

# Vehicle Park System

Mrs. Kirti Borhade<sup>[1]</sup>, Mr. Shlok A Gaikwad<sup>[2]</sup>, Mr. Chaitanya D Thonge<sup>[3]</sup>, Mr. Prajwal A Purnapatre<sup>[4]</sup>  
 Department of Computer Engineering <sup>[1,2,3,4]</sup>  
 Nutan Maharashtra Institute of Engineering and Technology, Pune, Maharashtra<sup>[1,2,3,4]</sup>

**Abstract** - The increasing number of cars in urban areas has led to a pressing issue: ineffective management of parking spaces. This not only worsens traffic congestion but also frustrates car owners struggling to find parking spots. The aim is to address these challenges with a comprehensive vehicle parking management program. The program caters to both car owners and parking lot managers, offering a solution that optimizes traffic flow and parking procedures. Through a user-friendly interface, individuals can reserve or pre-book parking spaces after registering for the app. They'll have access to a variety of parking options tailored to their specific needs, reducing time spent searching for parking and allowing for better trip planning. Users can also personalize the app by selecting parking spots based on their vehicle type and any additional requirements they may have, such as access to electric vehicle charging stations. The application accommodates a wide range of customer preferences, whether they drive a compact car, a larger vehicle, or need specific amenities.

**Keywords:** Vehicle parking, parking management, parking management, Parking reservation system, Application on vehicle parking.

## I. INTRODUCTION

In bustling urban areas grappling with parking congestion, the proposed parking management system aims to revolutionize traditional parking methods. By automating vehicle entry and exit recording, it offers a practical solution to issues faced by manual systems. The system's user-friendly interface simplifies data management, minimizing errors and enabling administrators to quickly access vehicle records using license plate numbers. Specifically tailored for urban environments, the web-based application reduces data entry errors, addressing parking challenges commonly encountered in public spaces like malls, hospitals, and businesses. The system optimizes resource utilization and saves time for users by eliminating the need to search for parking spots manually. Additionally, it provides a secure and cost-effective alternative to vehicle towing. This innovative solution streamlines payment processes for users and offers valuable data for urban planning and traffic control to municipalities. By addressing urban parking complexities, the Metropolitan Pay2Park Management System contributes to creating more accessible, organized, and eco-friendly metropolitan environments.[5]

The application is designed with user-friendliness in mind, aiming to create an error-free, secure, reliable, and efficient system. It assists organizations and public spaces in maximizing resource utilization, addressing significant parking challenges faced by venues such as malls, theaters, hospitals, offices, and market areas. The application provides a low-cost, secure parking solution, reducing the risk of vehicle towing and benefiting individual users. Furthermore, it offers valuable insights for parking administrators through an administrative dashboard, facilitating informed decision-making and reallocation. The goal is to develop a scalable and user-centric application that enhances the parking experience for vehicle owners while optimizing traffic management and parking space utilization in urban settings.

Key features of the system include tracking vehicle entry and exit, maintaining comprehensive records of parked vehicles, and assessing parking availability. Developed using Java Android Studio and Firebase, the project leverages modern technological advancements to deliver a secure, reliable, and efficient management system. The Vehicle Park System represents an innovative approach to urban parking solutions, addressing challenges posed by growing metropolitan populations and increasing vehicular traffic. By offering a seamless and user-friendly experience, motorists can pay for parking through digital platforms, reducing the time spent searching for parking spaces. Real-time monitoring and data analytics optimize parking space utilization and enhance overall urban mobility. Ultimately, the implementation of this parking management system promises to improve the parking experience for users, reduce manual labor, and facilitate better resource management in public areas, contributing to a more efficient and sustainable urban infrastructure.

## II. LITERATURE SURVEY

In the initial stages of parking management, systems relied heavily on manual operation, necessitating human personnel to oversee parking areas and handle fee collection. This manual approach involved parking attendants directing vehicles to available spaces, issuing tickets or permits, and collecting payments from parkers upon entry or exit.[2] With the advancement of technology, parking management underwent a significant transformation. Automated systems emerged to streamline and enhance the efficiency of parking operations. Additionally, the introduction of electronic payment methods revolutionized the process of collecting parking fees. Rather than solely relying on cash transactions managed by attendants, users now have the option to make electronic payments using methods such as credit cards, mobile payments, or prepaid parking cards. This shift towards electronic payments not only improves convenience for users but also enhances revenue collection for parking operators while reducing the risk of cash theft or mishandling. Overall, the transition from manual to automated parking systems represents a notable advancement in parking management technology.

This paper discusses the importance of infrared and ultrasonic sensors in parking management systems, which play a crucial role in detecting vehicle presence within parking spots. These sensors operate by detecting environmental changes, such as the presence or absence of a vehicle, and transmitting this data to the parking management system.[6,1]

Automated ticketing systems are a crucial component of modern parking facilities, replacing the manual issuance of tickets with automatic ticket generation upon entry. This eliminates the need for attendants to distribute tickets or handle payments. Moreover, technological advancements have minimized the requirement for human intervention in ticketing processes. Barrier controls, equipped with sensors and automated mechanisms, regulate access based on ticket validation or electronic permits. By automating entry and exit procedures, barrier controls facilitate traffic flow management and maximize space utilization efficiency within parking facilities.

This paper introduces an innovative application of machine learning (ML) in parking management systems, where video feeds are analyzed to determine available parking spaces. This approach leverages artificial intelligence to automate the identification and real-time monitoring of parking availability. By utilizing machine learning, parking management systems can achieve increased automation, efficiency, and accuracy in monitoring parking space availability. This technology benefits drivers by providing immediate parking information and enhances overall parking facility management, leading to improved traffic flow and customer satisfaction.[7]

A comprehensive approach to parking management involves integrating various technologies and services to create a holistic solution that enhances urban mobility. This includes providing real-time information on parking space availability, traffic conditions, and other relevant factors to urban drivers. Sensors, cameras, and IoT devices continuously monitor parking spots and collect occupancy data, which is then accessible to drivers through mobile apps, sites, or digital displays. Additionally, automated systems have emerged as a solution to streamline parking operations and optimize the overall parking experience for operators and users alike.

### III. METHODOLOGY

Analyzing parking space utilization based on data collected from car driver trips recorded in travel surveys involves a sequential examination of vehicle movements over time and space. This allows for an understanding of user behavior regarding parking space usage throughout a typical day, particularly during the fall period when the survey took place. Further details on data will be provided later. The manual assessment of parking capacity in an area entails observing the maximum accumulation of vehicles throughout the day. [4] The validation method proposed in this study combines various techniques, including traditional approaches such as field surveys and conventional measurements, as well as newer tools like Google Street View, OpenStreetMap, and other publicly available geographic information. A parking management system is employed to keep track of vehicles entering and exiting a parking facility, making it easier for administrators to retrieve data by allowing access to vehicle information via license plate numbers. This record is vital for authorizing access to the Vehicle Parking Management System, assigning usernames and passwords to users (staff) based on their level of authority, distinguishing between regular users and administrators.

To evaluate parking space usage based on car driver trips recorded in travel surveys, a sequential analysis is conducted to monitor vehicle movements across both time and space. This method allows for an examination of user behavior regarding parking space usage throughout a typical day, particularly during the fall period when the survey was conducted. Further details regarding [9,10]

the data will be provided later. The manual determination of parking capacity in an area involves observing the maximum accumulation of vehicles throughout the day. The validation approach proposed in this study combines various methods, including traditional techniques such as field surveys and conventional measurements, as well as tools like Google Street View, OpenStreetMap, and other publicly available geographic information.[3,8]

#### Proposed System:

The proposed system follows the waterfall model methodology for systematic development. It begins with thorough research and stakeholder consultations during the Requirement Gathering and Analysis phase to identify project needs. System Design focuses on crafting a user-friendly architecture using UML diagrams. Implementation involves coding modular units, each rigorously tested in Unit Testing. Integration Testing ensures compatibility, leading to overall performance assessment in System Testing. Deployment involves transitioning the system into the customer environment with proper documentation and support. Maintenance addresses evolving requirements through ongoing updates and bug fixes. This structured approach aims to deliver a reliable and scalable solution that meets stakeholder expectations. A parking management system is employed to keep track of vehicles entering and exiting a parking facility, making it easier for administrators to retrieve data by allowing access to vehicle information via license plate numbers. This record is essential for granting access to the Vehicle Parking Management System and assigning usernames and passwords to users (staff), categorizing them according to their level of authority, thereby distinguishing between regular users and administrators.

#### 1. System Architecture:

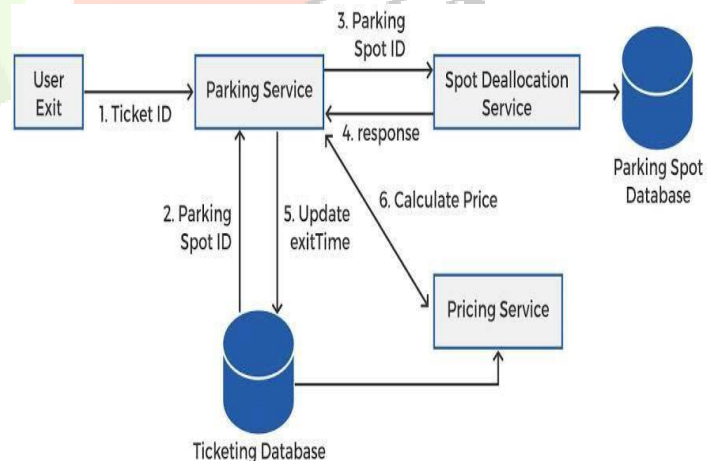


Fig.1 System Architecture

The proposed approach for assessing parking space utilization based on car driver trips recorded in a travel survey employs a sequential processing method. This technique monitors the movement of vehicles over both time and space, allowing for an examination of parking space usage patterns throughout a typical day in the specified fall period. Further details on the utilized data sets will be provided later in the study. Manual determination of parking capacity in an area involves identifying the peak accumulation of vehicles observed during a day, indicating the highest demand for parking spaces in that area. The validation strategy outlined in this study combines various methods, incorporating traditional techniques like field surveys and conventional measurements, alongside newer approaches using OpenStreetMap and other publicly available geographic information. By integrating diverse data sets and methodologies, the validation process aims to ensure the accuracy and reliability of the analysis of parking space utilization.[8,2] [ref fig.1]

The proposed parking management system, designed to oversee records of vehicles entering and exiting a parking facility, emphasizes convenience and efficiency for administrators. This system simplifies the retrieval of vehicle visit data using license plate numbers, streamlining authorization for the Vehicle Parking Management System. Additionally, it assigns usernames and passwords to users, categorizing them as regular users or administrators based on their level of authority.[5,2] This hierarchical access control mechanism ensures that only authorized personnel can access and manage sensitive parking data, thereby enhancing security and accountability within the system. In summary, the proposed method for evaluating parking space utilization and the accompanying parking management system offer comprehensive solutions for understanding and optimizing parking operations. By combining traditional and innovative approaches, these methods aim to address the challenges of parking management in urban environments while ensuring user-friendly operation and robust security measures.

#### ADVANTAGE –

1. Implementing an Android-based vehicle park system offers numerous advantages, catering to both operators and users. Here are 10 advantages:
  2. User-Friendly Interface: Android-based systems can offer intuitive interfaces familiar to users of smartphones, making it easy for them to navigate and use the system for parking.
  3. Real-Time Updates: Users can receive real-time updates on available parking spaces, reducing the time spent searching for a spot and improving overall efficiency.
  4. Remote Monitoring: Operators can remotely monitor the parking lot's status, including occupancy rates, revenue, and any maintenance requirements, through a connected Android device.
  5. Payment Integration: Android-based systems can integrate various payment methods, such as credit/debit cards, mobile wallets, and even cryptocurrencies, providing users with flexible payment options.
  6. Digital Ticketing: Users can receive digital tickets on their smartphones, eliminating the need for physical tickets and
  7. reducing paper waste.
  8. Navigation Assistance: Android-based systems can provide navigation assistance to guide users to available parking spots within the parking facility, optimizing the parking experience.
  9. Customization Options: Android-based systems offer flexibility for customization according to specific parking facility requirements, allowing operators to tailor the system to meet their unique needs.
- .Integration with IoT Devices: Android devices can seamlessly integrate with Internet of Things (IoT) devices such as sensors and cameras to enhance security, automate processes, and improve overall efficiency.

10. Scalability and Accessibility: Android-based systems are scalable, allowing for easy expansion or modification as the parking facility grows or changes. Additionally, the widespread use of Android devices ensures accessibility for both operators and users.

#### FUTURE SCOPE

The future scope for metropolitan Pay2Park vehicle parking systems is promising, with advancements in technology and urbanization trends driving demand. Integration of AI-driven algorithms can optimize parking space allocation, reducing congestion and emissions. Smart sensors and IoT devices will enhance user experience by providing real-time availability updates and seamless payment options through mobile apps. Moreover, incorporating renewable energy for parking infrastructure aligns with sustainability goals. Expansion into autonomous parking solutions could revolutionize urban mobility, offering efficient and convenient parking experiences. Overall, the future of metropolitan Pay2Park systems lies in innovation, sustainability, and enhancing urban living standards.

#### IV. CONCLUSION

This project aims to simplify the process of parking a vehicle by enabling users to make payments and provide vehicle details to store data securely. The application ensures the safety of parked vehicles, and prototypes have been tested with sample inputs and outputs to meet project requirements. With minor adjustments, the system's efficiency can be enhanced, and future developments could include integrating additional services such like:

1. Implementing the application via web pages.
2. Adding new modules to improve effectiveness in line with updates over time.

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