

VEHICLE PARKING MANAGEMENT SYSTEM

A Project Report

submitted in partial fulfillment of the requirements

of

Applied Cloud Computing for Software Development

By

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ABSTRACT

The Vehicle Parking Management System is a comprehensive solution designed to streamline and enhance the parking operations for owners and administrators. This project empowers owners with exclusive functionalities, granting them the ability to efficiently manage parking facilities. Key features include real-time monitoring of available parking slots, generating parking bills, and accessing revenue reports.

Owners can seamlessly navigate through the system, gaining insights into the current status of parking slots, allowing for optimal space utilization. The system enables owners to generate accurate and timely parking bills, providing a transparent and automated billing process. Additionally, owners have the capability to track and analyze revenue, ensuring a clear understanding of the financial performance of the parking facility.

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CHAPTER 1

INTRODUCTION

1.1. Problem Statement:

The Vehicle Parking Management System aims to address the inefficiencies and challenges faced by parking facility owners and administrators. The current manual processes for managing parking facilities often lead to issues such as under utilization of parking spaces, inaccuracies in billing, and a lack of real-time insights into parking availability and revenue. Owners and administrators require a comprehensive solution that enables them to effectively manage parking operations, optimize space utilization, and ensure transparent billing processes. The absence of a centralized system for monitoring parking slots in real-time and generating accurate parking bills leads to revenue leakage and operational inefficiencies.

1.2. Problem Definition:

The Vehicle Parking Management System project aims to address several critical challenges faced by parking facility owners and administrators through innovative technological solutions. The primary problems identified in the parking management domain include:

Limited Parking Space Utilization:

Parking facilities often struggle with underutilization of parking spaces, leading to inefficiencies in space allocation and revenue generation. Owners and administrators need a system that enables them to optimize parking space utilization and maximize revenue generation opportunities.

Inaccurate Billing Processes:

Current billing processes for parking services lack accuracy and transparency, leading to disputes and revenue loss. There is a need for a system that automates billing processes, ensures accuracy in charging, and provides transparent billing information to both facility owners and users.

Lack of Real-time Parking Slot Monitoring:

The absence of real-time monitoring mechanisms makes it difficult for facility owners to manage parking availability efficiently. A system that enables real-time monitoring of parking slots and provides insights into parking availability will help optimize space utilization and enhance user experience.

Complex Revenue Reporting:

Parking facility owners face challenges in generating comprehensive and timely revenue reports due to the complexity of data collection and analysis. There is a need for

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a system that simplifies revenue reporting processes, provides detailed insights into revenue generation trends, and facilitates informed decision-making.

1.3. Expected Outcomes:

Expected Outputs:

Optimized Parking Space Utilization:

The Vehicle Parking Management System will ensure optimal utilization of parking spaces by providing real-time insights into available parking slots. Owners and administrators will be able to monitor parking occupancy levels and adjust space allocation accordingly, reducing instances of underutilized parking spaces.

Accurate and Transparent Billing Processes:

The System will automate billing processes, ensuring accuracy in charging for parking services. Users will receive transparent billing information, including details of parking duration and charges, enhancing trust and reducing disputes.

Real-time Parking Slot Monitoring:

Facility owners and administrators will have access to real-time monitoring of parking slots through the system's dashboard. Users will be able to check parking availability in advance, reducing the time spent searching for parking spaces and improving overall user experience.

Simplified Revenue Reporting:

The system will generate comprehensive and timely revenue reports, simplifying the process of tracking revenue generation. Owners and administrators will gain insights into revenue trends and patterns, enabling informed decision-making to maximize revenue potential.

Enhanced Communication with users:

The system will facilitate effective communication with users through notifications about parking availability, updates on billing information, and reminders about parking rules and regulations. Users will receive timely and relevant information, improving their overall experience and satisfaction with the parking facility.

CHAPTER 2

LITERATURE SURVEY

2.1. Paper – 1:

<https://ieeexplore.ieee.org/document/9675691>

2.1.1. Brief Introduction of Paper:

The main concern for vehicle owners often is to identify the proper place to park the vehicle at the earliest. In this work, a web application is created and tested, which can be used to find the availability of different parking slots in a parking lot. The web application controlled by the admin consists of various modules ranging from parking allotment to payment status. To implement this, we have used the Apache Tomcat server using the database SQL server. This system will verify the occupancy of parking slots, provide customers about the availability of parking slots in a short period and monitor occupied slots. The convenience of the person driving the vehicle is positively handled which further improves the effective time management with increased effectiveness which also paves way for less energy consumption and pollution.

2.1.2. Techniques used in Paper:

Based on the provided information, the following techniques are used in the implementation of the Vehicle Parking Management System:

- **Web Application Development:** A web application is developed to facilitate vehicle owners in finding available parking slots in a parking lot. The web application is accessible through web browsers, making it convenient for users to access the system from various devices.
- **Apache Tomcat Server:** Apache Tomcat server is utilized to host and run the web application. Tomcat provides a robust and reliable environment for deploying Java-based web applications, ensuring seamless operation of the parking management system.
- **Database Management with SQL Server:** - SQL Server is used as the backend database management system to store and manage parking-related data such as slot availability, parking allotment, and payment status. Structured Query Language (SQL) is employed to interact with the database, allowing for efficient data retrieval, modification, and storage.
- **Parking Slot Verification:** The system verifies the occupancy status of parking slots in real-time, providing accurate information to vehicle owners about slot availability. Through integration with the SQL Server database, the system retrieves and updates parking slot occupancy data, ensuring timely and reliable information for users.

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- **Monitoring Occupied Slots:** The system monitors and tracks occupied parking slots, allowing administrators to oversee the parking facility's status and manage slot allocation efficiently. Occupancy data is stored and updated in the SQL Server database, enabling administrators to view real-time occupancy status and make informed decisions.
- **Effective Time Management:** By providing vehicle owners with timely information about parking slot availability, the system contributes to effective time management for drivers. Users can quickly locate available parking slots, reducing the time spent searching for parking spaces and improving overall efficiency in managing parking needs.
- **Reduced Energy Consumption and Pollution:** The efficient management of parking operations facilitated by the system leads to reduced energy consumption and pollution. By minimizing the time vehicles spend idling in search of parking, the system helps decrease fuel consumption and emissions, contributing to environmental sustainability.

By incorporating these techniques, the Vehicle Parking Management System aims to enhance user convenience, optimize parking slot utilization, and promote sustainable transportation practices. The integration of web technologies, server-side infrastructure, and database management enables the system to efficiently address the parking needs of vehicle owners while supporting environmental conservation efforts.

CHAPTER 3

PROPOSED METHODOLOGY

3.1 System Design:

The Vehicle Parking Management System is designed to provide comprehensive functionality for parking facility owners and administrators. The system is primarily accessed through an admin dashboard, where administrators can perform various tasks to manage parking operations efficiently. The system design includes the following key components:

- 1. Admin Dashboard:** Upon successful login, administrators are presented with an intuitive dashboard interface. The dashboard provides an overview of key metrics such as total parking slots, occupancy rates, and revenue generated. It includes interactive data visualizations and charts to facilitate quick insights into parking facility performance.
- 2. Real-Time Monitoring:** Upon successful login, administrators are presented with an intuitive dashboard interface. The dashboard provides an overview of key metrics such as total parking slots, occupancy rates, and revenue generated. It includes interactive data visualizations and charts to facilitate quick insights into parking facility performance.
- 3. Billing and Payment Management:** Administrators have access to billing and payment management features to streamline revenue collection processes. The system allows administrators to generate parking bills based on configurable pricing rules and parking duration. Payment integration enables users to make payments online, and administrators can track payment status and issue receipts.
- 4. Reporting and Analytics:** The system includes reporting and analytics tools to provide insights into parking facility performance. Administrators can generate comprehensive reports on revenue, parking occupancy trends, and user demographics.

By implementing these system design components, the Vehicle Parking Management System provides a robust platform for administrators to efficiently manage parking operations, optimize revenue generation, and enhance user satisfaction.

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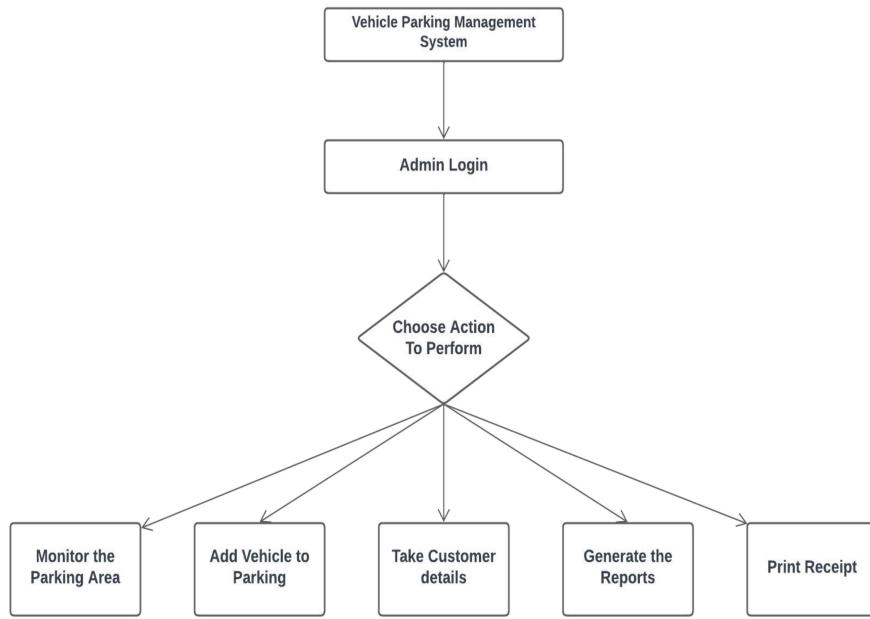


Figure 1: System Design

3.2 Modules Used:

- **Login and Authentication Module:** The Login and Authentication Module serves as the gateway for administrators to access the Vehicle Parking Management System. Through this module, administrators are required to provide their credentials to authenticate their identity and gain entry into the system. Robust security measures, including encryption techniques and secure password storage, are implemented to safeguard sensitive information. This module ensures that only authorized personnel can access the system, thereby protecting the integrity and confidentiality of the data within.
- **Parking Space Management:** Within the Vehicle Parking Management System, the Parking Space Management module plays a pivotal role in overseeing and administering parking spaces within the facility. Administrators wield the ability to add, modify, or remove parking spaces as needed, configuring details such as location, capacity, and availability status. Real-time monitoring features afford administrators insights into the occupancy of parking spaces, enabling efficient management of parking resources and optimal utilization of available slots.
- **User Details Management:** The User Details Management module facilitates the efficient management of user information and accounts within the system. Administrators possess the capability to create, update, and deactivate user accounts, ensuring accurate record-keeping and effective communication with users.

 **Income Monitoring:** Enables The Income Monitoring module provides administrators with the tools and functionality to closely monitor and analyze the revenue generated from parking services. Through real-time tracking and analysis of income streams, administrators gain valuable insights into revenue trends over time and factors influencing income generation. Armed with this information, administrators can make informed decisions to optimize revenue streams and enhance the financial performance of the parking facility.

3.3.1. DFD Level 0

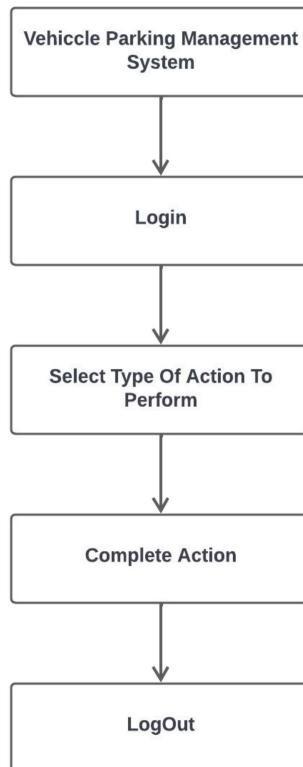


Figure 2: DFD level-0

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3.3.2. DFD Level 1 –

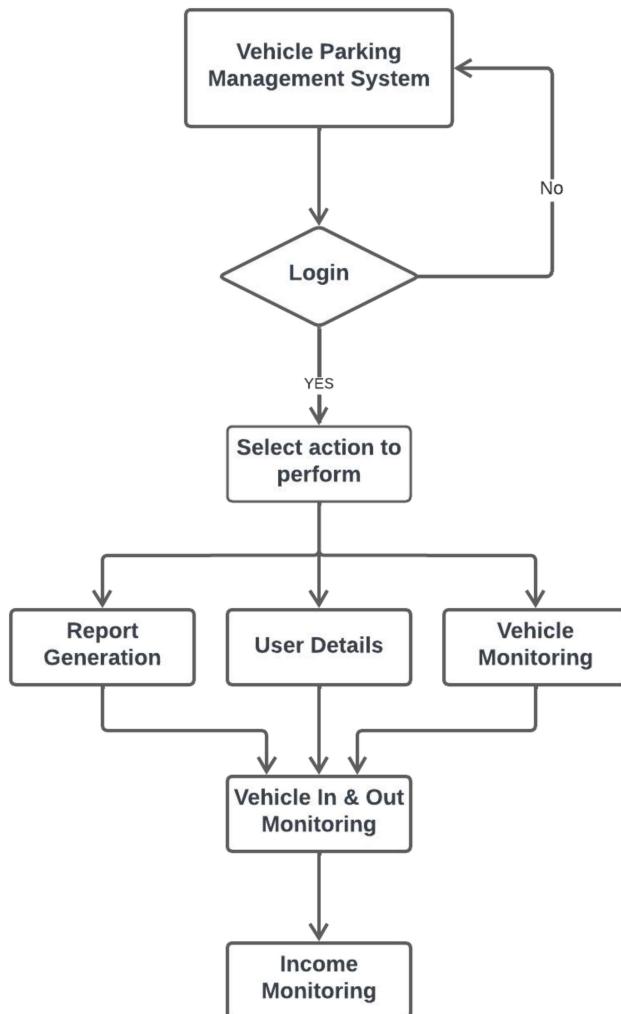


Figure 3: DFD Level-1

3.3 Advantages:

The Vehicle Parking Management System offers numerous advantages, enhancing efficiency in parking operations and fostering a user-friendly experience for both administrators and users. Here are some potential advantages of the system:

Efficient Resource Allocation:

- **Efficient Resource Allocation:** The system facilitates efficient utilization of parking spaces by providing real-time monitoring of available slots. This ensures that parking spaces are optimally utilized, minimizing instances of underutilization and maximizing revenue generation for parking facility owners.
- **Transparency and Accountability:** By automating billing processes and providing transparent billing information, the system promotes transparency and accountability in parking management. Users receive clear insights into parking charges and payment transactions, fostering trust and accountability within the parking community.
- **User-Friendly Interface:** The system features a user-friendly interface, making it easy for administrators to navigate through various functionality such as monitoring parking occupancy, generating reports, and managing user accounts. Intuitive design enhances user experience, promoting continued usage and engagement with the system.
- **Improved User Experience:** Users benefit from enhanced visibility into parking availability and streamlined payment processes, resulting in a more convenient and pleasant parking experience. Real-time updates on parking availability reduce search time for parking spaces, leading to greater user satisfaction.
- **Enhanced Security Measures:** The system incorporates robust security measures to protect user data and ensure the integrity of parking transactions. Encryption techniques and secure authentication protocols safeguard sensitive information, providing users with peace of mind regarding the security of their personal and financial data.
- **Scalability and Adaptability:** The modular design of the system allows for scalability and adaptability to accommodate future growth and evolving needs. New features and functionalities can be seamlessly integrated into the system to meet the changing demands of parking management.
- **Scalability and Adaptability:** The modular design of the project allows for scalability and adaptability. As the platform grows, new features and functionalities can be seamlessly integrated to meet evolving needs.

3.4 Requirement Specification:

3.4.1 Hardware Requirements:

Server:

- Multi-core processor (e.g., quad-core or higher)
- Sufficient RAM (e.g., 8GB or more)
- Adequate storage space (e.g., SSD for better performance)
- Stable internet connection

Database Server:

- Capable of handling the expected database load
- Efficient storage solution (e.g., SSDs for better database performance)

Backup Server:

- Regular automated backup system
- Sufficient storage for backup data

3.4.2 Software Requirements:

Operating System:

- Linux distribution (e.g., Ubuntu, CentOS) for the server
- Windows or macOS for development environments

Web Server:

- XAMPP

Database:

- MySQL or PostgreSQL as the relational database management system (RDBMS)

Back-End Technology (Server-Side Scripting):

- PHP for server-side scripting

Front-End Technology (Client-Side Scripting):

- HTML5, CSS3, JavaScript for web development

CHAPTER 4

IMPLEMENTATION AND RESULT

4.1 System Implementation:

The implementation phase of the Vehicle Parking Management System is a critical stage in the software development lifecycle, where the planned design is translated into a fully functional and operational system. It involves the conversion of design specifications into executable code, database creation, and integration of various components to create a usable application tailored to the needs of parking facility owners and administrators.

1. Admin Authentication:

The admin authentication process verifies the credentials of administrators during login. This involves validating the entered username and password against stored credentials in the system database, employing secure hashing mechanisms to ensure data security.

2. Parking Space Management:

The parking space management algorithm oversees the management of parking spaces within the system. It facilitates the addition, modification, and deletion of parking spaces, updating the database accordingly to reflect changes in parking space availability and status.

3. Revenue Monitoring:

The revenue monitoring algorithm tracks and manages income generated from parking services. It processes payment transactions, updates revenue records in the database, and generates revenue reports to provide administrators with insights into financial performance.

4. User Management:

The user management algorithm handles user accounts and permissions within the system. It enables administrators to create, update, and deactivate user accounts, as well as assign roles and access privileges based on user responsibilities.

5. Communication Handling:

The communication handling algorithm processes user inquiries submitted through contact forms. It validates and stores the inquiries in the database and may involve sending automated notifications or acknowledgments.

6. Data Validation:

Algorithms for querying the database are employed to retrieve, update, or insert records as needed for system operations. Structured Query Language (SQL) statements are

utilized for interacting with the system database, ensuring efficient data retrieval and manipulation.

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7. Database Queries:

Algorithms for querying the database are employed to retrieve, update, or insert records as needed for system operations. Structured Query Language (SQL) statements are utilized for interacting with the system database, ensuring efficient data retrieval and manipulation.

4.2 Testing and Validation:

During the testing and validation phase, rigorous procedures are implemented to verify the functionality, reliability, and performance of the Vehicle Parking Management System. This includes unit testing, integration testing, and system testing to identify and rectify any potential issues in the codebase. Special emphasis is placed on validating security measures, ensuring encryption, secure authentication, and protection against common vulnerabilities. User acceptance testing is conducted to confirm that the system meets specified requirements and provides an intuitive experience for administrators. Feedback gathered from testing informs iterative improvements to guarantee the robustness and reliability of the final product before deployment and operational use.

4.3 Results and Findings:

Throughout the implementation and testing phases of the Vehicle Parking Management System project, several significant results and findings emerged, providing valuable insights into the system's performance and user interactions. Key observations include:

1. Robust Functionality: The system demonstrated robust functionality, effectively managing parking space allocation, user authentication, and revenue monitoring.

2. Security Measures: Extensive testing confirmed that the implemented security measures, such as encryption and secure authentication, effectively protected user data and system integrity. Measures to prevent unauthorized access and mitigate security risks were found to be successful in safeguarding sensitive information.

3. User-Friendly Interface: User acceptance testing revealed that the system's user interface was intuitive, responsive, and user-friendly. Users reported positive experiences navigating through the system, contributing to overall satisfaction and usability.

4. Seamless Module Integration: The integration of various system modules demonstrated seamless collaboration, ensuring cohesive functionality across different components. Modules such as parking space management, revenue monitoring, and user management worked harmoniously to fulfill their intended purposes.

5. Effective Feedback Handling: The feedback handling algorithm efficiently captured user input and stored feedback in the database as expected. Findings from user testing and feedback collection provided valuable insights into areas for improvement, guiding iterative refinements to enhance user satisfaction and system performance.

6. Continuous Improvement: Ongoing monitoring and feedback mechanisms will be implemented to gather user feedback and inform further enhancements and optimization's. Iterative refinements based on user suggestions and needs will ensure the sustained success and usability of the Vehicle Parking Management System.

These results collectively affirm the successful implementation of the Vehicle Parking Management System, highlighting its reliability, security, and user-centric design. Continued monitoring and iterative improvements will further enhance the system's effectiveness in managing parking operations and providing a seamless experience for administrators and users alike.

CHAPTER 5

CONCLUSION

The Vehicle Parking Management System marks a significant milestone in leveraging technology for efficient parking management and user satisfaction. Through the development of a user-friendly web-based platform, we have created a system that addresses the complexities of parking facility management while enhancing user experience. Leveraging technologies such as HTML, CSS, JavaScript, and PHP, alongside the robust infrastructure provided by the XAMPP server and phpMyAdmin, we have established a solid technological foundation for the system.

The system facilitates seamless parking management, enabling administrators to efficiently allocate parking spaces, monitor revenue, and provide users with a convenient parking experience. By prioritizing user experience and implementing stringent security measures, including encryption and secure authentication, the deployed system aims to ensure both security and usability.

The successful deployment of the Vehicle Parking Management System underscores the potential of technology to streamline operations and enhance user satisfaction in parking management. Continuous monitoring, maintenance, and potential scalability will be crucial to ensure the ongoing success and effectiveness of the system in meeting the evolving needs of parking facilities and users.

The Vehicle Parking Management System represents a testament to the transformative power of technology in optimizing parking operations and fostering user convenience. As we move forward, we remain committed to further enhancing the system's capabilities and making a positive impact on parking management practices.

Scope:

The future scope of the Vehicle Parking Management System holds immense potential for expansion, enhancement, and increased efficiency in parking management. Here are some potential avenues for future development:

- ✓ Geographic Expansion: Extending the system to cover a wider geographic area, catering to parking facilities in different locations.
- ✓ Mobile Application Development: Developing a mobile application to provide users with on-the-go access to parking availability, reservations, and payments.
- ✓ Integration with Social Media Platforms: Integrating the system with social media platforms to enhance user engagement and facilitate communication with users.

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- ✓ Advanced Analytics and Reporting: Implementing advanced analytics and reporting features to provide administrators with deeper insights into parking trends and revenue generation.
- ✓ Collaboration with Corporate Partners: Collaborating with corporate partners to offer exclusive parking services and incentives to users.
- ✓ Educational Initiatives: Launching educational initiatives to raise awareness about parking management best practices and promote sustainable transportation options.

The future scope of the Vehicle Parking Management System is dynamic and adaptable, with opportunities for growth and innovation in response to emerging technologies and user needs. By embracing these opportunities and remaining responsive to feedback, the system can continue to drive efficiency and user satisfaction in parking management practices.

Video: https://www.youtube.com/watch?v=Qxq56hs_vfI

GitHub: <https://github.com/SairamMatampalli143/Techsakhyam-Project>

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APPENDIX

In this section, we provide additional information and resources related to the implementation of the Vehicle Parking Management System:

- 1. System Architecture Diagram:** A visual representation of the system architecture, depicting the interaction between various components such as the web application, Apache Tomcat server, SQL Server database, and user interfaces.
- 2. Database Schema:** Detailed documentation outlining the structure of the SQL Server database, including tables, columns, and relationships used to store parking-related data.
- 3. User Manual:** A comprehensive guide for users and administrators, providing step-by-step instructions on how to use the Vehicle Parking Management System. This includes guidance on accessing the web application, checking parking slot availability, making payments, and monitoring parking status.
- 4. Source Code:** Access to the source code of the web application, written in languages such as HTML, CSS, JavaScript, and Java. This allows developers to review the codebase, make modifications, and contribute to the ongoing development of the system.
- 5. Testing Documentation:** Documentation detailing the testing procedures and results, including unit tests, integration tests, and system tests conducted to ensure the functionality, reliability, and performance of the Vehicle Parking Management System.
- 6. Deployment Guide:** Instructions for deploying the system on different environments, including setting up the Apache Tomcat server, configuring the SQL Server database, and deploying the web application to make it accessible to users.
- 7. Support and Contact Information:** Contact details for technical support and assistance related to the Vehicle Parking Management System. Users can reach out for help with troubleshooting issues, reporting bugs, or seeking additional information about the system.
- 8. Acknowledgments:** Recognition of individuals, organizations, or institutions that contributed to the development and implementation of the Vehicle Parking Management System. This may include project collaborators, advisors, sponsors, or funding agencies.