SMART PARKING

IOT_PHASE 5

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1. Introduction

The Smart Parking system using IoT is designed to address the growing problem of urban traffic congestion and the difficulty of finding parking spaces in crowded cities. This project aims to provide real-time parking space availability information to drivers through a mobile app, enabling them to find and reserve parking spots more efficiently.

2. Objectives

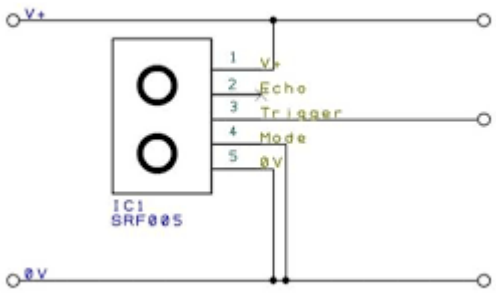
The primary objectives of this project are as follows:

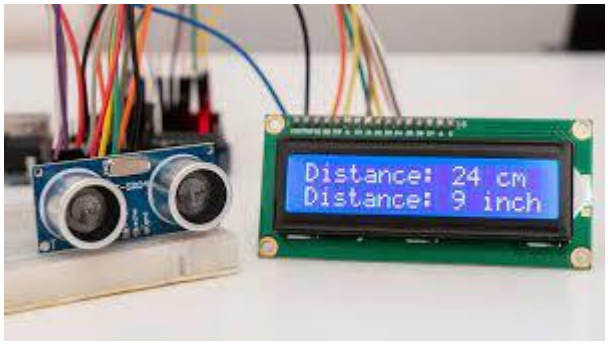
- Develop a system that monitors parking space occupancy in real-time.
- Create a mobile app to display parking availability information.
- Enable users to reserve parking spaces through the mobile app.
- Integrate Raspberry Pi devices with IoT sensors for data collection.
- Implement efficient code for data processing and communication.

3. IoT Sensor Setup

3.1 Hardware Components

- Ultrasonic distance sensors placed at each parking space.





- Raspberry Pi devices with Wi-Fi capabilities for data collection and processing.
- Internet connectivity for data transmission.

3.2 Sensor Operation

- Ultrasonic sensors measure the distance to detect the presence of vehicles.
- Data from these sensors is transmitted to Raspberry Pi devices for processing.

4. Mobile App Development

4.1 Features

- Real-time parking space availability status.
- GPS integration to locate nearby parking areas.
- Reservation system for parking spots.
- User-friendly interface with maps and notifications.

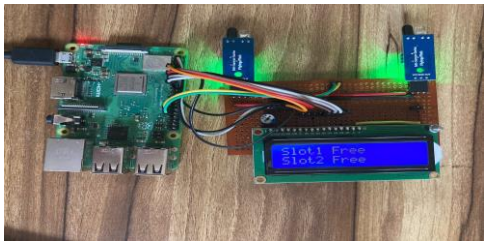
4.2 Technologies

- Android/iOS app development using native or cross-platform tools.
- Integration of Google Maps API for location services.
- Database for user profiles and parking spot reservations.

5. Raspberry Pi Integration

5.1 Setup

- Raspberry Pi devices are placed within each parking area.
- They collect data from ultrasonic sensors and send it to a central server.



5.2 Data Transmission

- Data is sent to the server using Wi-Fi or cellular networks.
- Raspberry Pi devices run scripts to ensure data accuracy and reliability.

6. Code Implementation

6.1 Server-Side

- A central server receives and processes data from Raspberry Pi devices.
- Data is stored in a database for access by the mobile app.
- Server logic handles user reservations and parking space updates.

6.2 Raspberry Pi Code

- Raspberry Pi devices run Python scripts to read sensor data.
- Data is formatted and transmitted to the server using REST APIs or MQTT.
- Error handling and connectivity checks are implemented for robustness.

```
import RPi.GPIO as GPIO
import time
import requests

# GPIO pin configuration
TRIG = 23  # Trigger pin
ECHO = 24  # Echo pin

# Set up GPIO
GPIO.setmode(GPIO.BCM)
GPIO.setup(TRIG, GPIO.OUT)
GPIO.setup(ECHO, GPIO.IN)

# Function to measure distance
def measure_distance():
    GPIO.output(TRIG, True)
    time.sleep(0.00001)
    GPIO.output(TRIG, False)

    while GPIO.input(ECHO) == 0:
        pulse_start = time.time()
```

```
    while GPIO.input(ECHO) == 1:
        pulse_end = time.time()

    pulse_duration = pulse_end - pulse_start
    distance = (pulse_duration * 34300) / 2  # Speed of sound = 343 m/s

    return distance

# Main loop
try:
    while True:
        distance = measure_distance()

        # Adjust this threshold based on your setup
        parking_threshold = 10  # Distance in centimeters

        if distance < parking_threshold:
            # Parking space is occupied, send the status to the server
            data = {'parking_space_id': 1, 'status': 'occupied'}
            response = requests.post('http://your_server/api/parking/status', json=data)

        else:
            # Parking space is vacant, send the status to the server
            data = {'parking_space_id': 1, 'status': 'vacant'}
            response = requests.post('http://your_server/api/parking/status', json=data)

        time.sleep(5)  # Wait before the next measurement

except KeyboardInterrupt:
GPIO.cleanup()
```

A real-time parking availability system can bring several benefits to drivers and help alleviate common parking issues in urban areas. Here's how it can make a positive impact:

- **Time and Fuel Savings**: Drivers can quickly locate available parking spaces, reducing the time and fuel wasted in circling around for parking. This not only saves money but also helps in reducing carbon emissions and traffic congestion.

- **Reduced Stress**: The frustration of searching for a parking spot in a crowded area can be stressful. Real-time availability information reduces this stress, making the overall driving experience more pleasant.

- **Optimized Parking**: Drivers can make informed decisions about where to park based on real-time data. They can choose the closest available spot, one that suits their needs (e.g., handicapped or family spaces), or even reserve a parking spot in advance, ensuring convenience and accessibility.

- **Traffic Flow**: When drivers can find parking spaces efficiently, it reduces the number of cars on the road and minimizes the likelihood of illegal parking or double parking. This, in turn, improves traffic flow and reduces congestion.

- **Economic Benefits**: Cities can benefit from improved traffic flow as it leads to increased economic productivity. Businesses in urban areas also see higher foot traffic as potential customers are more likely to visit shops and restaurants when parking is accessible.

- **Environmental Impact**: Reduced time spent searching for parking and decreased idling in traffic not only save fuel but also contribute to lower greenhouse gas emissions and air pollution.

- **Reservations and Planning**: Real-time parking systems often allow users to reserve parking spots in advance. This feature is especially beneficial during peak hours or for special events, ensuring that parking is available when needed.

- **Accessibility and Inclusivity**: The system can also provide information about parking spaces for disabled individuals or parents with young children, making cities more inclusive and accessible to all.

- **Data for City Planning**: The data collected by the real-time parking system can be used by city planners to make informed decisions about parking infrastructure and traffic management. It can help in optimizing the distribution of parking spaces and identifying areas that need additional resources.

- **Security**: Drivers may feel safer knowing they are headed to a known and monitored parking area, which can deter criminal activity and increase personal safety.

Conclusion:

The Smart Parking system using IoT aims to enhance the parking experience in urban areas by providing real-time information and reservations to users. By integrating IoT sensors, Raspberry Pi devices, and mobile app development, this project seeks to reduce traffic congestion and make parking more convenient for city dwellers.

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