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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SCHOOL OF ENGINEERING

PROJECT REPORT

SMART CAR PARKING SYSTEM

A PROJECT REPORT

Submitted by

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B.Tech CSE (IoT)

Introduction to Internet of Things and

Laboratory

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ABSTRACT

The world's population is growing, and cities are becoming more crowded, resulting in an increase in the number of automobiles on the road. The management of car parking is one of the primary difficulties in cities.

In the past, studies on how to structure parking systems were done. Smart parking systems, on the other hand, are still in demand and are attracting researchers' interest as a potential upgrade to meet modern needs and requirements. It is critical to monitor and manage vehicle access in government and private sector parking lots in order to improve the world's security system.

The created system can control allowed vehicle admission into parking areas while blocking unauthorized vehicles. Currently, smart parking or parking guidance systems just receive available parking spot information from deployed sensor networks and then simply distribute it to drivers.

INTRODUCTION

OVERVIEW:

In smart cities, there is a greater need for new and effective technology to tackle many of the problems that are visible on the surface, as well as to make cities less crowded. Finding a parking spot is one of the most aggravating issues for drivers. Particularly in public venues such as shopping malls, 5-star hotels, and multiplex cinema halls. They concentrate on practical smart parking technologies developed to address existing issues through the use of a wireless sensor network and real-time data processing from the sensors. In this study, we create and design a smart parking system that effectively addresses these issues.

OBJECTIVES:

- The objective of a smart parking system using IoT is to optimize and streamline the process of parking by leveraging interconnected devices and technologies.
- The system aims to enhance the efficiency, convenience, and sustainability of parking operations by integrating sensors, communication networks, and data analytics.
- Through IoT-enabled sensors and devices, the system can provide accurate information about available parking spaces, guide drivers to vacant spots using navigation systems, automate payment processes, and enable remote monitoring and control of parking facilities

MOTIVATION:

The motivation behind implementing a smart car parking system using IoT stems from the need to address the challenges and inefficiencies associated with traditional parking systems. With the increasing urbanization and a growing number of vehicles on the roads, finding parking spaces has become a significant issue, leading to traffic congestion, wasted fuel, and increased pollution. The integration of IoT technologies provides a solution to this problem by enabling real-time monitoring and management of parking spaces. Ultimately, the motivation for implementing a smart car parking system using IoT lies in improving the overall parking experience, reducing traffic congestion and pollution, and promoting efficient and sustainable urban mobility.

LITERATURE SURVEY

The research paper mainly focuses on proposing a system that will help in overcoming this problem by pre–booking of parking slots sitting at home using a mobile application. The application will gather the data from the user in the form of date and time of reservation and check the availability and confirm the booking accordingly. The parking lot will have a microcontroller based system that will allow a vehicle by verifying an OTP provided previously. The vehicle will be allowed to exit on the successful payment of charges.

The authors tested the system in a real-world parking environment and found it to be effective in detecting and displaying the number of available parking spots in real-time. public parking areas. . It solves the parking issue in urban areas, also provides security to a vehicle and an unauthorized user is not allowed to enter into a parking place. It helps to park vehicles in multi-floored parking also as it will display which floor has free space.

The research paper explains the architecture and design of Arduino based car parking systems. They will give authorization cards to each user, which carries the vehicle number or other details. If the user is authorized and space is available in the parking, then the parking gate will open and the user is allowed to park the vehicle in a parking place else the user is not allowed. It solves the parking issue in urban areas, also provides security to a vehicle and an unauthorized user is not allowed to enter into a parking place. It helps to park vehicles in multi-floored parking also as it will display which floor has free space.

PROPOSED METHODOLOGY

The proposed methodology for implementing a smart car parking system was as follows:

Sensor Integration: Sensors were installed at each parking space to detect the presence or absence of a vehicle. Various sensor types, such as ultrasonic sensors, infrared sensors, or magnetic sensors, were utilized.

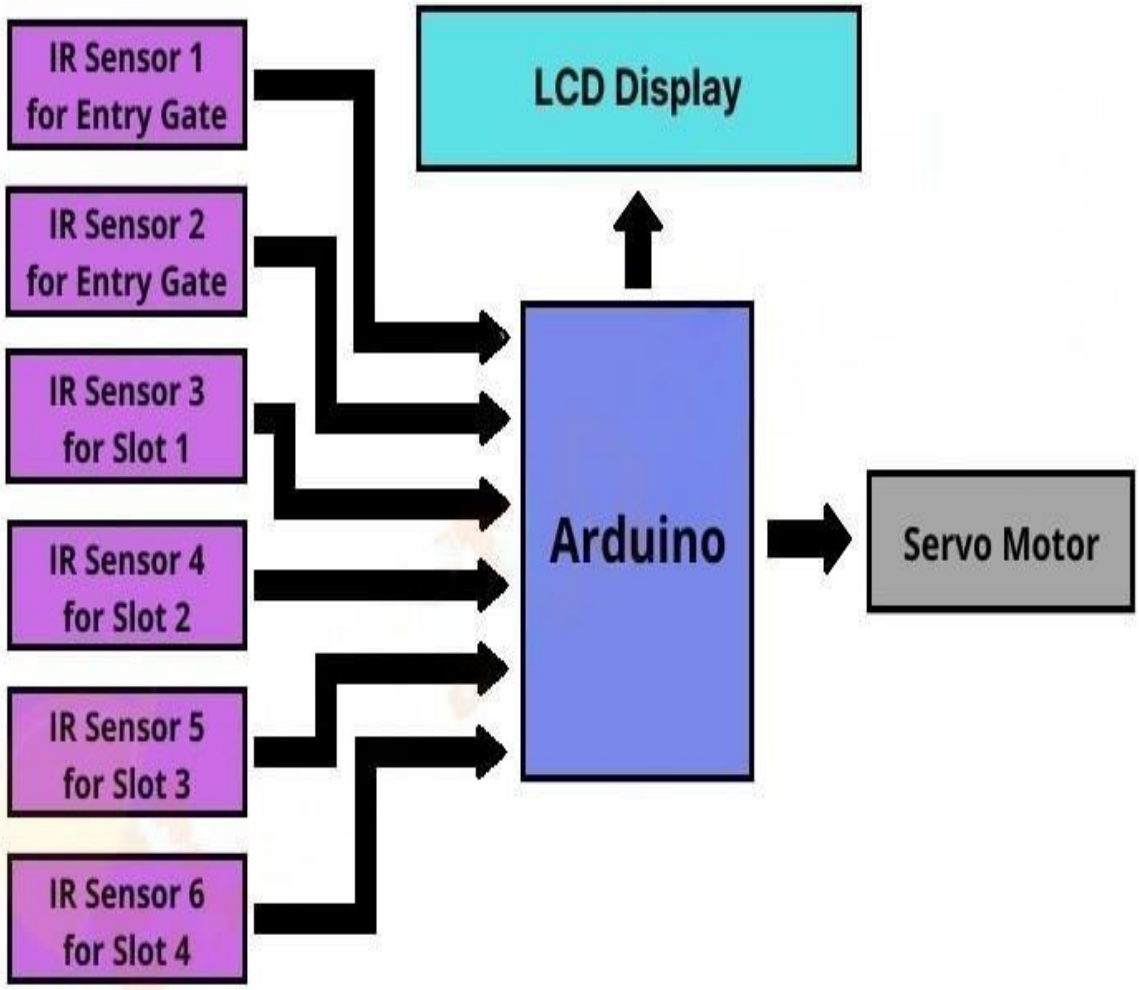
Hardware Setup: Infrared sensors were connected to the Arduino Uno boards to detect the presence of vehicles in parking spots. LCD displays were connected to provide visual feedback to drivers indicating the availability of parking spaces.

Testing and Deployment: The entire system was thoroughly tested to ensure proper functioning and reliability. Different scenarios were simulated to verify the accuracy of the sensors and the responsiveness of the system.

Centralized Management System: A centralized management system was developed to receive and process the data from the sensors. This system was responsible for monitoring parking space availability, generating reports, and handling user requests.

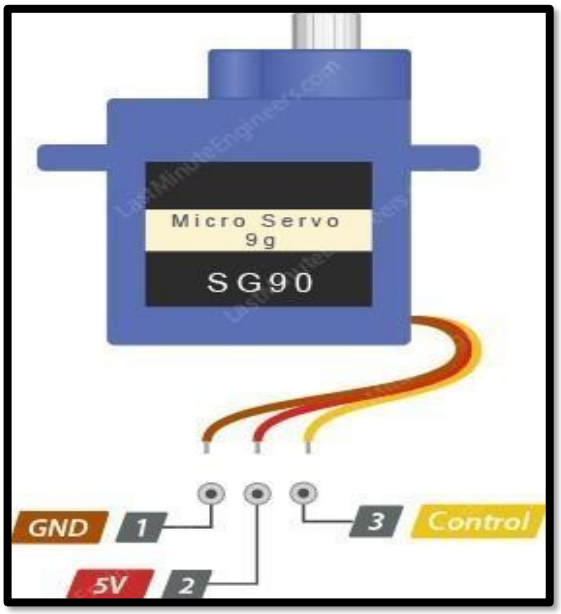
Overall, this methodology outlines the steps involved in developing and implementing a smart car parking system using IoT with Arduino Uno as the microcontroller.

BLOCK DIAGRAM:

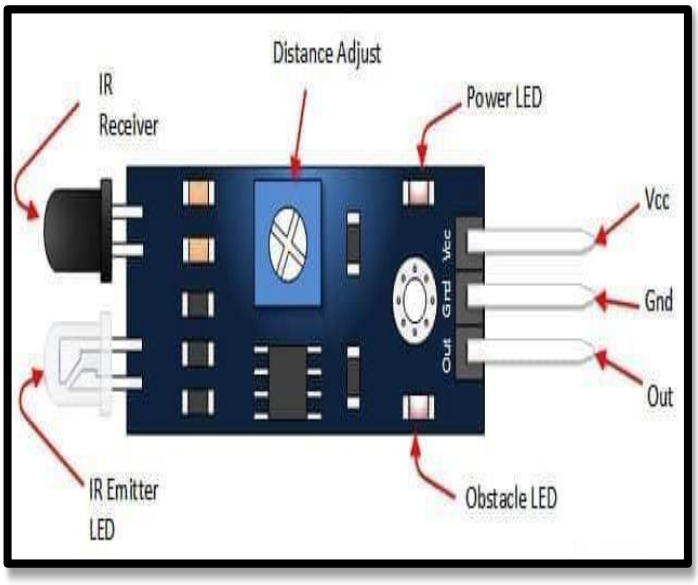


PIN DIAGRAMS:

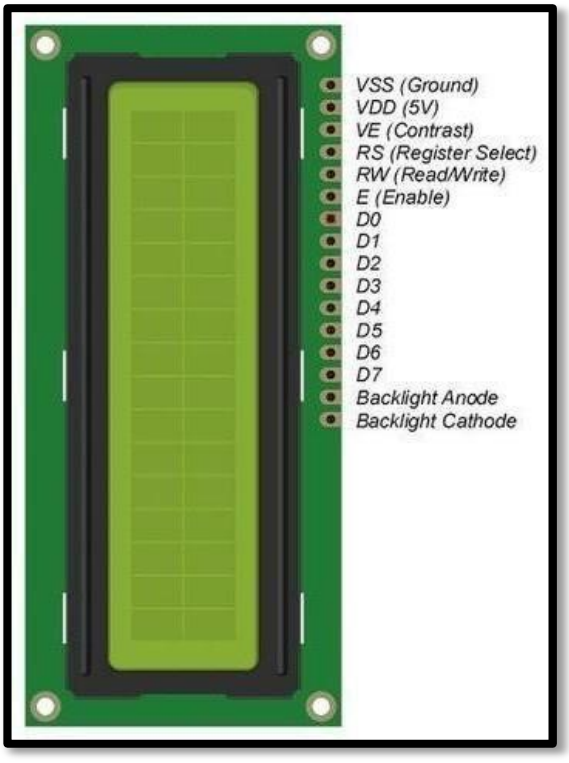
1) Servo motor



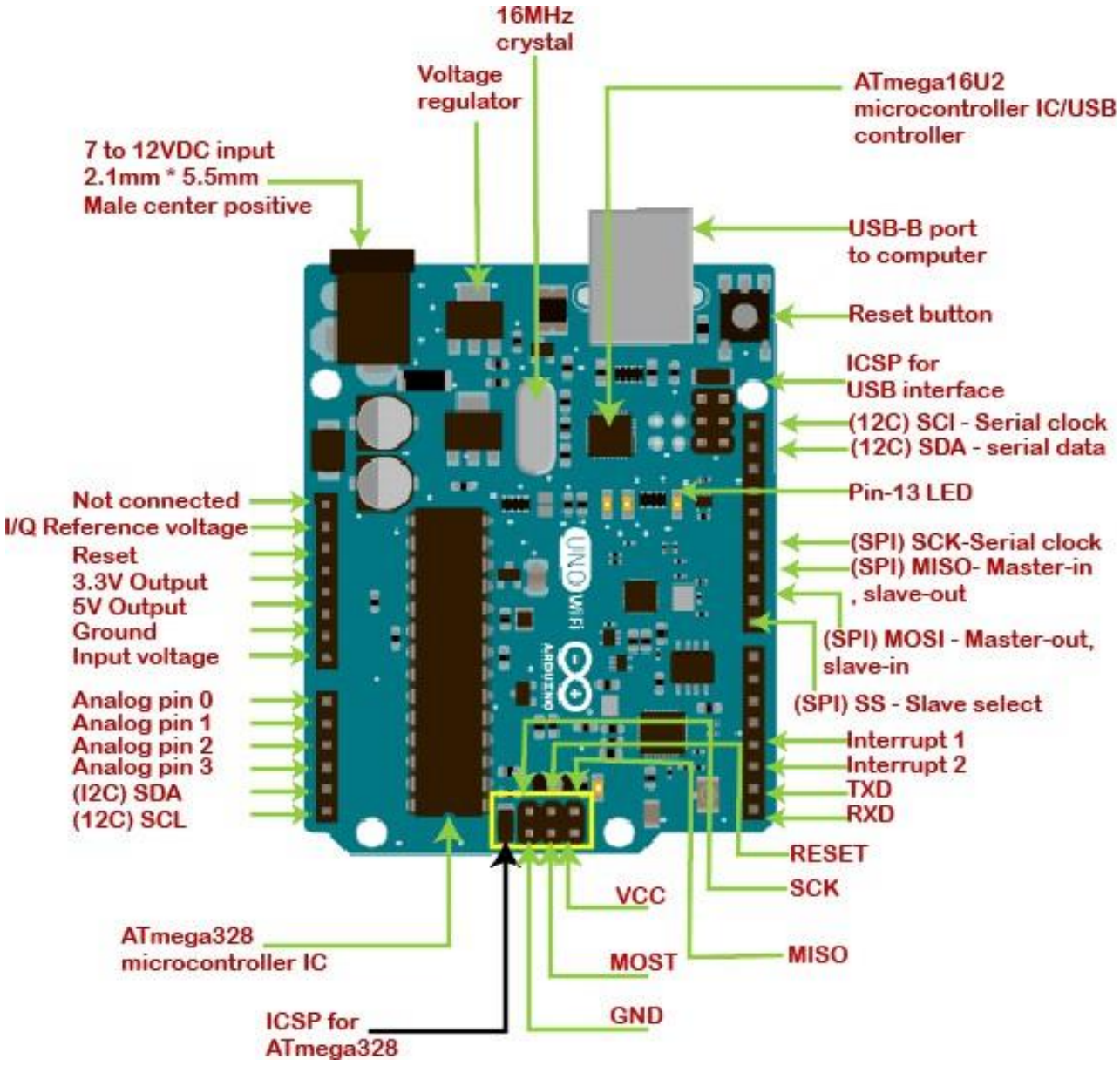
2) IR sensor



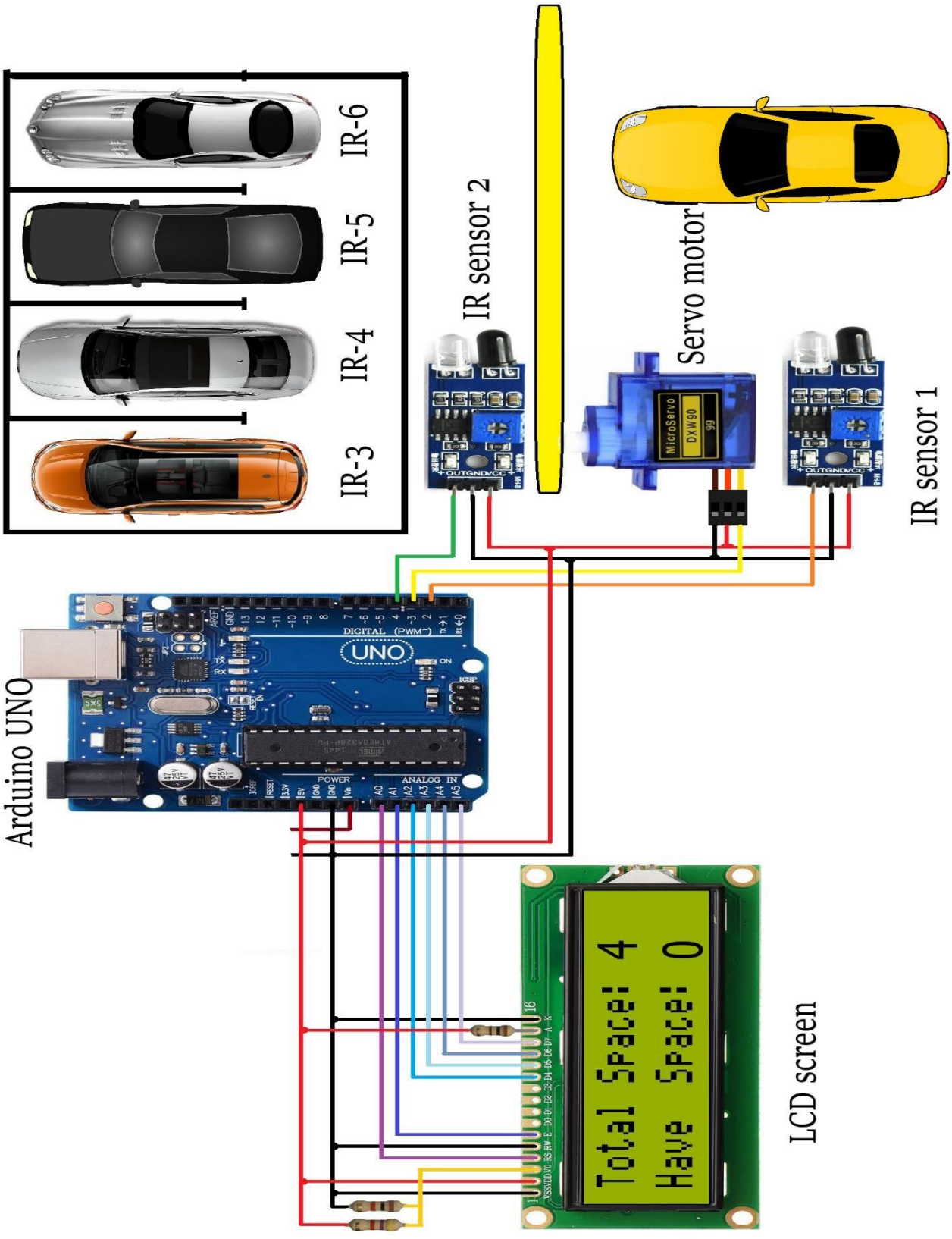
3) LCD screen display 16x



4) Arduino UNO



CIRCUIT DIAGRAM:



HARDWARE USED:

S.NO	HARDWARE	QUANTITY
1	Arduino uno	1
2	Lcd screen 16x2 display	1
3	Servo motor	1
4	IR sensors	6
5	Breadboard	1
6	I2C module	1
7	USB cable	1
8	Jumper wires	as required

1) Arduino uno

Microcontroller: ATmega328P

Digital I/O Pins: 14 and Analog Input Pins: 6

2) Lcd screen 16x2 display

Display Size: 16 characters per line2 lines

Character Size: 5x8 pixels

3) Servo motor

Type: DC Servo Motor

Torque: Specified in Ncm

4) IR sensors

Field of View: narrow or wide

Detection Method: Reflection or Interruption

SOFTWARE USED:

Arduino IDE

Libraries installed:

1. Wire.h
2. LiquidCrystal_I2C.h
3. Servo.h

METHODOLOGY:

1. Defined Requirements: The requirements and objectives of the smart car parking system were clearly outlined, including the number of parking spaces, IR sensors, LCD, and a servo motor.

2. Designed the Circuit: A circuit design was created, integrating the selected hardware components, ensuring proper connections and compatibility between the Arduino board, sensors, display, and other peripherals.

3. Developed the Software: The necessary code for the smart car parking system was written using the Arduino IDE. This code handled sensor data, displayed information, and implemented the system logic, including tasks like reading sensor data, updating the LCD display, and managing parking spot availability.

4. Deployed the System: The hardware components were installed, and the smart car parking system was deployed in the desired location. Wiring was done correctly, sensors were securely placed, and a reliable power supply was ensured.

PROGRAM CODE

```
#include <Servo.h>
#include <Wire.h>
#include <LiquidCrystal_I2C.h>
LiquidCrystal_I2C lcd(0x27, 20, 4);
Servo myservo;

#define ir_enter 2
#define ir_back 4
#define ir_car1 5
#define ir_car2 6
#define ir_car3 7
#define ir_car4 8

int S1 = 0, S2 = 0, S3 = 0, S4 = 0;
int flag1 = 0, flag2 = 0
int slot = 4;

void setup()
{
Serial.begin(9600);
pinMode(ir_car1,  INPUT);
pinMode(ir_car2,  INPUT);
pinMode(ir_car3,  INPUT);
pinMode(ir_car4,  INPUT);
pinMode(ir_enter, INPUT);
pinMode(ir_back, INPUT);

myservo.attach(3);
myservo.write(90);
lcd.init();
lcd.backlight();
lcd.setCursor (0, 1);
lcd.print(" Welcome ");
lcd.clear();
Read_Sensor();
```

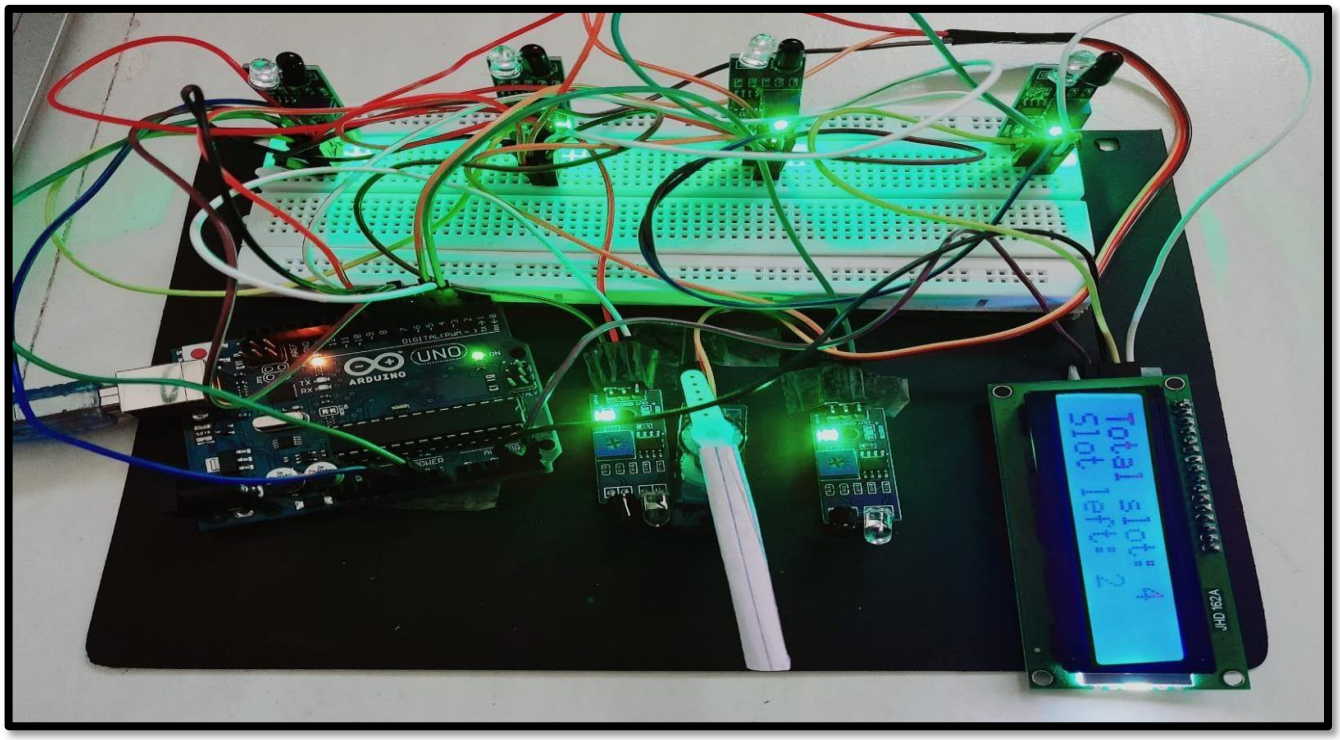
```
int total = S1 + S2 + S3 + S4; slot = slot - total;
  }

void loop()
{
Read_Sensor();
lcd.setCursor (0, 0); lcd.print(" Available Slot: "); lcd.print(slot); lcd.print(" ");
lcd.setCursor (0, 1); if (S1 == 1)
{
Lcd.print("S1:Full ");
}
else
{
lcd.print("S1:Empty");
}

lcd.setCursor (11, 1); if (S2 == 1)
{
lcd.print("S2:Full ");
}
else
{
lcd.print("S2:Empty");
}

lcd.setCursor (0, 2); if (S3 == 1)
{
lcd.print("S3:Full ");
}
else
{
lcd.print("S3:Empty");
}

lcd.setCursor (11, 2); if (S4 == 1)
{
lcd.print("S4:Full ");
    }
```

```
  else
    {
     lcd.print("S4:Empty");
     }

  if (digitalRead (ir_enter) == 0 && flag1 == 0) { if (slot > 0)
    {
    flag1 = 1;
    if (flag2 == 0) { myservo.write(180);
       slot = slot - 1;
    }}
  else
    {
    lcd.setCursor (0, 0);
    lcd.print(" Sorry Parking Full ");
    delay(1500);
    }}

  if (digitalRead (ir_back) == 0 && flag2 == 0)
    {
    flag2 = 1;
    if (flag1 == 0)
    {
       myservo.write(180);
       slot = slot + 1;
     }
    }

  if (flag1 == 1 && flag2 == 1)
  {
  delay          (1000);
  myservo.write(90);
flag1 = 0,;
flag2 = 0;
  }
```

```
delay(1);
}

void Read_Sensor()
{
S1 = 0, S2 = 0, S3 = 0, S4 = 0;
if (digitalRead(ir_car1) == 0)
{
  S1 = 1;
}
if (digitalRead(ir_car2) == 0)
{
   S2 = 1;
 }
if (digitalRead(ir_car3) == 0)
{
   S3 = 1;
}
if (digitalRead(ir_car4) == 0)
{
  S4 = 1;
```

OUTPUT

HARDWARE:



SOFTWARE:

OBSERVATION:

As the above model shows, the LCD screen now displays that there are totally 4slots available for the parking. We have placed 2 objects (as cars) near two of the sensors. So now the LCD displays that there are still 2 slots left to park.

APPLICATIONS

Smart car parking systems using the Internet of Things (IoT) have numerous applications that enhance convenience and efficiency. Some common applications of smart car parking system using IoT include:

1) Real-time Parking Space Monitoring: The system can utilize various sensors such as ultrasonic or infrared sensors to detect the availability of parking spaces in a parking lot. This information can be displayed on a user interface or mobile app, allowing drivers to quickly identify vacant spots.

2) Automated Parking Guidance: The smart parking system can guide drivers to the nearest available parking spot through indicators or digital displays. This can reduce the time spent searching for parking, minimize traffic congestion, and enhance the overall parking experience.

3) Reservation: The system can incorporate a reservation feature that allows users to book parking spaces in advance.

4)Traffic Management: By monitoring the occupancy of parking spaces, the system can collect data on parking patterns and analyze it to optimize traffic flow within the parking lot.

INFERENCE

The smart car parking system using Arduino Uno and IoT technology offers numerous benefits and innovations in the realm of parking management. By integrating IoT capabilities into the traditional car parking system, this solution enhances efficiency, convenience, and overall user experience.

One of the key inferences from this smart system is the optimized utilization of parking spaces. With real-time monitoring and communication between the Arduino Uno and IoT devices, the system can accurately determine the availability of parking spots. This information can be relayed to drivers, allowing them to quickly locate and occupy vacant spaces, reducing the time spent searching for parking and minimizing congestion within parking lots.

Another inference is the improved management and control of parking facilities. The Arduino Uno, acting as the brain of the system, can collect data on parking occupancy, duration, and patterns. This data can be analyzed to gain insights into peak hours, high-demand areas.

CONCLUSION

Our project detects the empty slots and helps the drivers to find parking space in unfamiliar city. The average waiting time of users for parking their vehicles is effectively reduced in this system. The optimal solution is provided by the proposed system, where most of the vehicles find a free parking space successfully. Our preliminary test results show that the performance of the Arduino UNO based system can effectively satisfy the needs and requirements of existing car parking hassles thereby minimizing the time consumed to find vacant parking lot and real time information rendering. This smart parking system provides better performance, low cost and efficient large scale parking system. When car enters the parking area, the driver will park the car in the nearest empty slot when slot is occupied the LED light glows and when slot is empty LED lights are turned off automatically indicating that the parking slot is empty to be occupied. It also eliminates unnecessary travelling of vehicles across the filled parking slots in a city.

Overall, the smart car parking system using IoT technology brings automation, optimization, and convenience to the parking industry. By leveraging real-time data analysis, predictive insights, and seamless connectivity, the system improves efficiency, enhances user experience, and enables data-driven decision-making for parking lot manager.

FUTURE WORKS

The smart car parking system using IoT has great potential for future development and improvement. Here are some future work and aspects that can be explored:

Scalability and Integration: Future work can focus on developing scalable and interoperable solutions that can be easily integrated with existing IoT ecosystems and infrastructure. This would allow for seamless connectivity and data exchange between different IoT devices and services, creating a more comprehensive and efficient parking experience.

Advanced Data Analytics: Enhancing the data analytics capabilities of the smart parking system can provide deeper insights and predictive analytics. By leveraging machine learning and artificial intelligence techniques, the system can analyse historical data to predict parking demand, optimize resource allocation, and improve overall parking efficiency.

Smart Pricing and Revenue Management: Incorporating dynamic pricing models based on real-time demand and supply can optimize parking revenue and utilization.

Integration with Smart City Initiatives: Smart car parking systems can be integrated into broader smart city initiatives. This includes sharing parking data with urban planning departments, traffic management systems, and public transportation services to optimize traffic flow, reduce congestion, and enhance urban mobility.

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