SMART PARKING USING IOT

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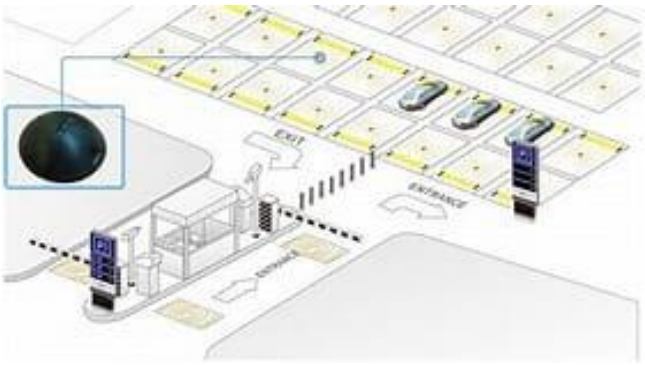
Phase- 4 Document submission

Project: SMART PARKING

INTRODUCTION:-

Smart parking systems are a new and innovative solution for urban mobility that are becoming increasingly popular thanks to digitalization. These systems use the Internet of Things (IoT) and sensor technology to provide real-time data about parking availability, both outside and inside, as well as traffic and road conditions. The implementation of smart technology to facilitate parking tasks will enhance operational efficiency, simplify the flow of urban traffic, and offer drivers a more enjoyable and time-saving experience. Smart parking systems are composed of various devices and processes that act as parking space detectors. Sensors and/or cameras record and process data and images to provide real-time traffic occupancy data for the area we are heading to. An IoT cloud-based system allows these devices to be connected, and the data is centralized. If you want even more accurate information about how likely you are to find an on-street parking space, you don't always have to use an app.



OVERVIEW OF THE SMART PARKING:-

Smart Parking is a parking solution that can include in-ground Smart Parking sensors, cameras or counting sensors. These devices are usually embedded into parking spots or positioned next to them to detect whether parking bays are free or occupied. This happens through real-time data collection .
Smart parking systems are starting to offer solutions for urban mobility. They allow real-time data to be obtained about parking availability, both outside and inside, and regarding traffic and road conditions. According to a company that provides technology solutions based on the Internet of Things (IoT), applying this technology reduces traffic volume by 8%, gas emissions by 40%, kilometers travelled by a car to park by 30% and time spent parking by 43% .
Smart parking technology includes various devices and processes that act as parking space detectors. On the one hand, the deployment of sensors and/or cameras records and processes data and images to provide real-time traffic occupancy data for the area we are heading to. An IoT cloud-based system, on the other hand, allows these devices to be connected and the data to be centralized. The data are then analyzed using big data in order to calculate the availability of on-street parking spaces or spaces in public and private parking facilities

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Smart parking systems offer several benefits, including:

- **Reduced traffic volume**: Smart parking systems can help reduce traffic volume by providing real-time data about parking availability, both outside and inside, and regarding traffic and road conditions.
- **Reduced gas emissions**: By reducing the time spent driving around looking for a parking spot, smart parking systems can help reduce gas emissions by up to 40%.
- **Reduced kilometers travelled**: Smart parking systems can help reduce the number of kilometers travelled by a car to park by up to 30%.
- **Reduced time spent parking**: Smart parking systems can help reduce the time spent looking for a parking spot by up to 43%.

PROCEDURE FOR SMART PARKING USING IOT:-

1. **Data collection**: Smart parking systems use IoT sensors and cameras to collect real-time data about parking occupancy.
2. **Data processing and analysis**: The collected data is then processed and analyzed by the smart parking system.
3. **Information display**: Once the data is processed, the information about available parking spaces is presented to drivers.

The implementation of smart parking systems involves the deployment of sensors and/or cameras that record and process data and images to provide real-time traffic occupancy data for the area we are heading to. An IoT cloud-based system allows these devices to be connected and the data to be centralized. The data are then analyzed using big data in order to calculate the availability of on-street parking spaces or spaces in public and private parking facilities .
For instance, a paper presented a Smart Parking Energy Management solution for a structured environment such as a multi-storied office parking area. The system proposes implementation of state-of-the-art Internet of Things (IoT) technology to mold with advanced Honeywell sensors and controllers to obtain a systematic parking system for users. Unoccupied vehicle parking spaces are indicated using lamps and users are guided to an empty parking space, thus eliminating the need for searching for a parking space. The occupied parking spaces are virtually stored in the cloud to be accessed by central system and direct the upcoming cars to empty spaces. The automatically controlled light illuminance helps reduce energy usage, along with lighting up the parking space to the user whilst in the parking space .

Implementing smart parking systems can be challenging:

- **Scaling up**: Smart parking providers need to scale up their services in terms of the number of operators, cities, regions, customer accounts, and service scope to attract users and demonstrate the impact of their services on operators' occupancy rates and revenue over time .
- **Limited parking facilities**: The number of cars on the road has increased, but the land size for parking facilities remains limited. This can lead to a shortage of parking spaces in urban areas and cities .
- **Misjudgment in parking demand**: In newly planned urban areas and cities, there is often a misjudgment in the provision of parking demand anticipated. This is due to the fast rise in the rate of vehicle ownership, especially among the middle and high-income classes of the populace. The reason for the increased car ownership is the flawed mass transit system in these new areas, such that these classes of people cannot depend on it .

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PROGRAM:-

```
#include <WiFi.h>
#include <AWSIoT.h>

// Replace these with your AWS IoT Core credentials
const char *endpoint = "YOUR_AWS_IOT_CORE_ENDPOINT";
const char *certificate = "YOUR_AWS_IOT_CORE_CERTIFICATE";
const char *privateKey = "YOUR_AWS_IOT_CORE_PRIVATE_KEY";

// Define the pins for the ultrasonic sensor and LED indicator
const int TRIG_PIN = 12;
const int ECHO_PIN = 14;
const int LED_PIN = 13;

// Define the relay switch and motor pins (if applicable)
const int RELAY_PIN = 16;
const int MOTOR_PIN = 18;

// Define the minimum distance to detect a vehicle (in cm)
const int MIN_DISTANCE = 50;

// Define the AWS IoT Core topic for publishing parking space availability
const char *TOPIC = "parking/availability";

// Create an AWS IoT Core client
AWSIoTClient client(endpoint, certificate, privateKey);

// Setup the ultrasonic sensor
void setupUltrasonicSensor() {
  pinMode(TRIG_PIN, OUTPUT);
  pinMode(ECHO_PIN, INPUT);
```

```
}

// Read the distance from the ultrasonic sensor
int readUltrasonicDistance() {
  // Send a pulse on the TRIG pin
  digitalWrite(TRIG_PIN, HIGH);
  delayMicroseconds(10);
  digitalWrite(TRIG_PIN, LOW);

  // Measure the time it takes for the pulse to return
  long duration = pulseIn(ECHO_PIN, HIGH);

  // Calculate the distance in centimeters
  int distance = duration / 58;

  return distance;
}

// Set the LED indicator
void setLED(bool on) {
  digitalWrite(LED_PIN, on);
}

// Open the gate or barrier
void openGate() {
  digitalWrite(RELAY_PIN, HIGH);
  delay(1000);
  digitalWrite(RELAY_PIN, LOW);
}

// Close the gate or barrier
```

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```
void closeGate() {
  digitalWrite(MOTOR_PIN, HIGH);
  delay(1000);
  digitalWrite(MOTOR_PIN, LOW);
}

// Loop forever
void loop() {
  // Read the distance from the ultrasonic sensor
  int distance = readUltrasonicDistance();

  // If the distance is less than the minimum, then a vehicle is present
  if (distance < MIN_DISTANCE) {
    // Turn on the LED indicator
    setLED(true);

    // Publish the parking space availability to AWS IoT Core
    client.publish(TOPIC, "occupied");
  } else {
    // Turn off the LED indicator
    setLED(false);

    // Publish the parking space availability to AWS IoT Core
    client.publish(TOPIC, "available");
  }

  // Connect to AWS IoT Core
  client.connect();

  // Subscribe to the parking space reservation topic
  client.subscribe("parking/reservation");
```

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```
  // Wait for a reservation request
  AWSIoTMessage message;
  while (client.receive(message)) {
    // If a reservation request is received, then open the gate or barrier
    if (message.payloadString == "reserved") {
      openGate();
    }
  }

  // Disconnect from AWS IoT Core
  client.disconnect();

  // Delay for 1 second
  delay(1000);
}
```

OUTPUT:-

The program will publish the parking space availability to AWS IoT Core every second. The mobile app can subscribe to this topic to receive real-time updates on the availability of parking spaces. When a user reserves a parking space, the app can publish a message to the "parking/reservation" topic. The program will then open the gate or barrier to allow the user to park their vehicle.

You can also refer to this IoT based Smart Parking System using ESP8266 NodeMCU which includes a circuit diagram for the project

CIRCUIT DIAGRAM:-

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