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Parking Allotment System

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***Abstract* - The Parking Allotment System is a software - based solution designed to efficiently manage and allocate parking spaces in organizations, residential complexes, malls, and public parking areas. The main objective of this system is to reduce manual effort, avoid parking conflicts, and optimize the utilization of available parking slots. The system maintains a centralized database that stores information about vehicles, users, parking slots, entry time, and exit time. When a vehicle arrives, the system automatically checks the availability of parking spaces and assigns a suitable slot. It also tracks parking duration and helps in generating reports for monitoring and management purposes. By automating the parking allotment process, the system minimizes human errors, saves time, and improves overall parking management. The Parking Allotment System provides a reliable, user-friendly, and efficient solution for managing parking operations in a systematic manner.**

Keywords: Parking Allotment System, Slot Allocation, Vehicle Management, Database System, Entry and Exit Tracking.

I. INTRODUCTION

With the rapid increase in the number of vehicles, managing parking spaces efficiently has become a major challenge in organizations, residential areas, shopping malls, and public places. Traditional parking systems are mostly manual, which leads to problems such as improper space utilization, time consumption, and parking conflicts. The Parking Allotment System is developed to overcome these issues by providing an automated and systematic approach to parking management. This system helps in allocating parking spaces to vehicles based on availability and maintains proper records of vehicle entry and exit. It reduces human effort, saves time, and ensures better utilization of parking spaces. By using a computerized parking allotment system, parking operations become faster, more accurate, and more reliable, making it an effective solution for modern parking management needs.

1.1 Automated Parking Allocation

The Parking Allotment System automatically assigns parking spaces to vehicles, reducing manual effort and eliminating human errors in parking management.

1.2 Real-Time Parking Availability

The system provides real-time information about available and occupied parking slots, helping users quickly find parking spaces and avoid unnecessary delays.

1.3 Efficient Space Utilization

By monitoring and managing parking slots digitally, the system ensures optimal use of available parking spaces and prevents overcrowding.

1.4 Time and Traffic Reduction

The system minimizes the time spent searching for parking and helps reduce traffic congestion, leading to improved user convenience and smoother vehicle flow.

II. LITERATURE SURVEY

A number of research studies and surveys have been conducted to address the challenges in parking management caused by rapid urbanization and increasing vehicle numbers. These works explore both smart parking technologies and various allocation approaches to improve efficiency, reduce congestion, and provide real-time information to users.

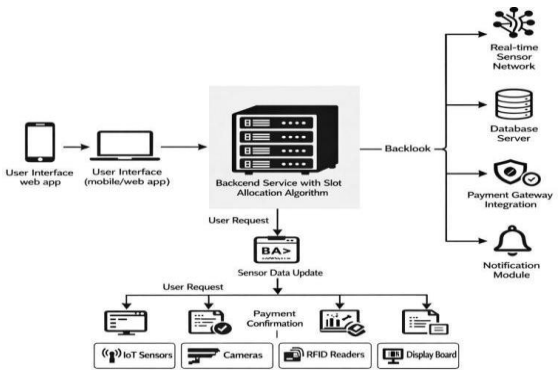

Figure 1: System Architecture of Parking Allotment System

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2.1 Smart Parking Management Surveys

Several comprehensive surveys summarize the state of smart parking systems developed over the years (2009 –2022), analyzing different technologies such as IoT, sensors, and wireless communication for efficient parking management. These studies emphasize the need for dynamic parking systems that minimize search time and congestion, and they propose recommendations for future research in smart parking solutions.

2.2 IoT & Sensor-Based Smart Parking

Research on IoT-based smart parking systems highlights the use of technologies like RFID and real-time sensors to detect slot availability and update databases. These systems often incorporate web interfaces to display changes in parking occupancy, improving user awareness through automated detection of free slots.

2.3 Real-Time Detection and Computer Vision Approaches

Modern literature also focuses on computer vision and machine learning to detect vehicle presence and space availability from cameras. Systematic reviews of vision-based methods show their effectiveness and limitations, including dataset issues and conditions like low light or weather effects. These vision approaches automate the detection process without requiring individual sensors for every parking space.

2.4 Advanced Parking with License Plate Recognition

Some studies integrate IoT with image processing, using cameras and OCR (Optical Character Recognition) to recognize license plates and verify vehicle parking. These systems also incorporate billing mechanisms, enabling automated entry, exit, fee calculation, and improved revenue management in urban lots.

2.5 Classification of Parking System Types

Literature has also classified smart parking solutions into various categories—including reservation systems, guidance systems, centralized search, and EV parking systems — highlighting the diversity of approaches and specific use cases.

III. METHODOLOGY

The Parking Allotment System describes the systematic approach used to design, develop, and implement an automated parking management solution. The system follows a modular and layered architecture to ensure efficiency, scalability, and reliability.

3.1 User Interaction and Request Generation

Users access the system through a web or mobile application. The user registers, logs in, and submits a parking request by selecting the desired location, date, and time. This request is forwarded to the backend server for processing.

3.2 Backend Processing and Slot Allocation

The backend service receives the user request and executes the slot allocation algorithm. The algorithm checks real-time parking slot availability using sensor data stored in the database. Based on availability, the system allocates the most suitable parking slot to the user.

3.3 Real-Time Sensor Data Collection

IoT sensors, RFID readers, and cameras installed in the parking area continuously monitor slot occupancy. This real-time data is sent to the backend server, where it is processed and updated in the parking database to maintain accuracy.

3.4 Payment Processing

Once a parking slot is allocated, the user proceeds with online payment through an integrated payment gateway. After successful payment confirmation, the booking details are stored in the database.

3.5 Notification and Confirmation

The system sends automated notifications to the user regarding slot allocation, payment confirmation, and parking instructions. Notifications may be delivered via in-app alerts, SMS, or email.

3.6 Parking Guidance and Monitoring

Display boards and guidance systems provide directions to the allocated parking slot. Continuous monitoring ensures proper slot usage and detects violations or unauthorized parking.

3.7 Admin Monitoring and Report Generation

Administrators access an admin panel to monitor parking status, manage slots, and view real-time data. The system generates reports related to slot utilization, payments, and user activity for analysis and decision-making.

IV. SYSTEM IMPLEMENTATION

The Parking Allotment System is implemented using a modular architecture that integrates user interfaces, backend services, databases, real-time sensors, and payment gateways.

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The implementation focuses on automation, accuracy, and real- time data processing.

Parking Allotment System

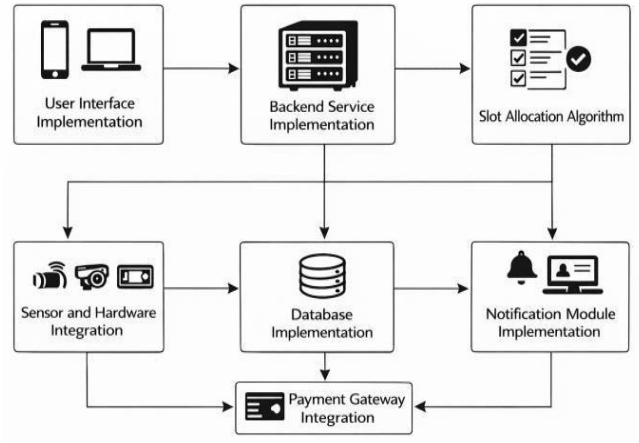

Figure 2: Implementation Architecture Diagram of Parking Allotment System

4.1 User Interface Implementation

The user interface is developed as a web and mobile application. It allows users to register, log in, check parking availability, book slots, and make payments. The interface is designed to be user-friendly and responsive for easy access across devices.

4.2 Backend Service Implementation

The backend service is implemented using a server-side application that handles all system logic. It processes user requests, executes the slot allocation algorithm, communicates with sensors, and manages data flow between different modules. The backend ensures secure and efficient request handling.

4.3 Slot Allocation Algorithm

The slot allocation algorithm assigns parking slots based on real-time availability, user requirements, and booking time. The algorithm checks the parking database and sensor data to avoid double allocation and ensure optimal utilization of parking spaces.

4.4 Sensor and Hardware Integration

IoT sensors, RFID readers, and cameras are deployed in parking slots to detect vehicle presence. These devices continuously send occupancy data to the backend server. The system updates slot status automatically whenever a vehicle enters or exits a parking space.

4.5 Database Implementation

The system uses centralized databases to store user details, parking slot information, booking records, and payment transactions. The database is updated in real time to maintain data consistency and accuracy.

4.6 Payment Gateway Integration

An online payment gateway is integrated into the system to enable secure and cashless transactions. After successful payment, the system confirms the booking and updates the billing database.

4.7 Notification Module Implementation

The notification module sends alerts and confirmations to users regarding slot allocation, payment status, and parking instructions. Notifications are delivered through email, SMS, or in-app messages.

V. RESULT AND DISCUSSIONS

The implemented Parking Allotment System successfully automates the process of parking slot allocation. The system provides real-time information on parking availability and allocates slots accurately based on sensor data. Users were able to book parking slots through the web/mobile application, complete payments securely, and receive instant confirmations. The admin panel effectively monitored parking usage and generated utilization and payment reports.

The results demonstrate that the system reduces manual effort and time spent searching for parking spaces. Real - time sensor integration improves allocation accuracy and prevents double booking. Online payment and notification modules enhance user convenience. Compared to traditional parking systems, the proposed system improves space utilization, reduces traffic congestion, and supports efficient parking management. Minor limitations include dependency on network connectivity and sensor accuracy, which can be improved in future enhancements.

VI. CONCLUSION

The Parking Allotment System provides an efficient and systematic solution to the problem of parking management. By automating the allocation of parking spaces, the system reduces manual work, saves time, and minimizes errors that occur in traditional parking methods. It ensures proper utilization of available parking slots and maintains accurate records of vehicle entry and exit. This system improves overall parking efficiency and user convenience while helping authorities manage parking areas more effectively. Hence, the

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Parking Allotment System proves to be a reliable and practical solution for modern parking management needs.

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