

SMART PARKING MANAGEMENT SYSTEM

Mrs. D. Swarna¹, Sirichandana pothkanoori², Uppula Snehitha³, Dindigala Rishitha⁴, Varre Mahesh⁵, Vallapu Ajay⁶.

¹ Assistant Professor in CSE, Dept. of Computer Science & Engineering, Christu Jyothi Institute of Technology & Science, Jangaon, Telangana, India.

^{2,3,4,5,6} UG Student, Dept. of Computer Science & Engineering, Christu Jyothi Institute of Technology & Science, Jangaon, Telangana, India.

Abstract

These days, finding a parking spot and avoiding traffic congestion are major problems that frequently cause annoyance and anger. Conventional parking management methods frequently result in traffic jams, protracted wait times, and ineffective use of available space. Our proposal uses database technology and ticket generate to construct an easy-to-use, real-time parking management system in order to solve these issues. By providing a safe and quick parking system, this study offers a software-based solution to these problems. A state-of-the-art system called the " Smart Parking Management System" is intended to completely change how we handle parking for cars in urban areas. This system, which was created with Java and MySQL, provides a smooth and effective method of managing parking spaces, improving user convenience and optimizing usage. The necessity to look for parking spots on-site is eliminated with our suggested application, which enables users to reserve parking spots in advance at any location.

The principal aim of this study is to design and execute an automated parking system that will improve public parking zones' convenience and minimize human intervention by automating parking charge collection. The trouble of looking for parking spaces is minimized for users thanks to an intuitive web application that makes it simple to find and reserve open spots. In addition, this research presents a new method for easing parking problems and provides information on other ways to deal with these problems. The online program gives customers the freedom to choose parking spots whenever it's most convenient for them, doing away with the necessity for hurried searches and providing immediate parking solutions. Our goal in showcasing this cutting-edge software is to offer a different way to deal with parking issues and enhance urban mobility in general. This study adds to the continuous efforts to improve parking facilities' usability and efficiency, which will make living in cities easier and less stressful for everyone. Through the optimization of parking resources, the reduction of traffic congestion, and the improvement of the general quality of life in urban areas, this initiative represents a significant step towards smart, sustainable urban development.

Keywords: Parking management, database technology, ticket generator, state-of -the art system, convenience , optimizing.

1. Introduction

In today's metropolitan environments, finding a parking spot can frequently become an arduous and time-consuming task. Conventional parking systems find it difficult to assign available spaces effectively because they mostly rely on manual administration. This inefficiency is most noticeable in regions with high population density, where there are considerably more cars than parking spaces.[1] As a result, drivers lose a lot of time going around blocks in circles trying to find that elusive parking spot.

Smart Parking Systems appear to be a possible answer to these problems. These systems transform the parking experience by utilizing state-of-the-art technologies.[2] Sensors that are systematically placed across parking lots and continuously track each space's occupancy status in real time are essential to their operation. Drivers can then conveniently obtain the most recent information about available parking spots from their devices by integrating this data into user-friendly web or mobile applications. The option for consumers to reserve parking spots in advance through online booking platforms is one of the distinguishing characteristics of smart parking systems. [3] This lessens the chance of frustration and time lost by doing away with the need for aimless circling. Furthermore, these systems frequently include dynamic pricing mechanisms that modify charges according to location, demand, and time of day. In addition to maximizing the use of parking spots, this flexibility gives parking lot managers a source of income.

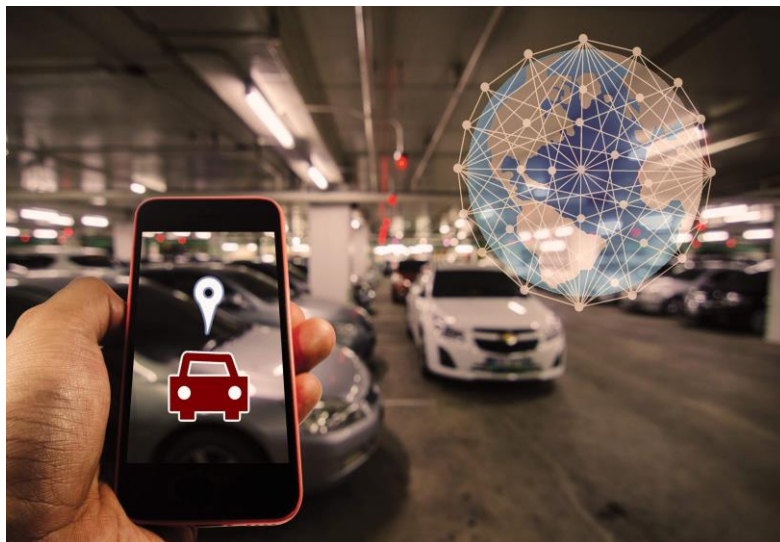


Fig. Smart parking system

Additionally, smart parking systems assist with navigation by guiding cars to the closest parking space by smoothly connecting with GPS and navigation apps. These solutions improve traffic flow and lessen congestion, which makes the urban mobility environment more effective. Furthermore, Smart Parking Systems offer insightful information about user behavior and parking trends because to their powerful data analytics capabilities. Parking lot managers and city planners can make well-informed decisions about resource allocation and infrastructure development with the help of this data-driven strategy. Smart parking systems give priority to sustainability and accessibility in addition to convenience. [4] They can have amenities that encourage inclusion and eco-friendly forms of transportation, such bike racks, handicapped parking, and places set out for electric cars. The advent of Smart Parking Systems, which

seamlessly combine efficiency, sustainability, and technology to improve urban transportation overall, is essentially a major advancement in urban parking management.

2. LITERATURE REVIEW

“1 .Smart parking reservation system using short message services (SMS). [9] By 1.Noor HazrinHanyMoham adHanif 2.Mohd Hafiz Badiozaman 3.Hanita Daud 2009”

A smart parking reservation system using SMS integrates various components to efficiently manage parking spaces and facilitate user reservations through text messages. This involves maintaining a database of available parking spaces, user registration, SMS gateway integration, reservation processing, confirmation and reminders, real-time occupancy monitoring, cancellation and modification capabilities, robust security measures, optional integration with payment systems, and provision for feedback and support. Through these components, the system optimizes parking space utilization and enhances user convenience via simple SMS interactions.

“2 ZigBee and GSM based secure vehicle parking management and reservation system. [11] By 1.Ashwin Sayeeraman 2.P.S.Ramesh 2012”

The ZigBee and GSM-based secure vehicle parking management and reservation system leverages ZigBee technology for local communication within the parking facility. ZigBee offers low-power, short-range wireless communication, making it ideal for connecting sensors and devices within the parking infrastructure.

Within the system, ZigBee-enabled sensors are deployed at each parking space to monitor occupancy status in real-time. These sensors communicate with a central ZigBee coordinator or gateway, which collects data and coordinates communication within the parking facility. GSM technology is employed for remote access and communication with the parking management system. Users can interact with the system via SMS or mobile application, enabling them to check parking availability, reserve parking spaces, and receive notifications. The system ensures secure communication and data transmission between users and the parking management system. Encryption techniques may be implemented to safeguard sensitive information, such as user credentials and reservation details, transmitted over the GSM network.

Parking administrators have access to a centralized management interface, allowing them to monitor parking occupancy, manage reservations, and generate reports. This interface may be web-based or accessed through dedicated software, providing administrators with real-time insights into parking utilization and trends.

“3 Smart Parking Service based on Wireless Sensor Networks. [12] 1.Jihoon Yang 2.Jorge Portilla 3.Teresa Riesgo”

A smart parking service based on wireless sensor networks (WSN) utilizes sensors deployed in parking spaces to monitor occupancy status and provide real-time parking availability information. This system employs WSN technology, which consists of a network of interconnected sensors capable of wirelessly transmitting data to a central server or gateway. By leveraging WSN, the smart parking service offers numerous benefits, including improved parking management efficiency, reduced traffic congestion, and enhanced user experience.

The system enables drivers to easily locate available parking spaces using mobile applications or other interfaces connected to the central server. Additionally, parking facility operators can access comprehensive data analytics and insights to optimize parking space utilization and streamline operations. Through the integration of WSN technology, the smart

parking service transforms traditional parking facilities into intelligent, data-driven environments, benefiting both drivers and parking operators alike.

“4 An Intelligent Parking Guidance and Information System by using image processing technique. [15] 1.P.DharmaReddy 2.A. RajeshwarRao 3.Dr. Syed Musthak Ahmed”

The system employs various image processing algorithms to accurately identify parking spaces and differentiate between occupied and unoccupied spots. These algorithms may include edge detection, object recognition, and machine learning techniques to enhance the system's accuracy and reliability.

Through the intelligent processing of parking area images, the system optimizes parking space utilization, reduces congestion, and improves overall parking efficiency. Drivers benefit from timely information on available parking spaces, reducing the time spent searching for parking and enhancing their overall parking experience.

3. EXISTING SYSTEM

Current smart parking systems locate available spaces and effectively manage parking through a network of sensors and software. Vehicles in parking spots are detected by sensors such as magnetic strips or cameras, which then wirelessly transfer data. This data is interpreted by a central software platform, which can also manage elements like entry/exit barriers and user apps for spot seeking, payment processing, and real-time information. The result is a real-time map of available parking. A real-time map of available parking spaces is generated by a central software platform that interprets the data gathered from sensors. This platform processes sensor data and produces insights on parking availability through the use of algorithms. Additionally, the platform can include APIs (Application Programming Interfaces) that facilitate integration with third-party programs, such as administrative dashboards and mobile apps with user interfaces. An existing smart parking system is built on a foundation of sensors, software platforms, frontend interfaces, backend servers, and databases. This integrated method improves user experience, allows for effective resource management, and gives parking managers insightful information.



Fig.Existing process of parking management

Disadvantages of existing smart parking systems:

- High Installation Costs
- Ongoing Maintenance
- Privacy Concerns
- Limited Compatibility
- Complexity of Implementation
- Dependency on Internet Connectivity

4. Proposed Method

The back-end server would need APIs to communicate with data sources and the Angular application. The Angular application would use features like maps and data binding to display parking information. Security features like user authentication might be implemented depending on the chosen functionalities. Users can view a map or list displaying available parking spaces in designated areas.[1] This information is updated in real-time based on data received from sensors. The interface allows users to register and login to the system. Different functionalities may be available based on user type, such as regular users or administrators.

The reservation system allows users to select a parking spot, choose a date and time for parking, and confirm the reservation[2]. Once a reservation is made, the selected parking spot is marked as reserved and unavailable to other users during the reserved time period. Users can make payments securely through the frontend interface using credit/debit cards, mobile wallets, or other payment methods supported by the payment gateway. The frontend interface provides navigation guidance to guide users to vacant parking spaces within the designated parking areas.

Advantages of the proposed smart parking system:

- Enhanced User Experience
- Real-time Updates
- Convenience of Reservation
- Optimal Resource Utilization
- Efficient Backend Management
- Data Integrity and Consistency
- Scalability and Flexibility
- Cost-effectiveness

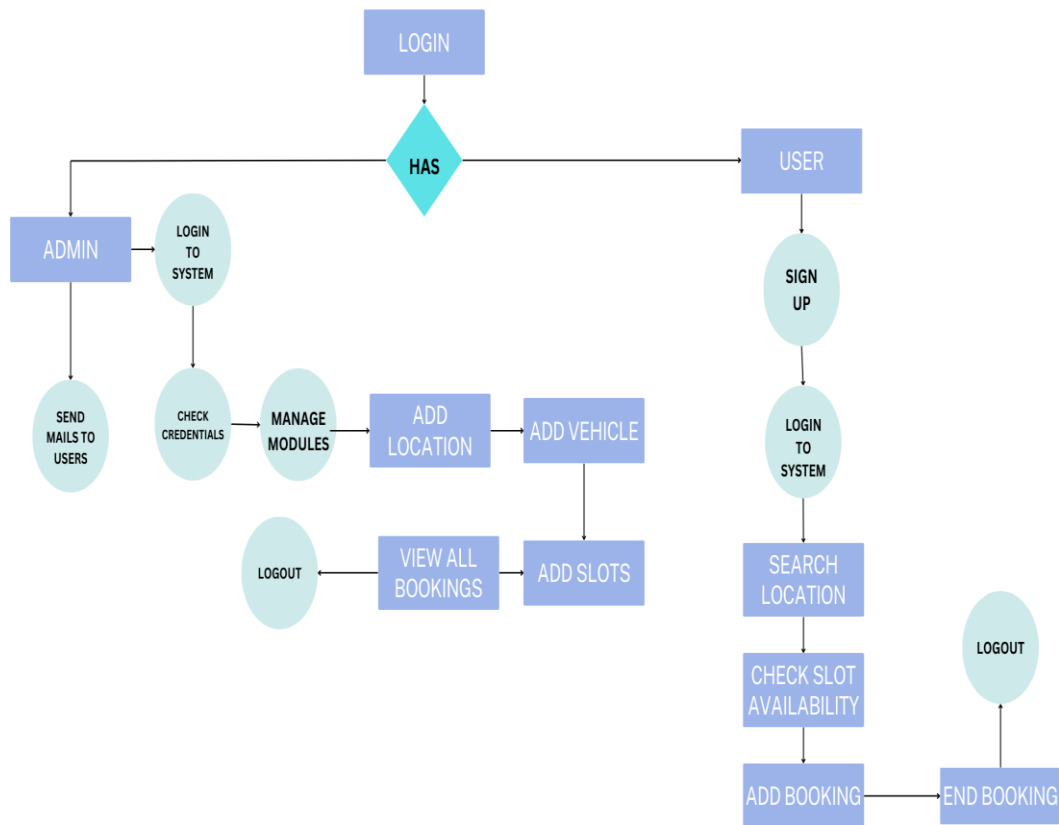


Fig: Block diagram of the proposed method

5. Methodology

Using a blend of state-of-the-art technology, a smart parking system transforms the way parking spots are used and maintained. These systems use sophisticated algorithms, cameras, and sensors to precisely identify parking spaces in real time. This allows drivers to easily find and book places using user-friendly interfaces such as electronic displays or mobile apps. [1]Comprehensive security measures safeguard user data and guarantee system integrity, while integration with current infrastructure guarantees smooth operation and compatibility. Smart parking systems improve user comfort and support more sustainable and effective urban transportation networks through ongoing maintenance and optimization.

When it comes to enabling user engagement, user interface design is essential. User-friendly interfaces can be achieved through electronic displays, web portals, or mobile apps. Compatibility and user-friendliness are guaranteed by integration with the current infrastructure, including payment gateways and access control systems. [2]Encryption and access control techniques protect user data and system integrity, making security measures crucial.

Iterative methods like testing and optimization are used to improve system performance by taking user feedback and usage patterns into account. [3]Installing the equipment and offering continuing maintenance and assistance to resolve any problems are all part of deployment. Frequent upgrades and maintenance procedures guarantee that the system is

resilient and adaptable to changing requirements.[4] In the end, a well-designed smart parking system improves user experience, simplifies parking administration, and helps to create more effective urban mobility.



Fig:Describing the Methodolgy

6. Results and Discussion

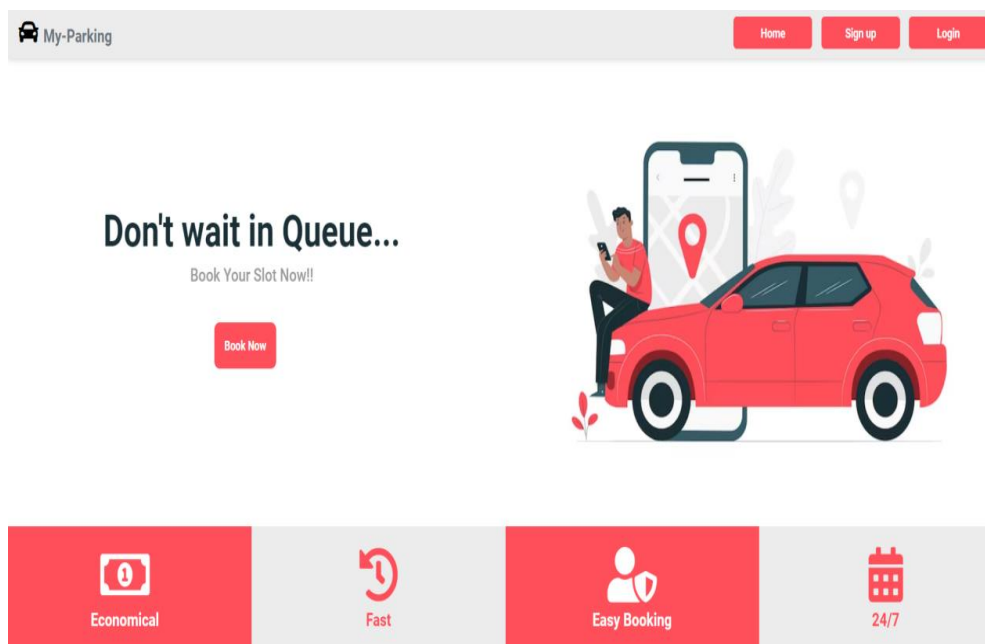


Fig.Home page

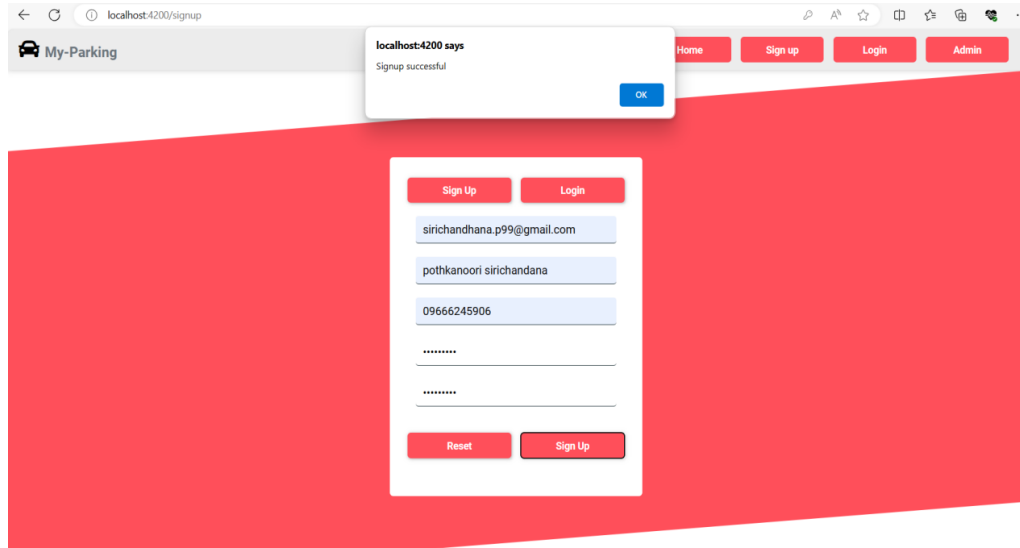


Fig. Signup page

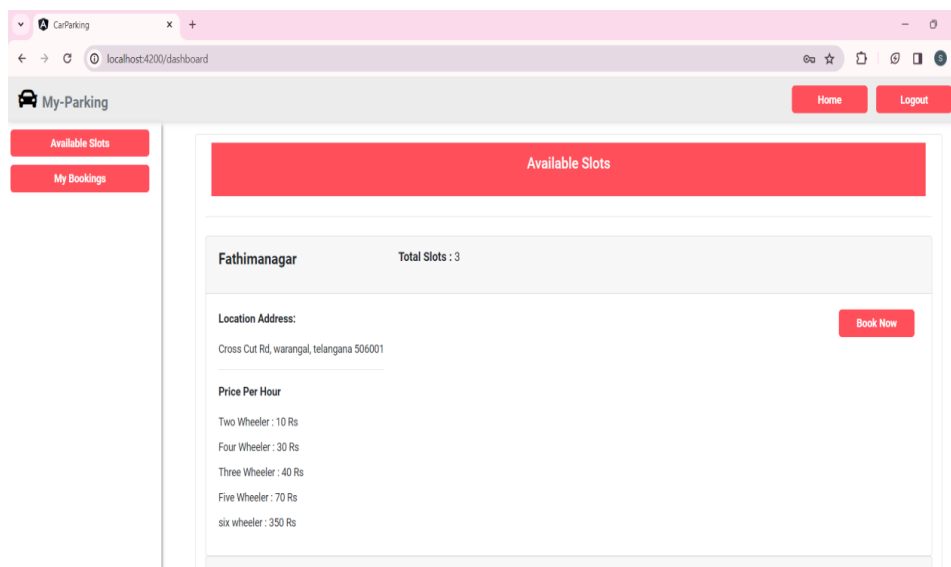


Fig. Available slot page:

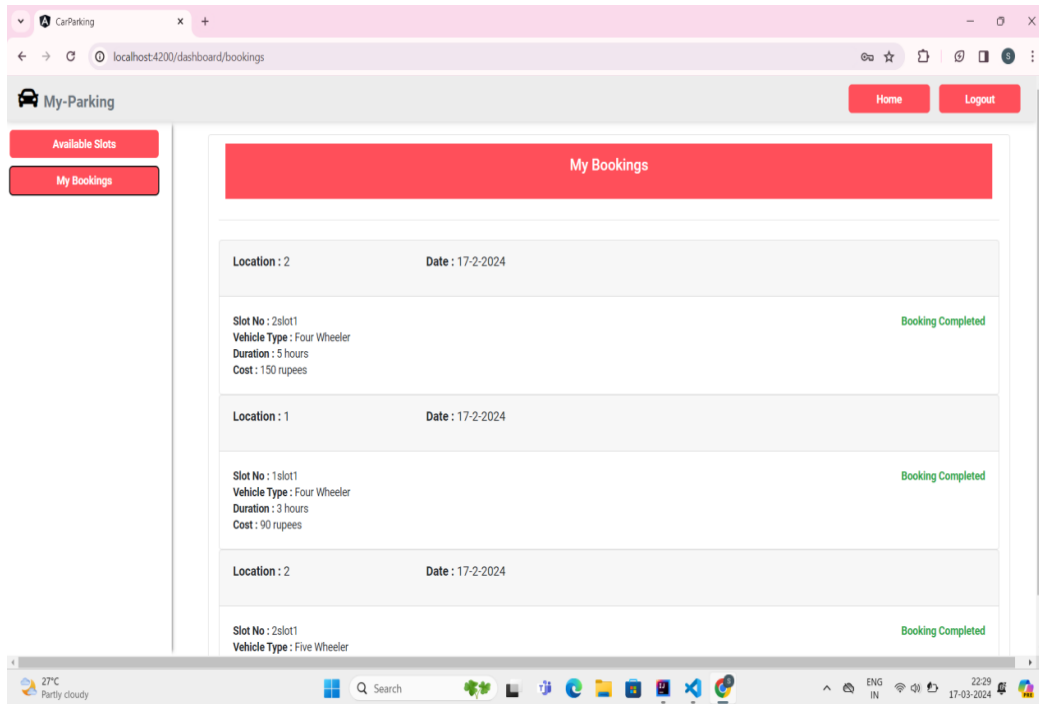


Fig.Slot Booking page

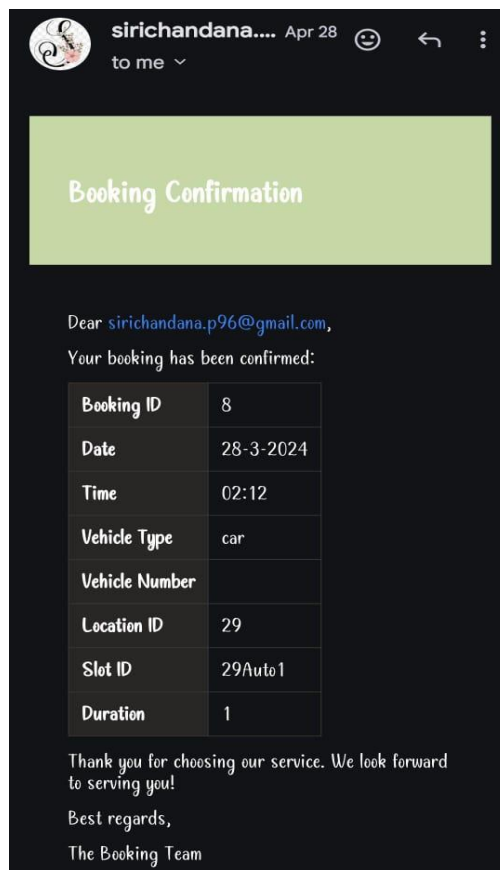


Fig.Booking Comformation Mail

When creating a smart parking system homepage, like "My-Parking," giving users a smooth and easy-to-use experience is essential.[1] Making sure that there are obvious navigation options and an easy-to-use interface for tasks like parking slot booking is a crucial factor during this decision-making process. The efficiency and engagement of users are improved by a clearly visible "Book Now" button and real-time parking space availability information. Prioritizing security measures to protect user data also promotes integrity of the system and confidence.[2] Users are reassured of accessible at all times by a 24/7 availability, and their engagement can be increased by an attractive design with pertinent images. Furthermore crucial is making sure that all users—including those with disabilities—can utilize the system.[3] Including these components in the site design can improve the smart parking system's usability and efficacy.

7. Conclusion

The development of this Angular-based smart parking system signifies a major leap forward in parking management.[1] This web application leverages the power of Angular's framework to provide a dynamic and user-friendly interface for drivers seeking available parking spaces. Real-time data is the backbone of the system, allowing drivers to effortlessly locate open spots, eliminating the frustration and wasted time associated with endlessly circling a parking lot[2]. This not only reduces traffic congestion but also minimizes driver stress, contributing to a more positive overall experience. From the parking management perspective, the system offers a wealth of valuable insights into parking usage patterns. This data empowers administrators to optimize pricing strategies, allocate resources more effectively, and make data-driven decisions to improve overall parking operations. [3]In conclusion, this innovative system, built using Angular's robust capabilities, paves the way for a smarter and more efficient parking experience for both drivers and parking management, ultimately leading to a more optimized and streamlined parking ecosystem.

8. Further Enhancement

In implementing payment processing for the further enhancement of the smart parking system utilizing Angular, several key considerations come into play. Firstly, Angular's robust framework provides a structured environment for developing seamless payment interfaces. Leveraging Angular's modular architecture, developers can efficiently integrate various payment gateways and methods, ensuring flexibility and scalability. A crucial aspect involves user experience design, where Angular's powerful templating engine facilitates the creation of intuitive and responsive payment interfaces. Through Angular's data binding capabilities, real-time updates and validations enhance user interaction, fostering a smooth payment experience. Additionally, Angular's support for reactive forms enables dynamic form validation, ensuring accuracy in payment details input. Integration with payment gateways demands meticulous attention to security. Angular's built-in features, such as HTTP client module and interceptors, facilitate secure communication with payment APIs, employing encryption and authentication mechanisms to safeguard sensitive data. Furthermore, Angular's adherence to best practices in web development,

including Cross-Site Scripting (XSS) and Cross-Site Request Forgery (CSRF) protection, bolsters the system's resilience against security threats.

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