

Smart Parking System with Real-Time Slot Availability

Presented by:

Name: C. Venkata Somnath

Reg no: 192212181

Name: P Hari krishna

Reg no: 192212358

Guided by:

Dr. R. Dhanalakshmi



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AIM:

To design and develop a Smart Parking System using IoT sensors and mobile applications to provide real-time information on parking slot availability, thereby reducing traffic congestion, saving time for drivers, and minimizing environmental impacts in urban areas.

ABSTRACT:

Urban traffic congestion and parking shortages are pressing issues that result in driver frustration, wasted time, and increased carbon emissions. Traditional parking systems lack the capability to provide real-time updates on parking availability, further exacerbating these problems. This project proposes a **Smart Parking System** that leverages IoT sensors to monitor parking slot occupancy and a mobile application to display real-time slot availability to drivers. By integrating IoT technology and data analytics, the system aims to streamline parking management, optimize the use of parking spaces, and enhance the overall urban driving experience. This solution not only improves convenience for drivers but also contributes to sustainable urban development by reducing unnecessary traffic and emissions.



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INTRODUCTION:

Parking in urban areas is a significant challenge due to the growing population, increased vehicle density, and limited parking spaces. Current parking systems lack real-time monitoring, leading to inefficiencies such as drivers circulating parking lots in search of available spaces. These inefficiencies contribute to traffic congestion, air pollution, and wasted time. The proposed Smart Parking System addresses these challenges by integrating IoT-based sensors to detect parking slot availability and a mobile application for real-time updates to users. The IoT sensors installed at each parking slot detect whether the slot is occupied or vacant and transmit this information to a central server. The data is then processed and displayed in a user-friendly format on a mobile application, enabling drivers to locate available parking spaces quickly and efficiently.



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Sensor Network and Data Collection

1

1. Sensor Deployment

Sensors are strategically placed in parking spaces to detect occupancy status.

2

2. Data Transmission

Sensors transmit real-time data on parking slot availability to a central platform via wireless communication.

3

3. Data Aggregation

The central platform processes and aggregates data from all sensors, providing a comprehensive picture of parking availability.



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Mobile App and User Interface



Search Function

Users can easily search for available parking slots based on their location and preferences.



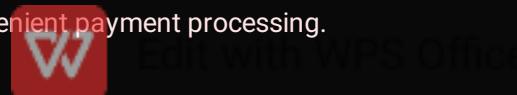
Navigation

The app provides turn-by-turn navigation to the selected parking slot.

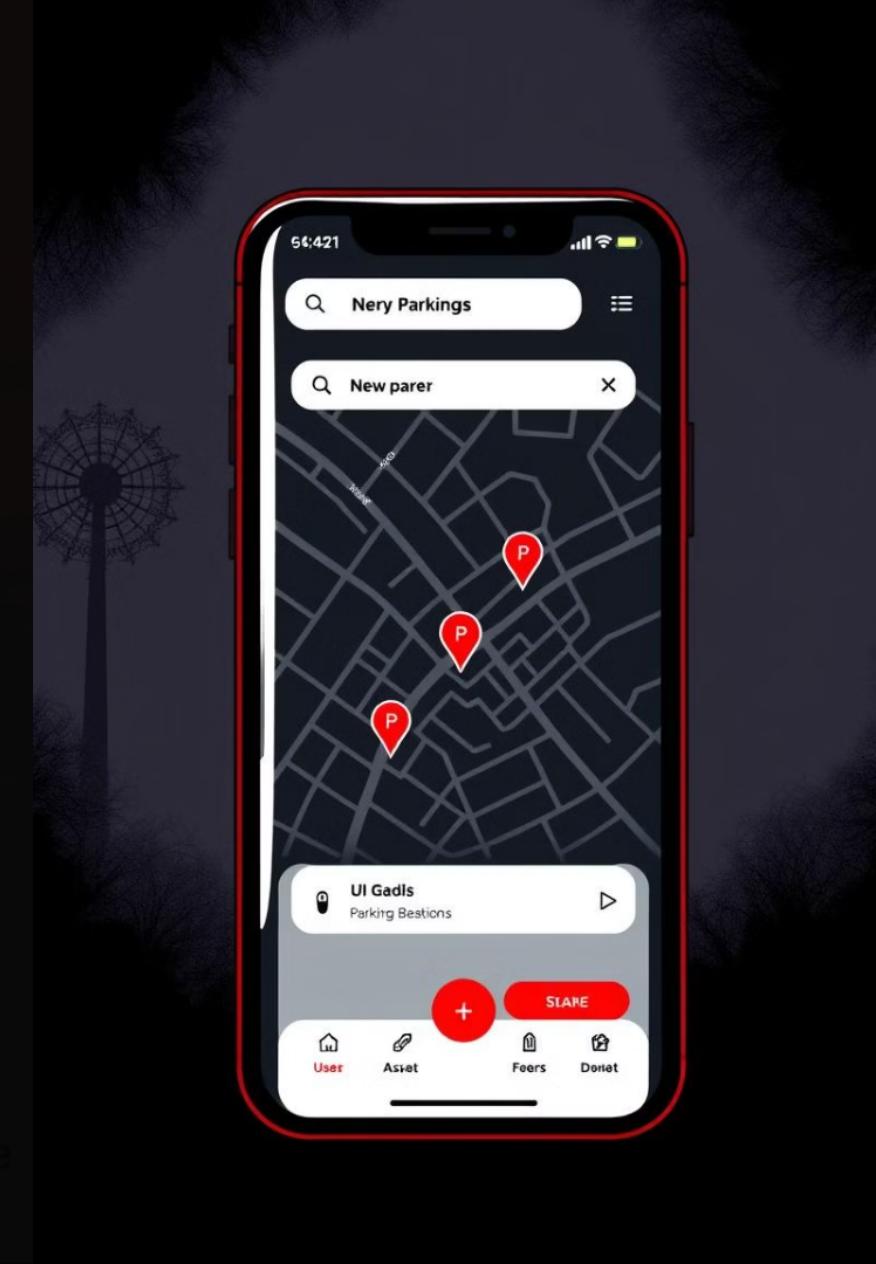


Payment Integration

Secure payment options are integrated within the app for convenient payment processing.



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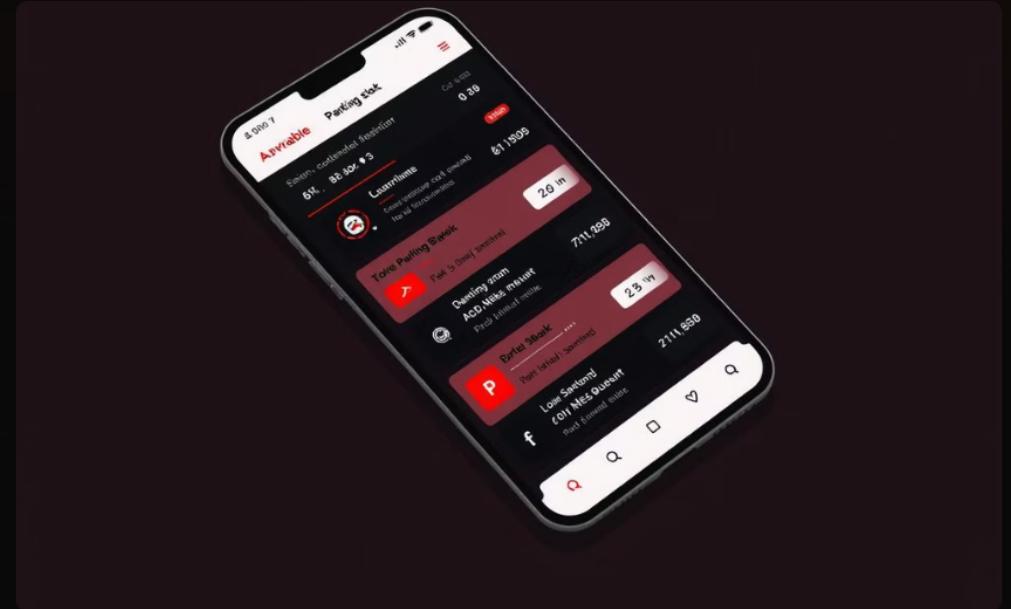


Real-Time Parking Slot Availability Monitoring



Interactive Map

A user-friendly map interface displays real-time parking slot availability.



Slot Details

Users can view detailed information about available parking slots, such as location, distance, and pricing.

C CODE IMPLEMENTATION:

```
#include <stdio.h>
#define MAX_SLOTS 10 // Define maximum parking slots

void displaySlots(int slots[], int n) {
    printf("\nParking Slot Status:\n");
    for (int i = 0; i < n; i++) {
        printf("Slot %d: %s\n", i + 1, slots[i] == 0 ? "Available" : "Occupied");
    }
}

void updateSlot(int slots[], int slot, int status) {
    slots[slot - 1] = status;
    printf("\nSlot %d has been updated to %s.\n", slot, status == 0 ? "Available" : "Occupied");
}

int main() {
    int slots[MAX_SLOTS] = {0}; // Initialize all slots as available
    int choice, slot, status;

    printf("Welcome to the Smart Parking System!\n");

    while (1) {
        printf("\nMenu:\n");
        printf("1. Display Parking Slots\n");
        printf("2. Update Slot Status\n");
        printf("3. Exit\n");
        printf("Enter your choice: ");
        scanf("%d", &choice);
    }
}
```

```
switch (choice) {
    case 1:
        displaySlots(slots, MAX_SLOTS);
        break;
    case 2:
        printf("\nEnter slot number to update (1-%d): ", MAX_SLOTS);
        scanf("%d", &slot);
        if (slot < 1 || slot > MAX_SLOTS) {
            printf("Invalid slot number! Try again.\n");
            break;
        }
        printf("Enter status (0 for Available, 1 for Occupied): ");
        scanf("%d", &status);
        if (status != 0 && status != 1) {
            printf("Invalid status! Use 0 or 1.\n");
            break;
        }
        updateSlot(slots, slot, status);
        break;
    case 3:
        printf("Exiting the system. Have a great day!\n");
        return 0;
    default:
        printf("Invalid choice! Try again.\n");
}
return 0;
}
```



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OUTPUT:

```
Welcome to the Smart Parking System!
```

```
Menu:
```

- 1. Display Parking Slots
- 2. Update Slot Status
- 3. Exit

```
Enter your choice: 1
```

```
Parking Slot Status:
```

```
Slot 1: Available
```

```
Slot 2: Available
```

```
Slot 3: Available
```

```
Slot 4: Available
```

```
Slot 5: Available
```

```
Slot 6: Available
```

```
Slot 7: Available
```

```
Slot 8: Available
```

```
Slot 9: Available
```

```
Slot 10: Available
```



```
Welcome to the Smart Parking System!
```

```
Menu:
```

- 1. Display Parking Slots
- 2. Update Slot Status
- 3. Exit

```
Enter your choice: 2
```

```
Enter slot number to update (1-10): 4
```

```
Enter status (0 for Available, 1 for Occupied): 1
```

```
Slot 4 has been updated to Occupied.|
```

```
Welcome to the Smart Parking System!
```

```
Menu:
```

- 1. Display Parking Slots
- 2. Update Slot Status
- 3. Exit

```
Enter your choice: 3
```

```
Exiting the system. Have a great day!|
```

Predictive Parking Slot Allocation



Historical Data

Historical parking patterns are analyzed to identify peak and off-peak hours.

Real-Time Conditions

Data from sensors and user behavior are used to predict parking availability in real time.

Predictive Allocation

The system intelligently allocates parking slots based on predictions, minimizing search times and maximizing utilization.



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Engineering Standards:

ISO 14813: Framework for Intelligent Transport Systems (ITS), providing general standards for information, communication, and service provision.

ISO 21542: Accessibility standards for building design, applicable to parking facilities.

IEC 60529: IP rating standards for sensor enclosures, ensuring protection against dust and water.

IEEE 802.11 (Wi-Fi): Standards for wireless communication in parking management systems.

ISO 27034: Guidelines for application security, essential for protecting the parking system's software from cyberattacks

ISO/IEC 12207: Software lifecycle process standards to ensure systematic and reliable development

ISO 12812: Standards for mobile payments, applicable to app-based parking fee payments.

IEEE 1547: Standards for interconnecting distributed energy resources, relevant if the parking system incorporates EV chargers.

ISO 14001: Environmental management standards for sustainable design and operation of parking facilities.

ISO 11064: Design of control centers for managing the parking system.



Benefits and Future Enhancements

Reduced Search Time

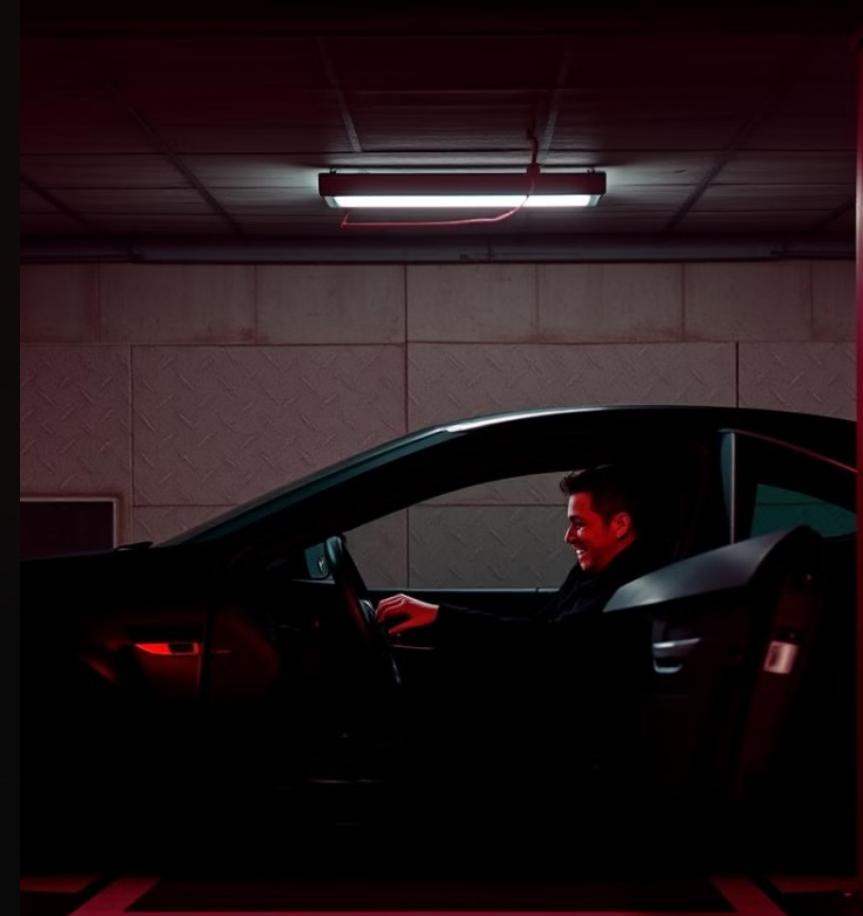
Drivers spend less time searching for parking spots, leading to increased efficiency and reduced stress.

Improved Parking Utilization

The system optimizes parking slot allocation, reducing wasted space and improving parking lot efficiency.

Enhanced User Experience

The user-friendly app and intelligent features create a seamless and convenient parking experience.



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CONCLUSION:

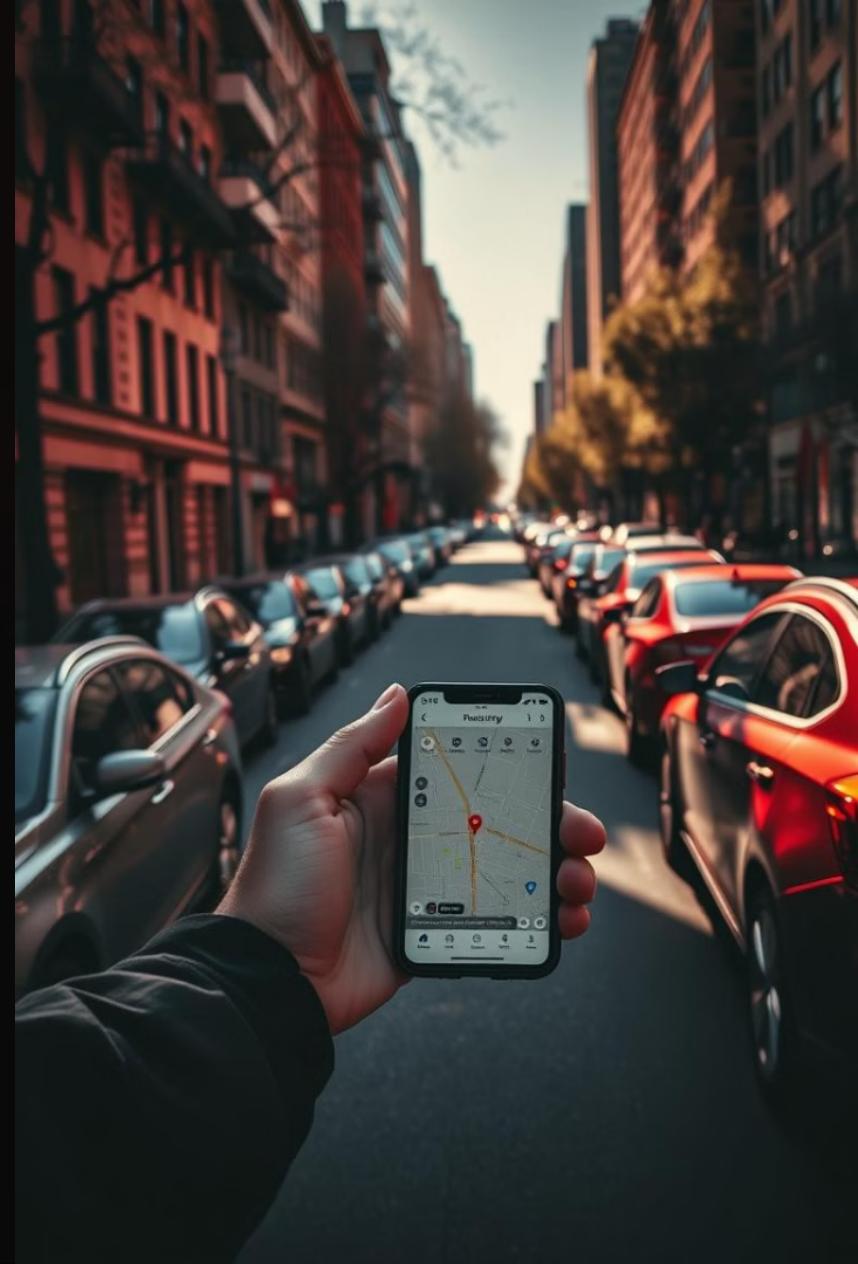
The Smart Parking System with Real-Time Slot Availability provides an innovative solution to the challenges of parking management in urban areas. By leveraging IoT sensors and mobile applications, the system offers real-time data on parking slot availability, enabling drivers to save time, reduce stress, and minimize their environmental footprint. This project not only addresses the inefficiencies of traditional parking systems but also contributes to reducing traffic congestion and carbon emissions, promoting sustainable urban living. The implementation of such systems can significantly enhance the convenience and efficiency of city transportation infrastructure, paving the way for smarter, greener cities. Future enhancements, such as AI integration, predictive analytics, and seamless payment systems, will further expand the capabilities and benefits of this system.



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THANK YOU

Thank you for your time and interest in this presentation. We are confident that our Smart Parking System with Real-Time Slot Availability will revolutionize parking management in urban areas.



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