



Smart Parking Allocation and Booking System

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Abstract— The Parking Management System is a web-based application designed to simplify the process of managing parking areas and slot bookings. The system allows an administrator to add, modify, and manage parking locations, slots, and pricing details efficiently. Users can register, log in, view available parking areas, and book slots based on their convenience. The application provides real-time slot availability, booking confirmation, and automated calculation of parking charges based on entry and exit time. It also includes features for releasing slots and viewing booking history, ensuring transparency and ease of use. By integrating database management and a user-friendly interface, the system reduces manual effort, avoids overcrowding, and enhances overall parking efficiency. This project demonstrates the practical use of Python, web technologies, and database systems to solve real-world problems effectively.

Keywords—Parking management system, web-based application, slot booking, real-time availability, user authentication, automated billing, database management, Python web development.

I. INTRODUCTION

In today's rapidly growing urban environment, managing parking spaces has become a significant challenge. With the increasing number of vehicles, traditional parking methods often lead to confusion, time wastage, and inefficient space utilization [1][6]. The Parking Management System is developed to address these challenges by providing a structured and automated solution [5]. This system enables administrators to manage parking areas digitally while allowing users to easily find and book available slots [3]. By replacing manual processes with a digital platform, the system improves accuracy, reduces human errors, and ensures better organization [10]. It also helps users save time by providing real-time information about

parking availability [7]. The application is designed to be simple, user-friendly, and efficient, making it suitable for both small and large parking facilities. Overall, the system aims to enhance convenience for users and improve operational efficiency for administrators [8].

The core functionality of the Parking Management System revolves around user interaction and administrative control. The administrator plays a key role in adding new parking areas, updating slot availability, and modifying pricing details based on requirements [5]. This flexibility allows the system to adapt to different environments such as malls, offices, or public parking zones. On the other hand, users can create accounts, log in securely, and access various features like booking slots, viewing parking details, and checking directions [3]. The system ensures that users can select parking spaces according to their preference, making the process convenient and efficient. Additionally, the system maintains proper records of all parking activities, which helps in tracking usage and managing data effectively [8]. By combining both administrative and user functionalities, the system creates a balanced and efficient parking management solution.

Another important aspect of the system is its ability to handle real-time booking and status updates [7]. When a user selects a parking slot, the system immediately updates its status to prevent double booking. This real-time functionality ensures that the information displayed to users is always accurate and reliable. The system also provides a visual representation of slot availability, making it easier for users to understand which slots are free or occupied. Once a slot is booked, the user can confirm the booking by entering vehicle details, and the system records the entry time. Later, when the user releases the slot, the system calculates the total parking charge based on the duration of use [2]. This automated calculation eliminates the need for manual billing and ensures transparency in the



payment process. Such features make the system efficient and user-friendly.

Security and data management are also essential components of the Parking Management System [9]. The application ensures that user information, booking details, and payment records are stored securely in the database. Proper authentication mechanisms are used to allow only authorized users to access their accounts and perform actions. The system also maintains a detailed history of all bookings, which users can view at any time. This feature helps users keep track of their past parking activities and payments. From an administrative perspective, the stored data can be used for analysis and decision-making, such as identifying peak usage times or optimizing parking space allocation [8]. By maintaining organized and secure records, the system enhances reliability and trust among users. Overall, it provides a safe and efficient environment for managing parking operations digitally.

II. RELATED WORK

Karunamurthy et al., [2024] [1] presented an advanced online parking reservation system to improve urban parking management. Their work focuses on reducing traffic congestion by allowing users to reserve parking spaces in advance. The system provides real-time updates about slot availability, which helps users make quick decisions. It also improves overall efficiency by minimizing the time spent searching for parking. The authors highlighted the importance of integrating smart technologies into city infrastructure. Their study shows that digital parking systems can significantly enhance user convenience. Furthermore, the solution contributes to better utilization of available parking resources. The research supports the concept of smart cities by promoting automation in daily activities.

Sadreddini et al., [2021] [2] proposed a multicriteria decision-based parking reservation system designed for electric vehicles. Their approach considers several important factors such as charging station availability, user preferences, and parking duration. The system uses decision-making algorithms to select the most suitable parking slot. This improves both efficiency and user satisfaction. The study emphasizes the growing need for specialized parking solutions for electric vehicles. It also demonstrates how intelligent systems can support sustainable transportation. The authors highlighted that integrating such models can reduce waiting time and optimize resource usage. Their work contributes to the development of smart and eco-friendly parking systems.

Shaik et al., [2019] [3] introduced a customer-to-customer parking reservation system that allows users to share their private parking spaces. This model helps in utilizing underused parking areas effectively. The system connects users who need parking with those who have available space. It reduces the problem of parking shortages in busy urban areas. The authors focused on improving accessibility and flexibility in parking management. Their approach also encourages community participation and resource sharing. The system is cost-effective and easy to implement in real-world scenarios. Overall, their research provides an innovative solution to urban parking challenges.

Hanif et al., [2010] [4] developed a smart parking reservation system using SMS technology. Their system allows users to book parking spaces by sending text messages, making it simple and accessible. This approach is especially useful in areas where internet connectivity is limited. The system ensures quick communication between users and the parking service. It reduces the need for advanced devices or applications. The authors focused on making the system user-friendly and widely available. Their work represents an early stage in the evolution of smart parking systems. It also highlights the importance of using basic technologies to solve real-world problems.

Migdadi et al., [2018] [5] designed an online parking booking system based on a practical case study. Their research focuses on improving the efficiency of parking management through digital solutions. The system allows users to reserve parking spaces in advance, reducing congestion and saving time. It also provides better organization and management of parking facilities. The authors emphasized user satisfaction and ease of use. Their findings show that such systems can significantly reduce the difficulties faced by drivers. The study also demonstrates the real-world applicability of parking reservation systems. Overall, their work contributes to improving modern parking infrastructure.

III. DATASET DETAILS

The dataset used in the Parking Management System is structured to store and manage information related to administrators, users, parking areas, and booking activities. It includes multiple tables such as admin details, user registration data, parking area information, and slot availability records. The admin dataset contains login credentials and control privileges required to manage the system. The user dataset stores personal details such as username, contact information, and login credentials, ensuring secure



authentication. Another important dataset is related to parking areas, where each entry includes area ID, location name, total slots, and pricing per unit time. Additionally, slot-level information is maintained to track the availability status of each parking space. This structured data organization helps in efficient storage, quick retrieval, and smooth functioning of the system while ensuring data consistency and reliability.

The system also maintains a dynamic dataset for booking and transaction management, which plays a crucial role in real-time operations. This dataset records details such as booking ID, user ID, parking area ID, slot number, vehicle number, entry time, and exit time. It also stores calculated parking charges based on the duration of usage. The booking dataset is continuously updated whenever a user reserves or releases a slot, ensuring accurate status tracking. Additionally, payment-related information such as transaction status and payment details is included to complete the booking process. The system also keeps historical records of all bookings, allowing users to view past activities and administrators to analyze usage patterns. This data can be useful for improving parking management strategies and optimizing resource allocation. Overall, the dataset supports both operational efficiency and decision-making processes within the system.

IV. PROPOSED METHODOLOGY

The proposed Parking Management System follows a structured and modular approach to handle parking operations efficiently. The system is divided into two main modules: admin and user. The admin module is responsible for managing parking areas, including adding new locations, updating slot availability, and setting parking costs. The user module allows individuals to register, log in, and access available parking slots. The system uses a backend server to process requests and a database to store all relevant data. Real-time updates ensure that slot availability is accurately displayed, preventing conflicts and improving system reliability.

The booking process is designed to be simple and efficient for users. Once logged in, users can view available parking areas and select a suitable slot. After entering vehicle details, the system confirms the booking and updates the slot status. When the user releases the slot, the system calculates the total parking fee based on entry and exit time. Payment is then processed, and the slot becomes available again. All booking activities are stored in the database for future reference. This methodology

ensures smooth operation, reduces manual work, and enhances user experience.

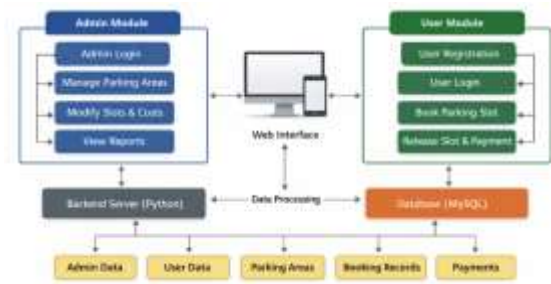


Figure [1] : Smart Parking System Architecture

Figure[1] diagram represents the architecture of a smart parking management system. It consists of two main modules: the admin module and the user module, both interacting through a web interface. The admin can manage parking areas, update slot availability and pricing, and view reports, while users can register, log in, book parking slots, and make payments. All operations are handled by a backend Python server, which processes data and communicates with a MySQL database that stores user data, parking details, booking records, and payment information.

V.RESULT AND DISCUSSION

The implementation of the Parking Management System produced effective and reliable results in managing parking operations digitally. The system successfully allowed the administrator to add, update, and manage multiple parking areas with ease. Each parking location was assigned unique identifiers, and slot availability was updated in real time. Users were able to register and log in without any issues, indicating proper authentication and data handling. The booking functionality worked smoothly, where users could view available slots and select their preferred parking space. Once a slot was booked, its status was immediately updated, preventing duplication. The system also recorded entry and exit times accurately, enabling automatic calculation of parking charges. Payment processing, even with dummy details, was completed successfully, and slots were released back into availability. Additionally, users could view their booking history, which confirmed proper data storage and retrieval. Overall, the system demonstrated consistency, accuracy, and efficiency in handling both admin and user activities.

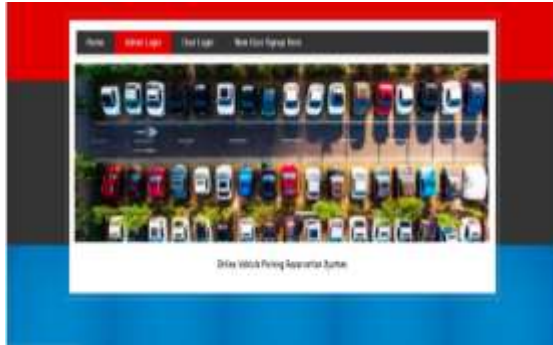


Figure [2] : Online Vehicle Parking Reservation System Interface

Figure [2] shows the homepage of the online vehicle parking reservation system. It provides navigation options such as admin login, user login, and new user registration. The interface is designed to allow both administrators and users to access the system easily. Users can book parking slots, while admins can manage parking areas and monitor system activities, making the platform efficient for handling parking reservations.



Figure [3] : Admin Dashboard – Online Vehicle Parking Reservation System

Figure [3] 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 [4] : User Dashboard with Parking Management Options

Figure[4] represents the user dashboard of the Online Vehicle Parking Reservation System after successful login. It allows users to perform key actions such as booking a parking slot, releasing a previously booked slot, and viewing their booking history. The interface is designed for easy navigation with clearly visible menu options. A welcome message confirms the user's login, and the system helps users manage their parking activities efficiently and conveniently.



Figure [5] :Parking Slot Selection Interface

Figure[5] 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 of the system highlight its practical usability and effectiveness in solving common parking issues. By automating the booking and management process, the system reduces manual effort and minimizes human errors. The real-time slot update feature plays a key role in avoiding conflicts and ensuring accurate information for



users. The separation of admin and user modules improves system organization and security, allowing controlled access to different functionalities. The system also enhances user experience by providing a simple interface and clear navigation for booking and releasing slots. However, there is scope for further improvement, such as integrating real payment gateways and GPS-based location tracking for better accuracy. The current system uses a basic setup, but it can be expanded to handle larger datasets and multiple users simultaneously. Overall, the system proves to be a scalable and efficient solution that can be applied in real-world scenarios to improve parking management and reduce congestion.

VI. CONCLUSION

The Parking Management System provides a practical solution to the challenges of managing parking spaces in an organized and efficient manner. It simplifies the overall process by allowing administrators to control parking areas and users to easily find and book available slots. The system reduces the time spent searching for parking and minimizes confusion through real-time updates and clear slot status. Features like automated charge calculation, booking history, and slot management improve both accuracy and user convenience. The project also demonstrates how technology can replace manual processes and improve day-to-day operations. With a simple design and effective functionality, the system can be applied to various environments such as malls, offices, and public parking areas. Although the current version uses basic features, it can be further enhanced by adding advanced options like online payments and location tracking. Overall, the system achieves its goal of providing a reliable, user-friendly, and efficient parking management solution.

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