**A PROJECT REPORT**

ON

**VEHICLE PARKING MANAGEMENT SYSTEM**

A report submitted in partial fulfilment of the requirement for the award of

The degree of

**POST GRADUATION DIPLOMA**

In

**ADVANCED COMPUTING**

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**DECLARATION**

We hereby certify that the work, which is presented in the Report, entitled Vehicle Parking Management System, in partial fulfilment of the requirement for the award of the Degree of Post Graduation Diploma and submitted to CDAC is an authentic record of our work carried out during one month under the guidance of Mr. Suleman Saudagar.

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**ABSTRACT**

Vehicle parking management systems (VPMS) are an integral part of urban infrastructure, addressing the growing challenges of parking in densely populated areas This report presents an overview of VPMS and research provides, focusing on its design, implementation and impact.

The report starts with the need for proper management in urban parking lots, and highlights associated challenges such as increasing demand for parking spaces, traffic congestion and environmental degradation. It then introduces the VPMS concept as a solution to make better use of parking spaces, improve traffic flow and enhance the overall urban travel experience It examines the VPMS systems segment, with key features such as automated entry and exit, real-time parking management and digital payment system integration The report examines VPMS architecture components, including hardware (sensors, barriers) and software (databases, . algorithms for operation). the character of the Implementation considerations are addressed, including selection of appropriate technology, scalability, security, and compliance with regulatory standards. Case studies and examples of successful VPMS implementations are examined to illustrate best practices and lessons learned. In addition, the report examines the impact of VPMS on various stakeholders including drivers, parkers, local authorities and the environment. Benefits such as reduced congestion, improved revenue generation, enhanced user experience, and environmental sustainability have been discussed, along with harsh environments for future research

**INTRODUCTION**

The Vehicle Parking Management System is a web application developed to streamline and automate the ticket generation process for vehicles upon their entry into parking facilities. As the demand for efficient parking management solutions continues to grow, there is a pressing need for an intuitive platform that simplifies the parking experience for both vehicle owners and parking facility operators. The Vehicle Parking Management System addresses this need by offering a user-friendly interface and robust functionality to facilitate seamless parking operations.

This report outlines the design and development journey of the Vehicle Parking Management System, covering various phases such as requirements gathering, design, implementation, and testing. Employing modern web technologies including HTML, CSS, Bootstrap, and React.js for the frontend, and Spring Boot Data JPA for the backend, alongside MySQL as the database, we aimed to create a scalable and reliable solution to meet the evolving needs of parking management.

To ensure the scalability and modularity of the system, we adopted a microservices architecture approach. This involved breaking down the application into smaller, independent services, each responsible for specific functionalities. Three key microservices were developed:

1. Ticket Management Microservice: This microservice handles all aspects of ticket generation and management, including creating tickets upon vehicle entry, updating ticket statuses, and generating reports.

2. User Management Microservice: The user management microservice is responsible for user authentication, registration, and profile management. It ensures secure access to the system and provides personalized user experiences.

3. Information Management Microservice: This microservice manages information related to parking facilities, such as available spaces, rates, and location details. It enables parking facility operators to update and maintain accurate information for users' reference.

Overall, the Vehicle Parking Management System represents an innovative solution to modernize parking operations and enhance user satisfaction. By automating the ticket generation process and providing a seamless user experience, we aim to optimize parking facility utilization and contribute to the efficient management of urban parking infrastructure.

**PURPOSE**

The purpose of developing the Vehicle Parking Management System is to address the challenges and inefficiencies associated with traditional manual parking management processes. This report offers insights into the design and development process of the system, highlighting the challenges faced and solutions implemented to create a robust and user-centric parking management solution. By automating the ticket generation process upon the entry of vehicles into parking facilities, the system aims to streamline parking operations, enhance user experience, and optimize space utilization. The primary objectives of the system include:

**1. Simplifying Parking Operations:** The system aims to automate ticket generation and management processes, reducing the need for manual intervention by parking facility operators.

**2. Enhancing User Experience:** By providing a user-friendly interface and seamless ticketing process, the system aims to improve the overall parking experience for vehicle owners.

**3. Optimizing Space Utilization:** By accurately tracking vehicle entries and exits, the system helps parking facility operators efficiently manage parking space availability and maximize occupancy rates.

**4. Improving Security and Accountability: The** system enhances security by maintaining a digital record of vehicle entries and exits, ensuring accountability and transparency in parking management.

**SCOPE**

The scope of the Vehicle Parking Management System encompasses the following key features and functionalities:

**1. Ticket Generation:** The system automatically generates tickets upon the entry of vehicles into parking facilities, capturing essential details such as entry time, vehicle information, and parking space assignment.

**2. Ticket Management:** It allows parking facility operators to monitor and manage tickets, including updating ticket statuses, tracking vehicle exits, and generating reports on parking activity.

**3. User Authentication and Management:** The system provides secure user authentication mechanisms for both vehicle owners and parking facility operators, enabling them to access relevant features and functionalities based on their roles.

**4. Real-time Parking Availability:** It offers real-time information on parking space availability, enabling vehicle owners to make informed decisions about parking their vehicles.

**5. Reporting and Analytics:** The system generates comprehensive reports and analytics on parking activity, including occupancy rates, revenue generation, and trends over time, to support data-driven decision-making by parking facility operators.

**6. Integration Capabilities:** It facilitates integration with other systems and services, such as payment gateways and external databases, to enhance functionality and interoperability.

The Vehicle Parking Management System is designed to cater to the needs of parking facilities of varying sizes and complexities, including both public and private parking lots, ensuring scalability and adaptability to diverse operational requirements.

**TECHNOLOGIES USED**

**FRONTEND**

- React Js

- HTML 5

- CSS

- Bootstrap

- JavaScript

**BACKEND**

- Spring Boot

- Spring Data JPA

- Spring Security

- Spring REST

**DATABASE MANAGEMENT SYSTEM**

- MySQL

**Feasibility Study**

**Vehicle Parking Management System**

**1. Technical Feasibility:**

**Software Requirements:**  The development of the Vehicle Parking Management System requires the utilization of modern web technologies including HTML, CSS, JavaScript, Bootstrap, React.js for the frontend, and Spring Boot Data JPA for the backend, alongside MySQL as the database. The availability of these technologies and the expertise of the development team in utilizing them will determine the technical feasibility of the project.

**Hardware Requirements:** The system will require servers or cloud infrastructure to host the application and store the database. The hardware must be capable of handling concurrent user requests and storing large volumes of data efficiently.

**Integration:** The system may need to integrate with other existing systems such as payment gateways, external databases, and hardware components like sensors and cameras. The feasibility of integration depends on the compatibility and availability of APIs or protocols for communication.

**2. Economic Feasibility:**

**Cost of Development:** The development cost includes expenses related to software development, hardware infrastructure, licensing fees, and personnel costs. A cost-benefit analysis should be conducted to ensure that the potential benefits outweigh the investment required for development.

**Return on Investment (ROI):** The Vehicle Parking Management System is expected to generate revenue through improved parking space utilization, increased customer satisfaction, and potentially new revenue streams such as premium parking services or advertising opportunities. The ROI should be evaluated based on projected revenue gains compared to the initial investment.

**Operational Costs:** Ongoing operational costs include maintenance, hosting, support, and updates. These costs should be factored into the economic feasibility analysis to ensure the long-term sustainability of the system.

**3. Operational Feasibility:**

**User Acceptance:** The success of the system depends on the acceptance and adoption by both parking facility operators and vehicle owners. User acceptance testing should be conducted to gather feedback and address usability issues to ensure smooth adoption.

**Training Requirements:** Training programs may be required to familiarize parking facility operators with the system interface, ticket management processes, and reporting functionalities. The feasibility of providing adequate training within budget and time constraints should be assessed.

**Scalability:** The system should be designed to accommodate future growth in the number of users, parking facilities, and system functionalities. Scalability testing should be conducted to ensure that the system can handle increased load and maintain performance efficiency.

**Functional Requirements:**

**1. User Authentication and Authorization:**

- Users should be able to create accounts and log in securely.

- Parking facility operators should have access to administrative functionalities with appropriate permissions.

- Different user roles (e.g., administrators, parking attendants, vehicle owners) should have access to different features and data.

**2. Ticket Generation and Management:**

- Upon the entry of a vehicle, the system should generate a digital ticket containing information such as entry time, vehicle details, and assigned parking space.

- Parking facility operators should be able to manage tickets, including marking vehicles as parked, updating ticket statuses upon vehicle exit, and handling exceptions (e.g., lost tickets).

**3. Real-time Parking Availability:**

- The system should provide real-time information on parking space availability, indicating vacant and occupied spaces.

- Vehicle owners should be able to view parking availability before arriving at the parking facility, helping them make informed decisions.

**4. Reporting and Analytics:**

- The system should generate reports and analytics on parking activity, including occupancy rates, revenue generated, and trends over time.

- Reports should be customizable and exportable in various formats (e.g., PDF, CSV) for further analysis.

**5. User Profile Management:**

- Users should be able to update their profiles, including contact information, vehicle details, and preferences.

- Parking facility operators should be able to manage user profiles and permissions, including adding new users and assigning roles.

**6. Integration with Payment Gateways:**

- The system should integrate with payment gateways to facilitate secure and seamless payment processing for parking fees.

- Users should have multiple payment options (e.g., credit/debit cards, mobile wallets) for added convenience.

**Non-Functional Requirements:**

**1. Performance:**

- The system should be able to handle a large number of concurrent users and transactions without significant performance degradation.

- Response times for user interactions (e.g., ticket generation, parking availability lookup) should be minimal to ensure a smooth user experience.

**2. Reliability:**

- The system should be highly reliable and available, with minimal downtime or service disruptions.

- Measures such as data backups, failover mechanisms, and disaster recovery plans should be in place to ensure continuous operation.

**3. Security:**

- The system should adhere to industry-standard security practices to protect user data and prevent unauthorized access.

- Data encryption, secure authentication mechanisms, and role-based access controls should be implemented to ensure data confidentiality and integrity.

**4. Scalability:**

- The system should be designed to scale horizontally and vertically to accommodate growth in the number of users and parking facilities.

- Scalability testing should be conducted periodically to identify potential bottlenecks and optimize system performance.

**5. Usability:**

- The system should have an intuitive and user-friendly interface, with clear navigation and informative feedback messages.

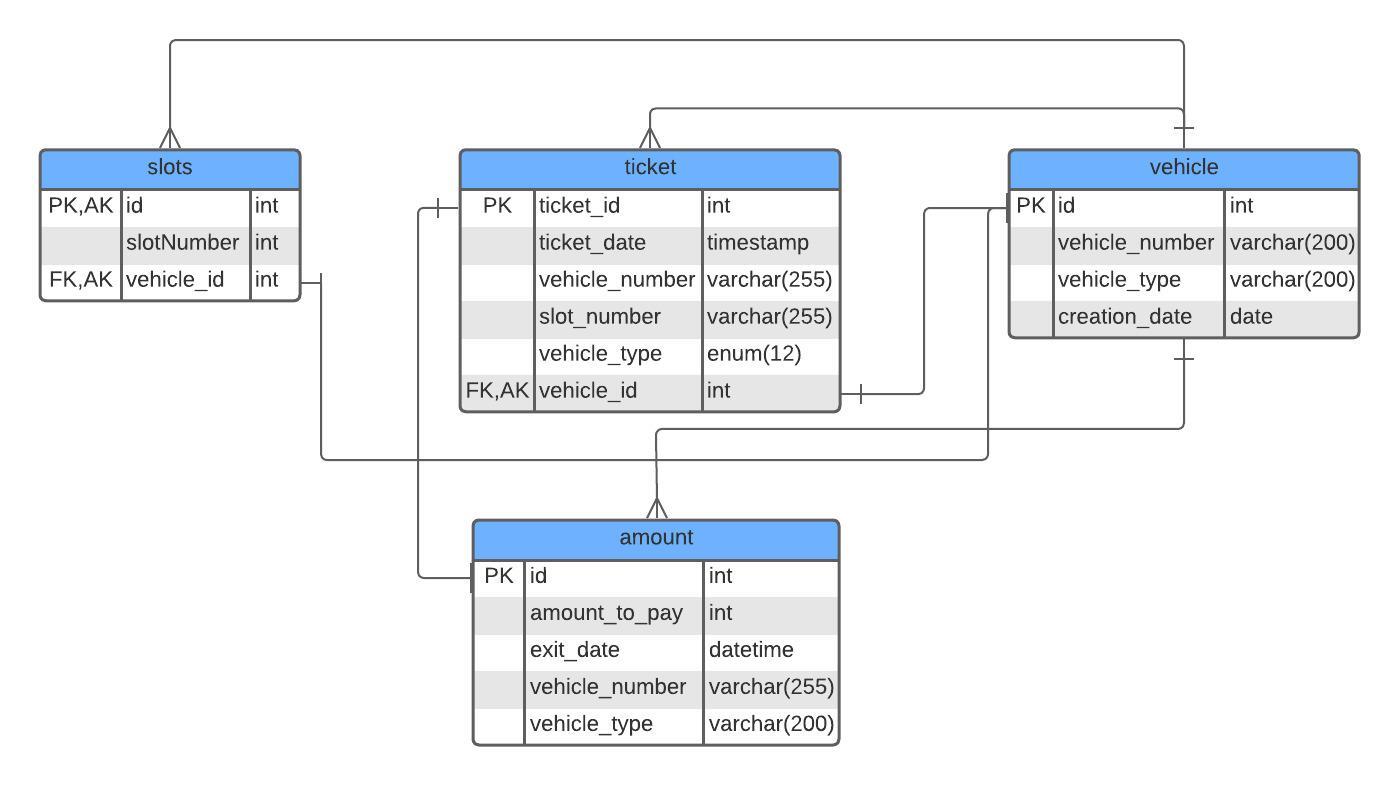
- Training materials and user guides should be provided to assist users in understanding and using the system effectively.

**6. Compliance:**

- The system should comply with relevant regulations and standards governing parking management, data privacy, and payment processing.

- Regular audits and compliance checks should be conducted to ensure adherence to legal requirements.

**Entity-Relationship Diagram**



**Relationships:**

**1. Vehicle - Ticket (One-to-Many):**

- Each vehicle can have multiple tickets (e.g., for different dates or slots).

- This is a one-to-many relationship because one vehicle (in the vehicle table) can be associated with multiple tickets (in the ticket table), but each ticket can only belong to one vehicle.

**2. Vehicle - Slots (One-to-Many):**

- Each vehicle can occupy multiple parking slots.

- This is a one-to-many relationship because one vehicle (in the vehicle table) can occupy multiple slots (in the slots table), but each slot can only be occupied by one vehicle at a time.

**3. Vehicle - Amount (One-to-Many):**

- Each vehicle can have multiple records in the amount table (e.g., for multiple exits or payment instances).

- This is a one-to-many relationship because one vehicle (in the vehicle table) can have multiple records in the amount table (representing different payment instances), but each payment instance (record in the amount table) corresponds to only one vehicle.

**4. Ticket - Vehicle (Many-to-One):**

- Each ticket belongs to one vehicle.

- This is a many-to-one relationship because multiple tickets (in the ticket table) can be associated with one vehicle (in the vehicle table), but each ticket can only belong to one vehicle.

**5. Slots - Vehicle (Many-to-One):**

- Each slot can accommodate one vehicle at a time.

- This is a many-to-one relationship because multiple slots (in the slots table) can be associated with one vehicle (in the vehicle table), but each slot can only be occupied by one vehicle at a time.

**PROJECT DESIGN**

BACKEND

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**Future Scope**

**1. Integration with Smart Technologies:** The Vehicle Parking Management System can be enhanced by integrating with smart technologies such as IoT sensors and cameras to provide real-time updates on parking space availability and security monitoring.

**2. Mobile Application Development**: Developing a mobile application for the system can extend its accessibility and convenience for users, allowing them to find parking spaces, generate tickets, and make payments on the go.

**3. Predictive Analytics:** Implementing predictive analytics algorithms can help forecast parking demand and optimize resource allocation, enabling parking facilities to better manage capacity and improve overall efficiency.

**4. Smart Parking Solutions:** Exploring the possibility of implementing smart parking solutions, such as dynamic pricing based on demand, automated parking guidance systems, and reservation-based parking, can further enhance the user experience and operational efficiency of the system.

**5. Integration with Public Transportation:** Integrating the parking management system with public transportation systems can provide seamless connectivity for commuters, offering incentives for using public transportation and promoting sustainable mobility options.

**Conclusion**

The development of the Vehicle Parking Management System represents a significant step towards modernizing parking operations and enhancing user experience in urban environments. By automating ticket generation processes, providing real-time parking availability information, and offering comprehensive reporting and analytics, the system aims to optimize parking space utilization, improve operational efficiency, and elevate customer satisfaction.

Throughout the design and development process, careful consideration was given to addressing the diverse needs of parking facility operators and vehicle owners, ensuring a user-centric approach and adherence to industry best practices. While the initial implementation of the system lays a solid foundation for efficient parking management, there are ample opportunities for future enhancements and innovations to further elevate its capabilities and impact.

As the system continues to evolve and adapt to changing technologies and user requirements, it is poised to play a pivotal role in shaping the future of parking management, contributing to the creation of smarter, more sustainable urban environments. With ongoing support, collaboration, and innovation, the Vehicle Parking Management System is positioned to make a lasting positive impact on the way parking is managed and experienced in cities around the world.