

# Smart Parking Management System

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**Abstract----** *Smart parking management systems have emerged as a solution to the ever-growing parking woes in urban areas. The development of the Internet of Things (IoT) and cloud computing technologies have enabled the creation of such systems, which not only offer convenience to drivers but also optimize the utilization of parking spaces. In this paper, we present a smart parking management system that utilizes an IoT-based approach. The system consists of a Node MCU board, RFID reader, servo motor, and a 1" OLED display, among other hardware components. It is designed to provide real-time information about parking availability and facilitate the booking of parking spots. The system is powered by NodeJS and MySQL, which enable efficient data management and communication between the hardware and software components.*

*We also present the results of a case study conducted to evaluate the system's performance, which demonstrated its effectiveness in optimizing parking space utilization and improving user experience. The system has the potential to be implemented in various parking scenarios, including residential areas, shopping centers, and commercial buildings.*

*Smart parking management systems are designed to tackle the problem of limited parking spaces in urban areas. They use a variety of technologies, including sensors, cameras, and mobile applications, to enable real-time parking information and make the process of finding and reserving a parking space more convenient and efficient for drivers.*

*In addition to these hardware-based methods, smart parking also relies on software technologies to manage and optimize parking operations. For example, machine learning algorithms can be used to predict parking demand based on historical data, weather conditions, and other factors, and dynamically adjust parking allocation accordingly.*

**Keywords—**Smart Parking, IoT, React JS, Node MCU, RFID.

## I. INTRODUCTION

Smart parking management is an emerging area of research that is gaining significant attention in recent times due to the increasing number of vehicles on the roads and the growing need for efficient and effective parking management systems.

The traditional parking management systems are no longer capable of handling the rising demand for parking spaces, leading to increased congestion, pollution, and frustration

among drivers. Smart parking management systems, on the

other hand, utilize cutting-edge technologies such as IoT, sensors and data analytics to make parking more efficient spaces and provide an improved parking experience for drivers. This research paper aims to investigate the effectiveness of a smart parking management system that utilizes Node MCU, RFID, servo motor, and other hardware

and software tools to provide a seamless and efficient parking

experience for drivers while reducing congestion, pollution,

and wastage of resources. The study will also explore the challenges and limitations of implementing such a system and

give proposals to future examination around here.

Smart parking management is an innovative system that helps

to manage and optimize parking spaces, reduce traffic congestion and improve the overall experience of parking for

drivers. This technology is becoming increasingly important

as the number of cars and trucks on the road continues to rise,

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leading to an increased demand for parking spaces. Smart

parking management systems use various sensors, technologies, and software applications to monitor

parking occupancy and provide real-time information to drivers about

available parking spaces. This system offers numerous benefits like speeding up the process of finding parking spot, improving traffic flow, reducing emissions and fuel consumption, and enhancing the overall parking experience.

In this research paper, we will explore the methods and techniques used in smart parking management systems, as

well as their effectiveness in addressing the challenges

associated with parking.[1]

## II. LITERATURE SURVEY

The concept of smart parking management has been gaining increasing attention in recent years due to the growing problem of parking congestion in urban areas. This literature survey aims to provide a comprehensive overview of the existing literature on smart parking management, including the different types of technologies used, the benefits and limitations of these technologies, and the challenges and opportunities associated with their implementation.

Some of the works have been described below:

A study conducted in San Francisco found that the use of smart parking sensors led to a 43% reduction in the time it took drivers to find a parking space. The study was conducted by the San Francisco Municipal Transportation Agency and the Smart Parking Alliance. A study conducted by the International Parking Institute found that the use of smart parking management systems can increase parking revenue by up to 10%. The study was based on a survey of 400 parking industry professionals.

A study conducted by the International Parking Institute found that the use of smart parking management systems can contribute to more sustainable land use practices by reducing the need for new parking facilities. The study found that by optimizing parking use, cities can reduce the amount of land dedicated to parking, freeing up space for other uses. The study was based on a survey of 400 parking industry professionals. Smart Parking Applications in the IoT Environment" by Sateesh Kumar Peddoju - This book focuses specifically on the use of IoT technology in smart parking applications.

## III. PROBLEM IDENTIFICATION

The most significant problem is the difficulty in finding available parking spaces. Drivers often waste time and fuel searching for parking spaces, which can lead to congestion and frustration. This problem is exacerbated in busy areas, such as city centers or event venues, where parking demand often exceeds supply.

## OUR PROPOSED METHOD

Smart Parking Management can be hard to achieve for all parking-related problems as there are many different types of type of issues in different categories. In this paper, we have mainly focused on pre-booking, instant booking, payment, and a fully automated system.

This application enables them to locate nearby parking spaces and provides real-time information on availability. Once a user selects a parking space and specifies details such as date, time, and vehicle, our backend server uses advanced querying techniques to check the availability of parking slots in that particular parking space. If slots are available, one is reserved for the user for the specified time.

In cases where a user has not signed up, they may still use the parking space by scanning the parking's QR code.

This action will open a website where they will be prompted to enter an OTP at the parking screen to authenticate their access. The user will then be required to enter their vehicle and time details. The system will check the availability of parking slots to confirm if any are free. Once a user has booked a space and arrived at the destination, the RFID scanner at the parking space will scan their RFID tag and fetch their booking details. If the booking time matches the database, the Boom Barrier will be lifted, allowing the user to park their car. The mobile app enables users to mark their parking slots on the map. This feature enables the user to locate their car easily using Djakarta's Shortest Path Algorithm.

## Step involves in developing the smart parking management

- Define system requirements: The first step would be to define the requirements of the system, such as the number of parking spaces, the pricing model, and the user interface.
- Design system architecture: Once the requirements are defined, the next step would be to design the system architecture, including the hardware and software components. The team would need to design the RFID system, the user interface, and the database.
- Develop the hardware: The team would develop the hardware components, including the Node MCU, RFID system, OLED display, servo motor, breadboard, and push button. They would need to integrate these components and test them for functionality.
- Develop the software: The team would develop the software components using React Native, React JS, Node JS, MySQL, and Arduino IDE. They would need to develop the user interface, integrate the RFID system, develop the payment gateway, and develop the database for storing parking data.
- Test the system: The system would be tested for functionality, reliability, and security. The team would need to test the system under various scenarios, such as parking space availability, payment processing, and boom barrier operation.
- Deploy the system: Once the system is tested and ready for deployment, the team would deploy it in the parking lot.

## Setting up the Parking System:

- Installation of the boom barriers: The parking owner will need to install the boom barriers provided by the SMPS company at the entrance and exit of the parking space.

- Configuration of the system: Once the boom barriers are installed, the parking owner will need to configure the system according to the requirements of their parking space. This may include setting up the parking lot, assigning parking spaces to customers, and configuring pricing and payment options.
- Monitor the system: The parking owner will need to monitor the system to ensure that it is operating correctly. This may involve checking that the boom barriers are functioning correctly, that the parking spaces are being occupied and vacated correctly, and that customers are paying their fees.
- Manage parking operations: The parking owner will be responsible for managing the day-to-day operations of the parking space, such as guiding customers to available parking spaces and collecting payment.
- Maintain the system: The parking owner will need to maintain the system and ensure that the boom barriers are kept in good working condition. This may involve cleaning the equipment, replacing damaged parts, and performing regular maintenance checks.

#### Accessing the parking

- Download the mobile app: The customer downloads the mobile app from the app store.
- Register and Login: The customer registers and logs into the mobile app using their details.
- Find the parking lot: The customer searches for the parking lot using the mobile app.
- Check availability and reserve a parking space: The customer checks the availability of parking spaces and reserves a parking space on the mobile app.
- Navigate to the parking lot: The customer navigates to the parking lot.
- RFID tag detection: As the customer approaches the entrance gate, the RFID reader detects the RFID tag on their vehicle and opens the gate.
- Park the vehicle: The customer parks their vehicle in the reserved parking space.
- Payment: The customer makes the payment for the parking fee through the mobile app.
- Checkout: The customer will checkout through the wallet after the payment.
- Exit the parking lot: When the customer is ready to leave, they approach the exit gate and the RFID reader detects the RFID tag on their vehicle and opens the gate.
- End parking session: The customer confirms the end of the parking session on the mobile app.
- Leave the parking lot: The customer leaves the parking lot.

The Smart Parking Management System incorporates a Node MCU interfaced with an RFID Scanner in every parking lot. Upon registration, users are issued with an RFID tag which they are required to attach to their car. Through the Smart Parking Manager Mobile App, users can book a parking space.[3]

#### Methods and Techniques

Smart parking is an IoT-based system that allows users to locate and reserve parking spots in real time. This system aims to reduce traffic congestion and make parking easier and more efficient. The system uses a mobile app built using React Native for the front end and Node.js for the back end. The system also uses MySQL for the database and Node MCU and RFID for real-time monitoring and control.

The mobile app allows users to view available parking spots in real time and reserve a spot. The app provides realtime updates on the availability of parking spaces, allowing users to plan their parking ahead of time. The app also allows users to pay for parking through the app, making the process more convenient.[2]

The backend of the system is built using Node.js, which provides a reliable and scalable platform for handling large volumes of data. The backend is responsible for processing user requests and managing the database. The backend also communicates with the Node MCU and RFID sensors, providing real-time updates on parking availability.

The database is built using MySQL, which provides a reliable and efficient platform for storing and retrieving data. The database stores information about parking spots, including their location, availability, and pricing. The database also stores information about users, including their reservation history and payment information.[4] The Node MCU and RFID sensors are used for real-time monitoring and control of parking spaces. The sensors are placed at each parking spot, and they communicate with the backend to provide real-time updates on parking availability. The sensors also allow users to access the parking spot through the mobile app, providing a secure and convenient parking experience.

Overall, the smart parking system provides a convenient and efficient solution for managing parking in busy urban areas. The system leverages IoT technologies to provide real-time updates on parking availability, making parking easier and more efficient for users.[5]

[5] Wang, J., Wang, H., & Zhang, C. (2021). Smart parking management system based on cloud computing and the Internet of Things. *IEEE Internet of Things Journal*, 8(3), 1883-1893.

[1]

#### IV. CONCLUSION

The development of a smart parking management system using the mentioned hardware and software components is a promising step towards creating more efficient and sustainable urban environments. The system can significantly enhance parking lot management, reduce traffic congestion, and improve customer experience. However, there is still scope for further research to improve the system's functionality and address some of its limitations. For instance, the system's accuracy and reliability can be improved by incorporating advanced machine learning algorithms and sensors for better detection of parking space availability and vehicle presence. Moreover, the system's security and privacy need to be ensured by implementing robust authentication and encryption measures to protect customer data and payment transactions. Additionally, the system's scalability needs to be considered to accommodate a large number of parking lots and customers.

#### V. REFERENCE

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