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DEPARTMENT OF

ELECTRONICS AND COMMUNICATION ENGINEERING

IBM - Naan Mudhalvan

Internet of Things – Group 3

Phase 4– Development Part 2

SMART PARKING

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SMART PARKING -DEVELOPMEMT PART -3

Introduction :

Smart parking refers to the use of technology and data-driven solutions to improve the efficiency and management of parking spaces. It involves the deployment of various sensors, cameras, and software applications to monitor and optimize parking facilities. Smart parking systems can provide real-time information to drivers, helping them find available parking spaces, reduce congestion, and minimize the time and fuel wasted in searching for parking. These systems also offer benefits to parking operators by enhancing revenue collection and improving overall operational efficiency. Smart parking is a significant component of smart cities, as it contributes to reduced traffic, environmental sustainability, and improved urban mobility

IMPLEMENTATION OF MY PROJECT WITH FOLLOWING DOMAIN:

AI:

AI plays a significant role in smart parking systems in several ways:

- **Parking Space Detection:**
  AI can be used to detect and monitor available parking spaces in real-time through various sensors such as cameras and ultrasonic sensors. This data helps drivers find vacant spots quickly.
- **Predictive Analytics:**
  AI can analyze historical parking data to predict parking demand and optimize space allocation, reducing congestion and improving the overall parking experience.
- **Mobile Apps and Navigation:**
  Smart parking apps often use AI to provide real-time information to users, guiding them to available parking spaces and allowing them to reserve spots in advance.
- **Traffic Management**:
  AI can help manage traffic flow within parking facilities, reducing congestion and ensuring a smoother parking experience.
- **Payment and Access Control**:
  AI-powered payment systems and access control mechanisms streamline the entry and exit process, making it more efficient and secure.
- **Security**:
  AI can enhance security by monitoring parking areas with video analytics, detecting unauthorized access or suspicious activities.
- **Maintenance and Operations**:
  AI can be used for predictive maintenance of parking infrastructure, ensuring that equipment like ticket machines and barriers are In working order.

Overall, AI in smart parking systems improves convenience, efficiency, and the utilization of parking spaces, benefiting both drivers and parking facility operators.

ADS:

ADS, which stands for Advanced Driver Assistance Systems, can play a role in a smart parking system to enhance safety and convenience. Here are some ways ADS can be integrated:

- **Automated Parking:**

ADS can take control of a vehicle's steering, acceleration, and braking to navigate it into a parking space, making parking easier and reducing the risk of accidents.

- **Parking Sensors:**
  ADS can use sensors like ultrasonic or cameras to detect obstacles or pedestrians in the parking area, providing real-time alerts to the driver
- **Traffic Flow Optimization:**
  ADS can provide real-time data on available parking spaces, reducing traffic congestion by directing drivers to open spots, saving time and fuel.
- **Collision Avoidance:**

ADS can assist in avoiding collisions with other vehicles or obstacles in tight parking spaces, preventing accidents.

- **Valet Parking:**
  In some smart parking systems, ADS can operate a vehicle autonomously to park it in a designated area, enhancing convenience for users.

By integrating ADS into a smart parking system, you can improve the overall parking experience, enhance safety, and optimize parking space utilization.

DAS:

Dynamic Access System (DAS) in smart parking typically refers to a technology or system that manages access to parking spaces in a flexible and dynamic manner. This system can optimize parking space allocation, control entry and exit, and provide real-time information to drivers. DAS can include features like:

- **Real-time Availability**:
  DAS can monitor the occupancy of parking spaces and provide real-time information to drivers, helping them find available spots quickly.
- **Reservation and Booking**:
  Users can reserve parking spaces in advance, reducing the time spent searching for a parking spot.
- **Payment Integration**:
  DAS often includes payment systems, allowing users to pay for parking electronically, which can improve efficiency and reduce the need for physical payment methods.
- **Access Control**:

DAS can control entry and exit points using technologies like RFID cards or license plate recognition.

- **Dynamic Pricing**:
  Some DAS may implement dynamic pricing, adjusting the cost of parking based on demand or time of day.
- **Integration with Apps**:
  Many smart parking solutions integrate with mobile apps, making it convenient for users to find, reserve, and pay for parking.

Overall, DAS in smart parking aims to enhance the efficiency of parking operations, reduce congestion, and improve the overall parking experience for users

IOT:

IoT (Internet of Things) in smart parking is a technology-driven approach that leverages sensors, connectivity, and data analytics to improve parking management and enhance the overall parking experience. Here are some key aspects of IoT in smart parking:

- **Sensor Deployment:**
  IoT-enabled parking systems use various types of sensors, such as ultrasonic, infrared, or magnetic sensors, to detect the presence or absence of vehicles in parking spaces. These sensors are often embedded in the ground or attached to parking structures.
- **Real-time Data:**
  The sensors collect real-time data on parking space occupancy and transmit it to a central server or cloud platform. This data is then made available to drivers through mobile apps or on-site displays.
- **Availability Information:**
  Drivers can access information on available parking spaces in real-time, reducing the time and frustration associated with searching for a parking spot.
- **Reservations and Payments:**
  IoT in smart parking systems often allow users to reserve parking spots in advance and make payments through mobile apps or online platforms, streamlining the parking process.
- **Traffic Flow Optimization**:
  By analyzing parking data, cities and businesses can optimize traffic flow and reduce congestion around popular parking areas.
- **Energy Efficiency:**
  Smart parking solutions can lead to energy savings by efficiently managing lighting and ventilation in parking facilities based on real-time occupancy.
- **Revenue Generation**:
  Municipalities and parking operators can generate additional revenue by implementing IoTbased parking solutions through paid parking, dynamic pricing, and fines for violations.
- **Maintenance Alerts:**
  Sensors can also help monitor the condition of parking facilities and send alerts when maintenance or repairs are needed.
- **Environmental Benefits:**
  Reducing the time spent searching for parking spaces can lead to a decrease in greenhouse gas emissions as vehicles spend less time idling and circling in search of a spot.
- **Data Analytics**:
  The data collected from IoT sensors can be analyzed to gain insights into parking patterns, peak usage times, and other valuable information for urban planning and decision-making.

IoT in smart parking offers benefits to both drivers and parking facility operators by enhancing convenience, reducing congestion, and improving operational efficiency. It's a key component of the broader smart city concept aimed at making urban areas more efficient and livable.

CAD:

Computer-Aided Design (CAD) can play a crucial role in designing and planning smart parking systems. Here are some ways CAD is utilized in smart parking:

- **Site Planning**:
  CAD software helps in designing the layout of parking facilities, optimizing space, and ensuring efficient traffic flow.
- **3D Modeling**:
  It enables the creation of 3D models for visualizing the parking structure or lot, which aids in better design decisions.

- **Simulation**:
  CAD can be used to simulate vehicle movements within the parking area to identify potential bottlenecks or congestion points.
- **Integration**:
  CAD models can be integrated with other technologies in smart parking systems, such as sensor placements, to ensure accuracy in design.
- **Accessibility**:
  It helps in planning accessible parking spaces for people with disabilities, ensuring compliance with regulations.
- **Data Analysis**:
  CAD data can be used to analyze the impact of different parking layouts on traffic patterns and overall efficiency.
- **Future Expansion**:
  CAD allows for easy modifications and future expansion planning of parking facilities as demand grows.

Incorporating CAD into smart parking design can lead to more efficient and user-friendly parking solutions

CODING:

```
include
<Wire.h>
#include <LiquidCrystal_I2C.h>
LiquidCrystal_I2C lcd(0x27, 16, 2);  // Change the HEX address

#include <Servo.h> Servo
myservo1;
 int IR1 = 2; int IR2 = 4; int SmokeDetectorPin = 6;  // Digital
pin for the smoke detector int BuzzerPin = 7;         //
Digital pin for the buzzer  int Slot = 4;  // Enter
Total number of parking Slots  bool flag1 =
false; bool flag2 = false;
 unsigned long lastLcdUpdate = 0;  // Variable to track the time of the last
LCD update unsigned long lcdUpdateInterval = 1000;  // Update the LCD every
1000 milliseconds (1 second)  void setup() {   lcd.begin(16,
2);  // Initialize LCD with 16
columns and 2 rows   lcd.backlight();   pinMode(IR1, INPUT);   pinMode(IR2,
INPUT);   pinMode(SmokeDetectorPin, INPUT);   pinMode(BuzzerPin, OUTPUT);

  myservo1.attach(3);
myservo1.write(100);
   lcd.setCursor(0, 0);
lcd.print("     ARDUINO    ");
lcd.setCursor(0, 1);   lcd.print("
PARKING SYSTEM ");   delay(2000);
lcd.clear();
```

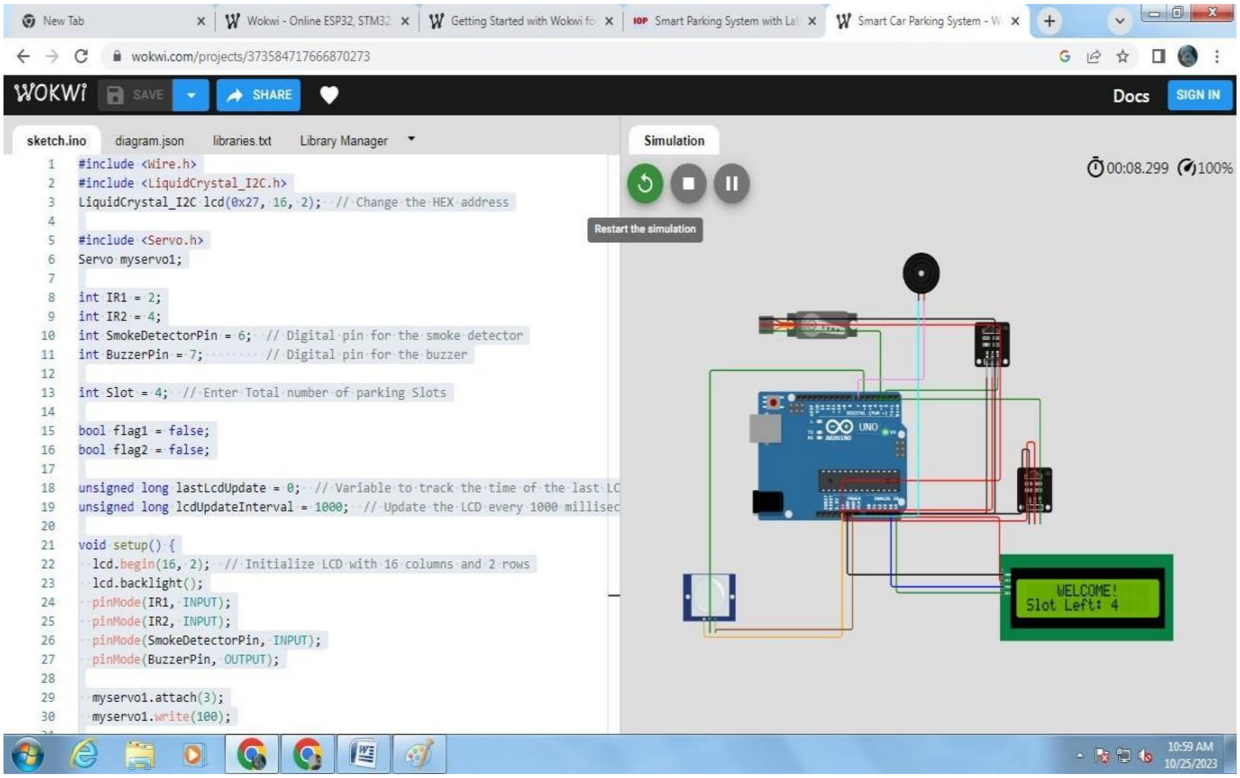
```
  Serial.begin(9600);  // Start serial communication for debugging
}        void
loop() {   if
(digitalRead
(
IR1) == LOW &&
!flag1) {
if (Slot > 0)
{       flag1
= true;
if (!flag2) {
myservo1.writ
e(0);
        Slot--;
      }     } else {       displayMessage("    SORRY :(    ",
"  Parking Full  ");
    }
  }    if (digitalRead(IR2) == LOW &&
!flag2) {     flag2 = true;     if
(!flag1) {       myservo1.write(0);
      Slot++;
    }
  }    if (flag1 &&
flag2) {     delay(1000);
myservo1.write(100);
    Serial.println("Servo   returned   to   initial
position.");     flag1 = false;     flag2 = false;
}

  // Update the LCD display with a delay   if
(millis() - lastLcdUpdate >= lcdUpdateInterval) {
updateLcdDisplay();     lastLcdUpdate = millis();
}

  // ... (Rest of your code)
}  void updateLcdDisplay() {   if
(digitalRead(SmokeDetectorPin) == HIGH) {
displayMessage("   WARNING!   ", " Smoke Detected ");
digitalWrite(BuzzerPin, HIGH);  // Turn on the buzzer
} else {
    displayMessage("    WELCOME!    ", "Slot Left: " + String(Slot));
digitalWrite(BuzzerPin, LOW);   // Turn off the buzzer
  }
}  void displayMessage(const char *line1, const String
&line2) {   lcd.clear();   lcd.setCursor(0, 0);
```

```
lcd.print(line1);   lcd.setCursor(0, 1);   lcd.print(line2);  }
```

SIMULATION:



CONCLUSION:

In conclusion, smart parking systems offer a range of benefits that enhance convenience, efficiency, and sustainability. These systems leverage technology to optimize parking space utilization, reduce congestion, and lower environmental impact. As cities continue to grow and face increasing urbanization, smart parking solutions will play a crucial role in addressing parking challenges and improving the overall urban experience.