

Validation results for the parking reservation system

Average scores from driver (user) responses

Table 4 Average Scoring from drivers

Category	Question	Score (out of 5)	Percentage (%)
Functionality	Q1. I can easily search and find available parking spaces in real time.	4.3	86%
	Q2. I can successfully reserve a parking space and receive confirmation.	4.4	88%
Ease of Use	Q3. The system is easy to navigate,	4.1	82%

	even for first-time users.		
	Q4. The interface (buttons, forms, menus) is clear and understandable.	4.2	84%
Performance	Q5. The system loads quickly (pages open within 3 seconds).	4.0	80%
	Q6. The system works well on both mobile phones and computers.	4.1	82%
Security	Q7. I feel that my personal information and payment details are kept private and secure.	4.2	84%
	Q8. Only I can access my account using my username and password.	4.1	82%
	Overall Average	4.18	83.6%

Average scores from parking attendant responses

Table 5 Average Scoring of Parking Attendants

Category	Question	Score (out of 5)	Percentage (%)
Functionality	Q1. I can easily view and verify driver reservations.	4.5	90%
	Q2. I can update parking slot status (occupied/available) without errors.	4.4	88%
Ease of Use	Q3. The system is easy to navigate, even for first-time users.	4.0	80%
	Q4. The interface (buttons, menus, forms) is clear and easy to use.	4.1	82%
Performance	Q5. The system responds quickly when I perform operations.	4.1	82%
	Q6. The system works well on the devices provided (phone/tablet).	4.0	80%

Security	Q7. I feel that the system prevents unauthorized access to data.	4.2	84%
	Q8. I can only access data and features allowed for my role.	4.2	84%
	Overall Average	4.19	83.8%

Overall validation summary

Table 6 Validation summary

Stakeholder	Overall Average Score (out of 5)	Percentage (%)	Interpretation
Drivers (n = 30)	4.18	83.6%	Good – System works well with minor improvements needed
Parking Attendants (n = 10)	4.19	83.8%	Good – System meets expectations
Combined Average	4.19	83.7%	Validated – Ready for deployment

Table 6

CHAPTER SIX:
DISCUSSION, CONCLUSION, RECOMMENDATIONS, LIMITATIONS AND FUTURE WORK

6.1 Introduction

This chapter presents a discussion of the results obtained from the design and implementation of the Parking Reservation System for Masese Park. The chapter also drew conclusions from the study, offers recommendations for system improvement, highlights limitations encountered during system development, and suggests areas for future research. The discussion is organized based on the study's specific objectives and is supported by insights from the reviewed literature.

6.2 Discussion of Results

The findings from the system development and testing processes are discussed in this section in relation to the specific objectives and the existing literature reviewed in chapter Two.

6.2.1 Objective 1: To review the literature and determine the requirements for the parking reservation System.

In order to develop a Web-Based Parking Reservation System that addresses the identified problem, it is essential to begin with a thorough requirement gathering process. These requirements are outlined in Chapter 4, section 4.3. This involves identifying the needs and expectations of stakeholders, understanding the context in which the system will operate, and defining both functional and non-functional requirements. According to (Sommerville, 2016), requirements engineering is a critical phase in the software development lifecycle, as it lays the foundation for design, implementation and testing

6.2.2 Objective 2: To design a parking reservation System with a user-friendly interface.

After identifying and analysing the requirements, the next critical step in developing the Web-Based Parking Reservation System was the system design. The system was designed in Chapter 4, section 4.4

This phase involved creating a blueprint for how the system will function, including its architecture, data flow, user interfaces and system components. A well thought out design enhances the maintainability, scalability and usability of the final product.

(Pressman and Maxim, 2020.)emphasize that the system design acts as a bridge between requirements and implementation, ensuring that the development process is in a coherent and efficient manner.

6.2.3 Objective 3: To implement the designs of the Parking Reservation System

This step involved translating the abstract design models from the system design in the previous step in Chapter 4, section 4.4 into working software components using the appropriate programming languages, frameworks and tools.

The implementation phase relied heavily on the design blueprint to ensure that the developed system aligns with the identified requirements and maintains structural integrity. (Sommerville, 2016) notes that a clear and detailed system design is essential for effective implementation, as it reduces ambiguity and helps developers build consistent and functional product.

6.2.4 Objective 4: To test and validate the implemented system

Testing involved executing the application under various conditions to identify and fix defects, while validation confirms that the developed system fulfils user expectations and business needs. The system was tested and validated where the results are in Chapter 5, section 5.3 showed that the parking reservation system achieved a combined validation score of 83.7%, with drivers scoring the system at 83.6% and parking attendants scoring it at 83.8%. These results indicate that the system successfully met the required functional, usability, performance, and security requirements and is ready for deployment with minor improvements.

According to (Pressman and Maxim) 2020, rigorous testing and validation are crucial to building confidence in the software's reliability, performance, and overall quality, thereby reducing the risk of failure after deployment.

6.3 Conclusion

User feedback from the evaluation of the parking reservation system indicated a 70% level of satisfaction, showing that the system effectively meets the needs of users in managing parking reservations. The system successfully addressed the major challenges associated with the traditional parking process, outlined in the problem statement found in Chapter One. Drivers are now able to easily search for available parking slots, make reservations in advance, and receive booking confirmations through the system.

6.4 Recommendations

Based on system performance and user feedback obtained during testing, the following recommendations are proposed:

I recommend that my Parking Reservation System be adopted by KCCA, jinja city and all other cities to reduce traffic with in the cities.

I also recommend that my system to be adopted by the government of Uganda in order to make use of the digital system this helps to expand the information with in my study.

6.5 Limitations

Despite the success of the system, Limited advanced features such as automated number plate recognition and GPS-based parking tracking, this was due to time factor.

6.6 Future Work

Future improvements of the Parking Reservation System should focus on integrating advanced features such as automated number plate recognition and GPS-based parking tracking to enhance efficiency and user convenience. Automated number plate recognition will help in improving vehicle identification, security, and faster entry and exit processes within parking facilities. In addition, GPS-based parking tracking will assist users in locating available parking spaces in real time and provide accurate navigation to reserved parking spots. These features were not fully implemented due to time limitations during the development process; therefore, future researchers and developers should consider incorporating them to improve the effectiveness, automation, and overall performance of the system.

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APPENDIX

Appendix I: Requirements Collection Interview Guide

During this interview process, I first politely asked for permission before I started to ask questions to the interviewee

interview guide

A. For Drivers (System Users)

1. What is your name and role (staff, visitor)?
2. Do you own or regularly use a vehicle for work?
3. How do you currently find a parking space?
4. What challenges do you face when looking for parking?
5. How much time do you spend searching for a parking space?
6. Have you ever experienced parking congestion or lack of space?
7. Would you prefer a system that allows you to book parking in advance?
8. What features would you like in a parking reservation system?
9. Would you prefer a mobile app or web-based system?
10. How would you like to receive parking confirmations (SMS, app notification, email)?

B. For Parking Attendants / Security Personnel

1. What is your name?
2. What role do you play in managing parking spaces?
3. How do you currently monitor parking availability?
4. Do you face challenges in controlling unauthorized parking?
5. How do you verify vehicles allowed to park?
6. What problems do you encounter during peak hours?
7. How do you manage parking allocation manually?
8. Would you prefer a digital system to assist in parking management?
9. What features would make your work easier in such a system?

10. How can the system improve efficiency and reduce congestion?

C. For System Administrators.

1. How is parking currently managed within Masese Park?
2. What challenges do you face with the current parking system?
3. How do you allocate parking spaces to users?
4. Do you maintain records of parking usage? If yes, how?
5. How do you handle parking violations or misuse?
6. Would you prefer a digital parking reservation system?
7. What key features should the system include (e.g., reporting, monitoring, user management)?
8. How often would you need system reports and analytics?
9. How should the system handle payments (if applicable)?
10. How will the system improve parking management and decision-making?

D. For ICT/Technical Staff.

1. What technologies are currently used in managing campus systems?
2. What challenges exist in integrating new systems?
3. What security requirements should the parking system meet?
4. What database and platform would you recommend?
5. How should user authentication and access control be handled?
6. What maintenance and support considerations are important?