



ParkSphere: An Advanced Digital Vehicle Parking Platform

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Abstract— The growing need for efficient parking management in urban areas has led to the adoption of smart, web-based solutions that automate daily operations. This project presents a parking management system developed using Python and MySQL, designed to support both administrators and users in handling parking activities more effectively. Administrators can log in to add and manage multiple parking locations, assign unique identifiers, and update slot availability and pricing details as required. On the user side, individuals can register, log in, and explore available parking areas along with real-time slot information. The booking process is straightforward, allowing users to select a location, choose a slot, and enter vehicle details. Once confirmed, the slot status changes to “Parked.” The system also records entry and exit times, which are used to automatically calculate parking charges. After completing payment, users can release the slot, making it available for others. In addition, the system maintains a record of previous bookings, including payment and status details. By combining real-time updates, automated billing, and structured management of multiple locations, the system reduces manual effort and improves overall efficiency, offering a practical solution for modern parking needs.

Keywords— Parking management system, web-based application, Python, MySQL, slot booking, real-time availability, admin module, user module, parking reservation, automated billing, entry-exit tracking, payment processing, slot allocation, database management, transaction history, urban parking, smart parking, system automation, user interface, resource utilization, parking efficiency

I. INTRODUCTION

The rapid increase in vehicle usage has made parking management a major concern, particularly in urban areas [1]. As cities expand, the demand for parking spaces continues to rise, making traditional methods less effective. Manual parking systems often lead to inefficient space utilization, delays, and errors in tracking vehicle movement [5]. Drivers frequently spend extra time searching for available slots, which contributes to traffic congestion and unnecessary fuel consumption. Managing slot

availability and calculating parking charges manually becomes even more difficult in large

parking areas with frequent vehicle movement [3]. These challenges highlight the need for an automated system that can handle parking operations more accurately and efficiently [6].

To address these issues, this project introduces a web-based parking management system developed using Python and MySQL [1]. The system enables administrators to manage parking areas by adding locations, updating slot details, and setting pricing information [7]. Users can create accounts, log in securely, and view parking availability in real time. Based on this information, they can select suitable slots and complete the booking process easily. Once a booking is confirmed, the system updates the slot status automatically, ensuring accurate tracking of occupancy [10]. Real-time updates help maintain consistency between user actions and system data, improving overall efficiency [8].

In addition, the system includes features for recording entry and exit times, which are essential for calculating parking charges [2]. Charges are



generated automatically based on the duration of use, reducing errors and ensuring transparency. Users can complete payment and release their slots through a simple interface. The system also keeps a record of all previous bookings, making it easier to track usage and transactions [9]. These features together improve accuracy, reduce manual effort, and provide a more convenient parking experience [4].

II. RELATED WORK

Karunamurthy et al. (2024) [1] Karunamurthy and co-authors presented a study on improving urban parking management through the implementation of an online reservation system. Their research focused on addressing common challenges such as traffic congestion, time wastage, and inefficient utilization of parking spaces in busy city environments. The authors explained that traditional parking systems often force drivers to search for available slots manually, which leads to unnecessary delays and increased fuel consumption. By introducing an online reservation platform, users can check availability and book parking spaces in advance, thereby reducing uncertainty and improving overall efficiency. The study also emphasized the importance of integrating real-time updates so that users receive accurate information regarding slot availability and booking status. Additionally, the system supports better planning and management for parking administrators by maintaining structured data on usage patterns. The authors highlighted that such smart solutions contribute to the development of intelligent transportation systems and smart cities. Their work demonstrates that adopting digital technologies in parking management not only enhances user convenience but also supports sustainable urban development by reducing congestion and improving resource utilization.

Sadreddini et al. (2021) [2] Sadreddini and colleagues developed a decision-based multicriteria reservation system specifically designed for electric vehicle parking lots. Their research addressed the growing demand for efficient parking solutions in the context of increasing electric vehicle adoption. The authors proposed a system that evaluates multiple factors, including parking availability, charging requirements, cost, and user preferences, to allocate parking spaces effectively. They highlighted that simple reservation systems may not be sufficient for handling the complexity of EV parking, where charging infrastructure and time constraints play a significant role. By incorporating decision-making algorithms, the system can prioritize users based on various criteria and optimize the utilization of available resources. The study also discussed how such intelligent systems can reduce waiting times and improve user

satisfaction by providing more personalized parking options. Furthermore, the authors emphasized the importance of integrating advanced technologies to support sustainable transportation systems. Their findings suggest that multicriteria approaches are highly effective in enhancing the performance of modern parking systems. Overall, the research contributes to the development of smarter and more adaptive parking solutions tailored to evolving urban mobility needs.

Shaik et al. (2019) [3] Shaik and co-authors introduced a customer-to-customer parking reservation system aimed at improving the utilization of available parking spaces through a peer-to-peer model. Their research focused on addressing the issue of underutilized private parking spaces in residential and commercial areas. The authors proposed a system where individuals can list their unused parking spaces and make them available to other users for temporary use. This approach helps in reducing the shortage of parking spaces, especially in densely populated urban areas. The study emphasized that traditional parking systems often overlook privately owned spaces, leading to inefficiencies in overall space utilization. By enabling direct interaction between parking providers and users, the system creates a flexible and cost-effective solution. The authors also discussed the role of digital platforms in facilitating secure transactions and communication between users. Additionally, the system promotes better resource sharing and reduces the need for constructing new parking infrastructure. Their findings highlight the potential of collaborative systems in solving urban parking challenges while also providing economic benefits to space owners.

Hanif et al. (2010) [4] Hanif and colleagues proposed a smart parking reservation system based on short message service (SMS), focusing on simplicity and accessibility. Their research aimed to provide a solution that could function effectively even in areas with limited internet connectivity. The authors explained that many early parking systems relied heavily on web-based platforms, which were not always accessible to all users. By using SMS technology, users can easily reserve parking spaces through mobile phones without requiring advanced devices or internet access. The study highlighted how this approach reduces dependency on manual booking methods and minimizes errors in parking management. The system allows users to send a request message, receive confirmation, and obtain parking details through a simple communication process. The authors also emphasized that SMS-based systems are cost-effective and easy to implement, making them suitable for developing regions. Their work demonstrated how basic communication technologies can be leveraged to



create efficient parking solutions. Overall, the research provided a foundation for the development of more advanced smart parking systems by showcasing the effectiveness of simple and widely accessible technologies.

He et al. (2018) [7] He and co-authors presented a real-time reservation service for smart parking systems, focusing on improving the accuracy and responsiveness of parking information. Their study highlighted the importance of providing users with up-to-date data on parking availability to reduce search time and enhance convenience. The authors proposed a system that continuously updates parking slot status and allows users to make reservations based on real-time information. This approach helps in minimizing uncertainty and ensures better utilization of parking resources. The research also discussed the system architecture required to handle dynamic user requests and maintain consistent performance under varying conditions. The authors emphasized that real-time systems play a crucial role in modern smart city applications, where timely information is essential for efficient decision-making. Additionally, the system can reduce traffic congestion caused by vehicles searching for parking spaces. Their findings demonstrate that integrating real-time data processing with reservation systems significantly improves the overall effectiveness of parking management solutions.

III. DATASET DETAILS

The dataset used in this parking management system is created and maintained through a MySQL database, where all records are generated dynamically based on user and administrator interactions. It includes multiple types of data such as parking area details, user information, booking records, and transaction history. Key attributes in the dataset include parking area ID, location name, number of slots, available slots, and parking cost. Each parking area is uniquely identified, which helps in managing multiple locations efficiently. In addition, the dataset stores user-related details such as user ID, name, contact information, login credentials, and vehicle number. Booking-related attributes include booking ID, selected parking area, slot number, booking status, entry time, and exit time. The dataset contains both numerical values (such as cost and time duration) and categorical data (such as slot status and location names), making it suitable for structured storage and retrieval. The system continuously updates the dataset whenever a new parking area is added, a slot is booked, or a booking is modified. Overall, the dataset supports efficient tracking and management of parking activities in real time.

The dataset is logically divided into different modules such as parking management, user management, booking details, and transaction records to ensure smooth system operation. The parking module stores information about all available parking areas and their configurations, while the user module maintains registration and login details. The booking dataset records all slot reservations, including entry and exit timestamps, which are used to calculate parking duration and charges. Transaction data includes payment details and booking status, such as "Parked" and "Released." The system ensures consistency by linking each booking with a specific user and parking area using unique identifiers. Data handling operations such as insertion, updating, and retrieval are performed automatically through the application interface. Unlike predictive systems, this dataset is primarily used for real-time operations rather than model training, but it still requires proper organization and validation. The structured nature of the dataset ensures accurate processing, reduces redundancy, and enables efficient management of multiple parking activities within the system.

IV. PROPOSED METHODOLOGY

The proposed system presents a structured web-based parking management solution designed to automate and simplify parking operations. The system begins with an administrator module, where the admin logs in and manages parking areas through a dedicated interface. Using the system screens, the admin can add new parking locations by providing details such as area name, number of slots, and parking cost. Each parking area is assigned a unique ID, ensuring proper identification and management. The admin can also modify existing parking areas by updating slot availability or changing pricing details. All updates are reflected instantly in the system, allowing accurate tracking of parking resources. The system ensures that parking information is well-organized and accessible, enabling efficient control over multiple parking locations.

The user module provides a simple and interactive interface for customers to access parking services. Users can register by entering basic details and then log in to the system to view available parking areas. The system displays real-time information about slot availability, helping users choose a suitable parking location. Through the booking interface, users can select a parking area, choose an available slot, and enter vehicle details to confirm the reservation. Once booked, the slot status changes to indicate it is occupied. The system continuously updates slot status, ensuring that users receive accurate information at all times. This process minimizes



confusion and improves the overall efficiency of parking space utilization.

In addition, the system includes features for managing booking completion and payment processing. It records entry and exit times for each booking and automatically calculates parking charges based on the duration of use. Users can release their booked slots through the system after completing payment, which updates the slot status to available again. The system also maintains a history of all bookings, allowing users to view past parking activities along with payment details. These features ensure transparency and proper record management. Overall, the proposed system provides an effective and reliable approach for handling parking operations, reducing manual effort, and improving user convenience through automation and real-time updates.

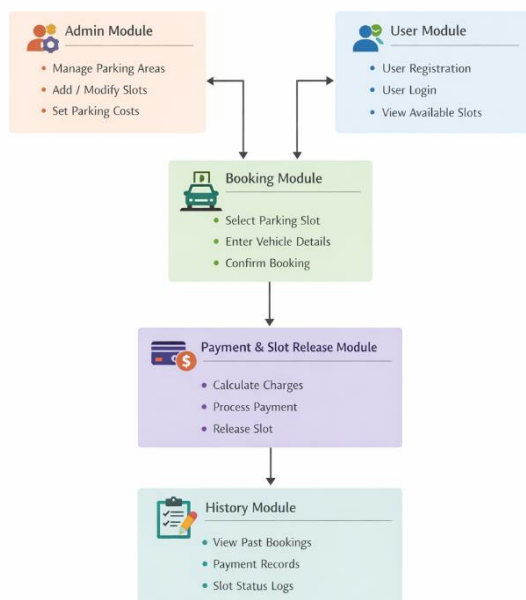


Figure [1]: System Architecture of vehicle parking system

Figure [1] This diagram represents the workflow of the parking management system. The process begins with the Admin Module and User Module, where the administrator manages parking areas by adding locations, defining slots, and setting parking costs, while users register and log in to access the system. Both modules interact with the Booking Module, where users can view available parking slots, select a preferred slot, and confirm their booking by entering vehicle details. Once a slot is booked, its status is updated to indicate occupancy. The process then moves to the Payment and Slot Release Module, where the system records entry and exit

times, calculates parking charges based on duration, and allows users to complete payment and release the slot. After the release process, the slot becomes available for future bookings. Finally, all booking and transaction details are stored in the History Module, which maintains records of past bookings, payment information, and slot status. This workflow ensures smooth coordination between modules and supports efficient parking management operations..

V.RESULT AND DISCUSSION

The experimental results demonstrate that the parking management system operates effectively in handling parking operations through its structured modules. Based on the system screens, the admin is able to successfully add parking areas, define slot availability, and update parking costs without any complexity. The modifications made by the administrator are reflected instantly, ensuring that the system maintains accurate and up-to-date information. On the user side, registration and login processes are completed smoothly, allowing users to access available parking areas and view slot status in real time. The booking process functions correctly, where users can select a slot, enter vehicle details, and confirm their reservation, after which the slot status changes to “Parked.” These results indicate that the system ensures proper coordination between modules and provides a reliable interface for both administrators and users.

Further observations from the system screens show that the payment and slot release process works efficiently. The system accurately records entry and exit times and calculates parking charges based on the duration of usage. Users can release their booked slots after completing the payment process, and the slot status is updated back to available, ensuring proper reuse of parking spaces. The history module successfully stores all booking and transaction details, allowing users to view past records including slot status and payment information. The overall system performance confirms that it reduces manual effort, minimizes errors, and improves operational efficiency. These results highlight that the system provides a practical and user-friendly solution for managing parking activities and supports smooth and continuous parking operations.

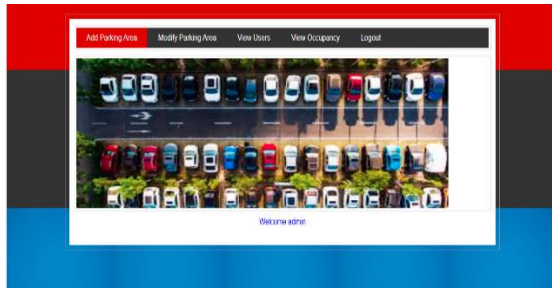


Figure [2] : Admin Dashboard – Online Vehicle Parking Reservation System

Figure [2] represents the admin dashboard of the parking reservation system, where the administrator can manage parking operations efficiently. It provides options such as adding new parking areas, modifying existing parking details, viewing registered users, and checking parking occupancy. The interface helps the admin monitor and control the system in real-time. A welcome message confirms successful login, and the navigation menu allows quick access to different administrative functions.

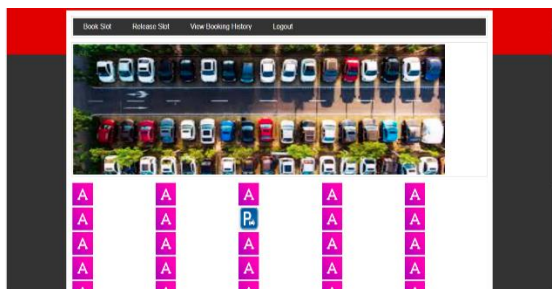


Figure [3] :Parking Slot Selection Interface

Figure[3] displays the parking slot selection interface where users can view available and occupied slots in a selected parking area. Each slot is visually represented, making it easy for users to identify free spaces and choose a suitable spot. The interface allows users to book a slot directly and manage their parking efficiently. It also includes navigation options like booking, releasing slots, and viewing booking history, providing a complete parking management experience.

DISCUSSION

The results observed from the system screens show that the parking management system performs its operations efficiently across all modules. The admin module allows smooth management of parking areas, including adding new locations and modifying slot details and pricing. These updates are

reflected immediately in the system, ensuring accurate data handling. On the user side, registration and login processes function without issues, and users can easily access available parking areas along with real-time slot status. The booking process works effectively, where users select a slot, enter vehicle details, and confirm the reservation, after which the slot status changes appropriately. These observations indicate that the system is capable of handling user interactions and administrative tasks in a coordinated manner.

The system also demonstrates the importance of real-time updates and structured data management. Slot availability is continuously updated, preventing double booking and ensuring efficient use of parking spaces. The booking interface provides clear information, helping users make decisions and quickly. The payment and slot release process works accurately, where entry and exit times are recorded and parking charges are calculated based on duration. This reduces manual errors and ensures transparency in billing. The history module further supports the system by maintaining complete records of bookings and transactions, allowing users to review their past activities. These features show that proper data handling and system design play a key role in improving performance and reliability.

Comparing different functionalities within the system highlights its overall effectiveness. Each module works independently while also being connected to others, ensuring smooth workflow throughout the application. The system provides a user-friendly interface that simplifies complex operations such as booking, payment, and record tracking. Additionally, the ability to handle multiple parking areas and bookings at the same time makes it suitable for real-time usage. The results confirm that the system reduces manual effort, improves accuracy, and enhances user convenience. Overall, the discussion shows that the system is reliable, efficient, and capable of managing parking operations effectively in a structured manner.

VI. CONCLUSION

This work presents a web-based parking management system designed to simplify and improve parking operations. The system brings together key modules such as admin management, user interaction, booking, payment processing, and history tracking into a single platform. From the implementation, it is clear that administrators can efficiently manage parking areas, while users can easily register, log in, and reserve parking slots without difficulty. The system reduces the complexity associated with manual parking methods and helps in organizing parking resources more effectively. The results show that proper data



handling and real-time updates play an important role in ensuring system performance. Accurate tracking of slot availability, booking status, and user activity helps maintain reliability. Automatic calculation of parking charges based on entry and exit time improves transparency and minimizes errors. Since all modules are well connected, the system operates smoothly and provides a user-friendly experience. Future improvements can include features such as secure online payment integration, mobile application support, and real-time notifications. Adding GPS-based location services and usage analytics could further enhance system capabilities. Overall, the proposed system offers a reliable and efficient solution for managing parking activities while reducing manual effort and improving user convenience.

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