A Project Report

On

“SMART PARKING SYSTEM”

to Submitted

Chhattisgarh Swami Vivekanand Technical University

Bhilai (C.G.), India

Bachelor of Technology

In

Computer Science & Engineering

specialization in

Internet Of Things

By

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DECLARATION

We solemnly declare the report of the project work entitled "Face Recognition Based Attendance System" is based on our own work carried **out** during my study under **Dr. Samta Gajbhiye,** HOD CSE department of **SSTC,** Bhilai.

I assert that the statements made, and conclusion drawn are an outcome of the project work. I further declare that to the best of my knowledge and belief that the report does not contain any part of any work which has been submitted for the award of any other degree / diploma / certificate in this university or any other university.

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CERTIFICATE

This is to certify the report of the project submitted is an outcome of the project work entitled:

"Smart Parking System" carried out by

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To the best of my knowledge the report:

- Embodies the work of the candidate himself/herself.
- Has duly been completed.
- Fulfils the requirements of Ordinance relating to the B. Tech degree of the University.
- Is up to the desired standards for the purpose of which it is submitted.

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The project work mentioned above hereby recommended and forwarded for examination and evaluation.
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CERTIFICATE BY THE EXAMINERS

This is to certify that the project work entitled **"Smart Parking System"**

Submitted by

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External Examiner

Date:25/05/2024

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

In today's rapidly urbanizing world, the demand for efficient and effective parking solutions is more critical than ever. As cities expand and the number of vehicles on the road continues to rise, traditional parking systems—often characterized by manual operations and static infrastructure—are increasingly inadequate. The consequences of these outdated systems are evident: traffic congestion, heightened environmental pollution, economic inefficiencies, and significant frustration among drivers. The Smart Parking System project aims to address these pressing issues by leveraging cutting-edge technology to create a revolutionary, intelligent parking infrastructure that meets the needs of modern urban environments.

The core problem facing urban areas is the inefficiency in parking space utilization. Drivers frequently spend an inordinate amount of time searching for available spots, contributing to traffic jams, increased fuel consumption, and elevated emissions. This not only exacerbates air pollution but also places a substantial economic burden on both individuals and city administrations. Additionally, inefficient parking management often leads to illegal parking practices, which can obstruct traffic flow and emergency services.

The Smart Parking System is designed to mitigate these challenges through the integration of advanced technologies such as Internet of Things (IoT) sensors, mobile applications, data analytics, and artificial intelligence (AI). IoT sensors installed in parking spaces can detect vehicle presence in real-time, providing accurate and up-to-date information on parking availability. This data is then communicated to a central management system, which drivers can access via a user-friendly mobile application. The app allows users to locate and reserve parking spots, receive real-time updates, and be guided directly to their chosen spot through integrated navigation systems.

Moreover, the Smart Parking System employs sophisticated data analytics and AI to analyze parking usage patterns and predict future availability. This dynamic allocation ensures optimal utilization of parking spaces and enhances overall efficiency. The inclusion of contactless payment options further simplifies the parking experience, allowing users to pay seamlessly through the mobile app or automated kiosks.

Beyond improving the user experience, the Smart Parking System also supports city planners and administrators by providing valuable data insights. These insights can inform smarter urban planning and infrastructure development, ultimately contributing to more sustainable and livable cities.

In summary, the Smart Parking System project represents a significant advancement in urban mobility solutions. By harnessing modern technology, it aims to create a more efficient, convenient, and environmentally friendly parking experience, addressing the multifaceted challenges of urban parking management and paving the way for smarter cities.

1.2 SCOPE

The Smart Parking System project aims to revolutionize urban parking management through a comprehensive integration of advanced technologies and user-centric solutions. This project involves the installation of IoT sensors in parking spaces to provide real-time data on vehicle presence, enabling dynamic monitoring and management. These sensors will transmit data to a central management system, which will then be accessible via a user-friendly mobile application.

The mobile application will be a crucial component, offering drivers the ability to locate available parking spots, make reservations, and receive real-time updates on parking status. It will also feature GPS integration to guide drivers directly to their reserved spaces, significantly reducing the time spent searching for parking. Additionally, the app will facilitate seamless, contactless payments, simplifying the transaction process and enhancing user convenience.

The project will employ advanced data analytics and artificial intelligence to analyze parking usage patterns and predict future availability. This will allow for the dynamic allocation of parking spaces, ensuring optimal utilization of resources and improving overall efficiency. Predictive analytics will help anticipate demand fluctuations and adjust the system accordingly, providing a more reliable and responsive parking solution.

Furthermore, the Smart Parking System will integrate with existing city infrastructure, including traffic management systems and public transportation networks. This integration will ensure better coordination and enhance the overall efficiency of urban transportation. By aligning with broader city planning objectives, the system will support sustainable urban development and improve the overall quality of life for city residents.

To ensure a positive user experience, the project will include comprehensive customer support, offering training materials, tutorials, and a dedicated support center to address user inquiries and issues. Continuous feedback will be gathered to refine and improve the system, making it more responsive to user needs.

Overall, the scope of the Smart Parking System project is to develop a holistic, efficient, and user-friendly solution that addresses the complex challenges of urban parking. By leveraging modern technology, the project aims to create a sustainable and efficient parking infrastructure that enhances urban mobility and contributes to the creation of smarter, more livable cities.

1.3 PROBLEM STATEMENT

Urban areas worldwide are grappling with the growing challenge of managing parking efficiently amidst increasing vehicle ownership and rapid urbanization. Traditional parking systems, reliant on manual management and static infrastructure, are failing to meet contemporary demands, leading to several critical issues. Drivers often spend excessive time searching for available parking spaces, resulting in traffic congestion, heightened fuel consumption, and increased emissions. This inefficiency not only frustrates drivers but also exacerbates air pollution and economic inefficiencies, placing a significant burden on both individuals and city resources. Additionally, inadequate parking management often leads to illegal parking practices, obstructing traffic flow and emergency services. The lack of real-time data and dynamic management further compounds these problems, making it difficult for city planners to optimize parking resources and plan for future needs. The Smart Parking System aims to address these challenges by leveraging advanced technologies to create a more efficient, user-friendly, and sustainable parking infrastructure, thereby improving urban mobility and overall quality of life in cities.

CHAPTER 2

SYSTEM SPECIFICATION

2.1 SYSTEM REQUIREMENT

2.1.1 HARDWARE REQUIREMENTS

- NodeMCU ESP8266
- IR sensor
- Servo motor
- Jumper wire
- Breadboard

2.1.2 SOFTWARE REQUIREMENTS

- Arduino IDE: Arduino IDE (Integrated Development Environment) is a software application that facilitates the development and uploading of code to Arduino-compatible boards.
- io.adafruit.com : Control Panel for the Parking System

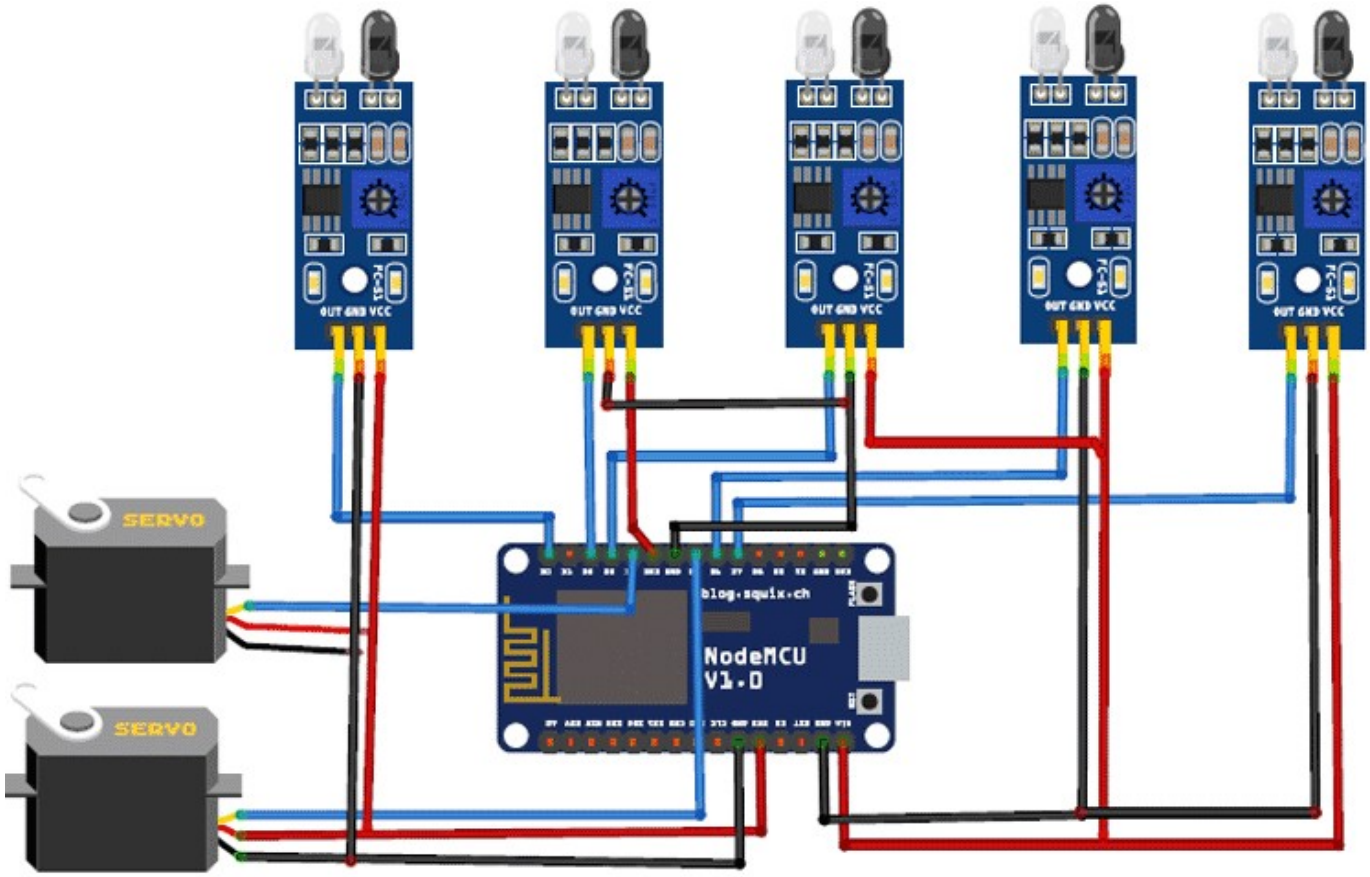
2.2 SYSTEM FEATURES

- **Precise Control**: Moves accurately for detailed tasks..
- **Ultrasonic Sensors**: Measures distance to objects.
- **Microcontroller**: Main brain of the car (like NodeMCU ESP8266).
- **Wireless Communication**: Connects to a smartphone or remote control.
- **User Interface**: App or remote for manual control and monitoring

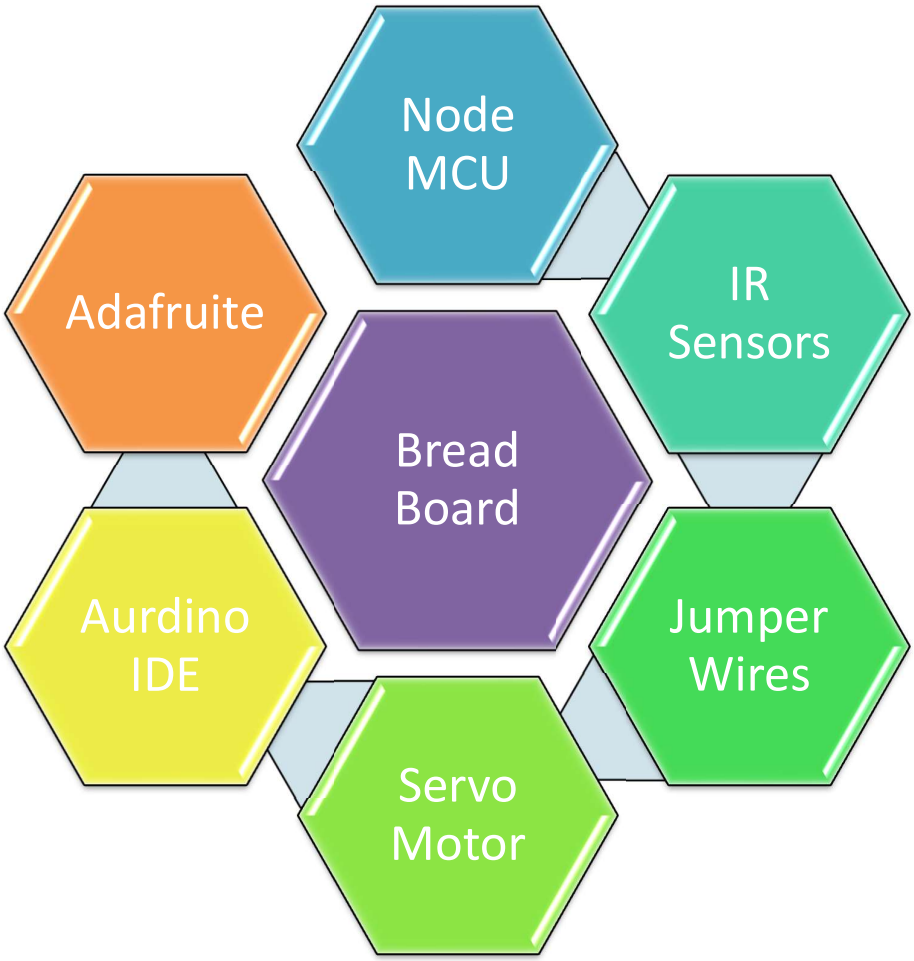
CHAPTER 3

SYSTEM DESIGN

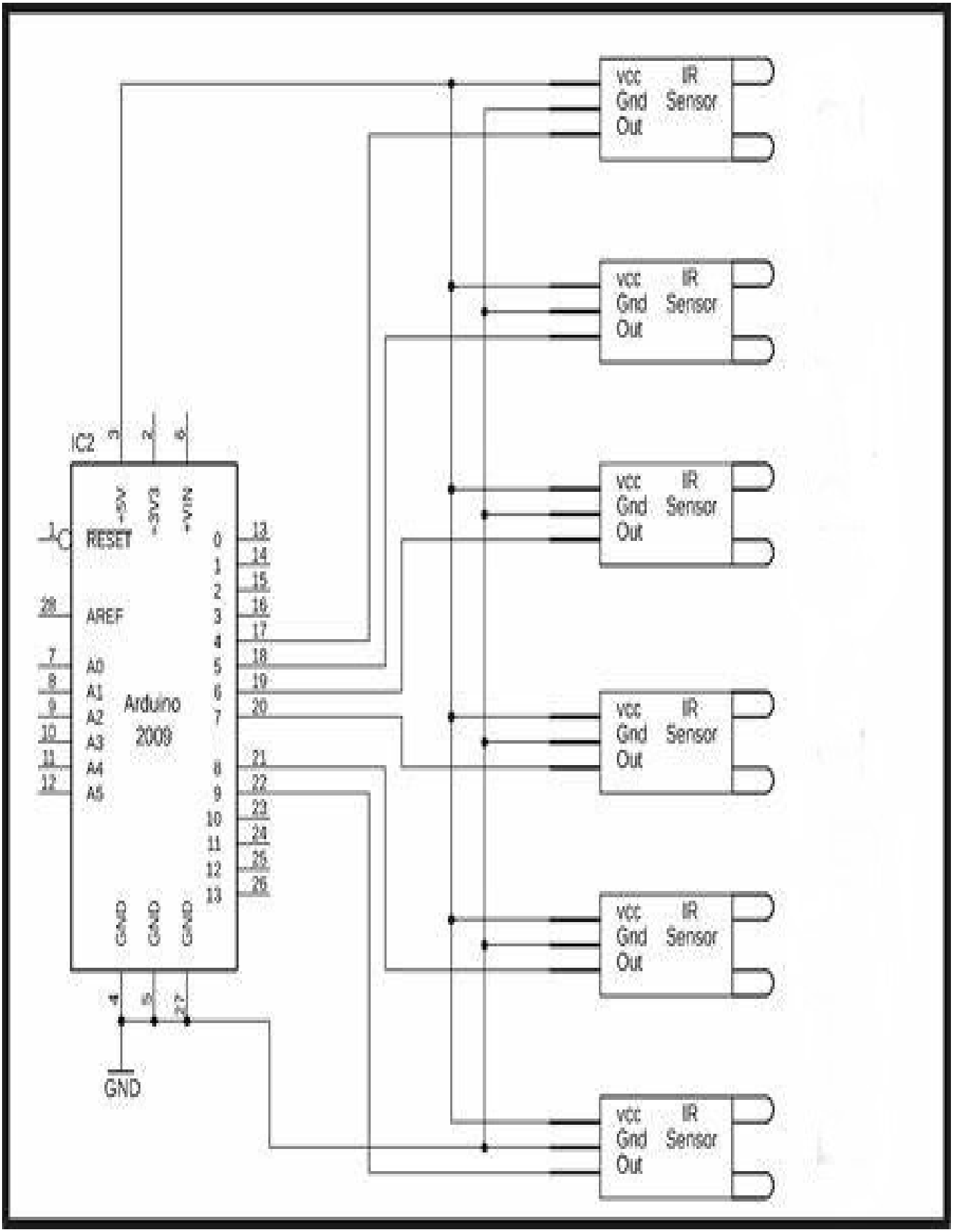
3.1 SYSTEM ARCHITECTURE



3.2 TOOLS & TECHNOLOGY USED



3.3 SCHEMATIC DIAGRAM



CHAPTER 4

IMPLEMENTATION

4.1 CODE SNIPPETS

```
#include <ESP8266WiFi.h>
#include <Servo.h>
#include <NTPClient.h>
#include <WiFiUdp.h>
#include <NTPClient.h>
#include <WiFiUdp.h>
#include "Adafruit_MQTT.h"
#include "Adafruit_MQTT_Client.h"
const char *ssid =  "realme";     // Enter your WiFi Name
const char *pass =  "13572468"; // Enter your WiFi Password

#define MQTT_SERV "io.adafruit.com"
#define MQTT_PORT 1883
#define MQTT_NAME "Cs3278"
#define MQTT_PASS "aio_eNFQ22R4OHLz0olaMrBJDvNhAav8"
WiFiUDP ntpUDP;
NTPClient timeClient(ntpUDP, "pool.ntp.org", 19800,60000);
Servo myservo;                    //servo as gate
Servo myservos;                         //servo as gate

int carEnter = D0;                 // entry sensor
int carExited = D2;               //exi sensor
int slot4 = D1;
int slot3 = D7;
int slot2 = D6;
int slot1  = D3;
int count =0;
int CLOSE_ANGLE = 170;  // The closing angle of the servo motor arm
int OPEN_ANGLE = 0;  // The opening angle of the servo motor arm
int  hh, mm, ss;
int pos;
int pos1;

String h, m,EntryTimeSlot1,ExitTimeSlot1, EntryTimeSlot2,ExitTimeSlot2, EntryTimeSlot3,ExitTimeSlot3;
boolean entrysensor, exitsensor,s1,s2,s3,s4;

boolean s1_occupied = false;
boolean s2_occupied = false;
boolean s3_occupied = false;
boolean s4_occupied = false;

WiFiClient client;
Adafruit_MQTT_Client mqtt(&client, MQTT_SERV, MQTT_PORT, MQTT_NAME, MQTT_PASS);

//Set up the feed you're subscribing to
Adafruit_MQTT_Subscribe EntryGate = Adafruit_MQTT_Subscribe(&mqtt, MQTT_NAME "/f/entry-gate");
Adafruit_MQTT_Subscribe ExitGate = Adafruit_MQTT_Subscribe(&mqtt, MQTT_NAME "/f/exit-gate");

//Set up the feed you're publishing to
Adafruit_MQTT_Publish CarsParked = Adafruit_MQTT_Publish(&mqtt,MQTT_NAME "/f/cars-parked");
Adafruit_MQTT_Publish EntrySlot1 = Adafruit_MQTT_Publish(&mqtt,MQTT_NAME "/f/slot-1-entry");
Adafruit_MQTT_Publish ExitSlot1 = Adafruit_MQTT_Publish(&mqtt,MQTT_NAME "/f/slot-1-exit");
Adafruit_MQTT_Publish EntrySlot2 = Adafruit_MQTT_Publish(&mqtt,MQTT_NAME "/f/slot-2-entry");
Adafruit_MQTT_Publish ExitSlot2 = Adafruit_MQTT_Publish(&mqtt,MQTT_NAME "/f/slot-2-exit");
Adafruit_MQTT_Publish EntrySlot3 = Adafruit_MQTT_Publish(&mqtt,MQTT_NAME "/f/ slot-3-entry");
Adafruit_MQTT_Publish ExitSlot3 = Adafruit_MQTT_Publish(&mqtt,MQTT_NAME "/f/slot-3-exit");
```

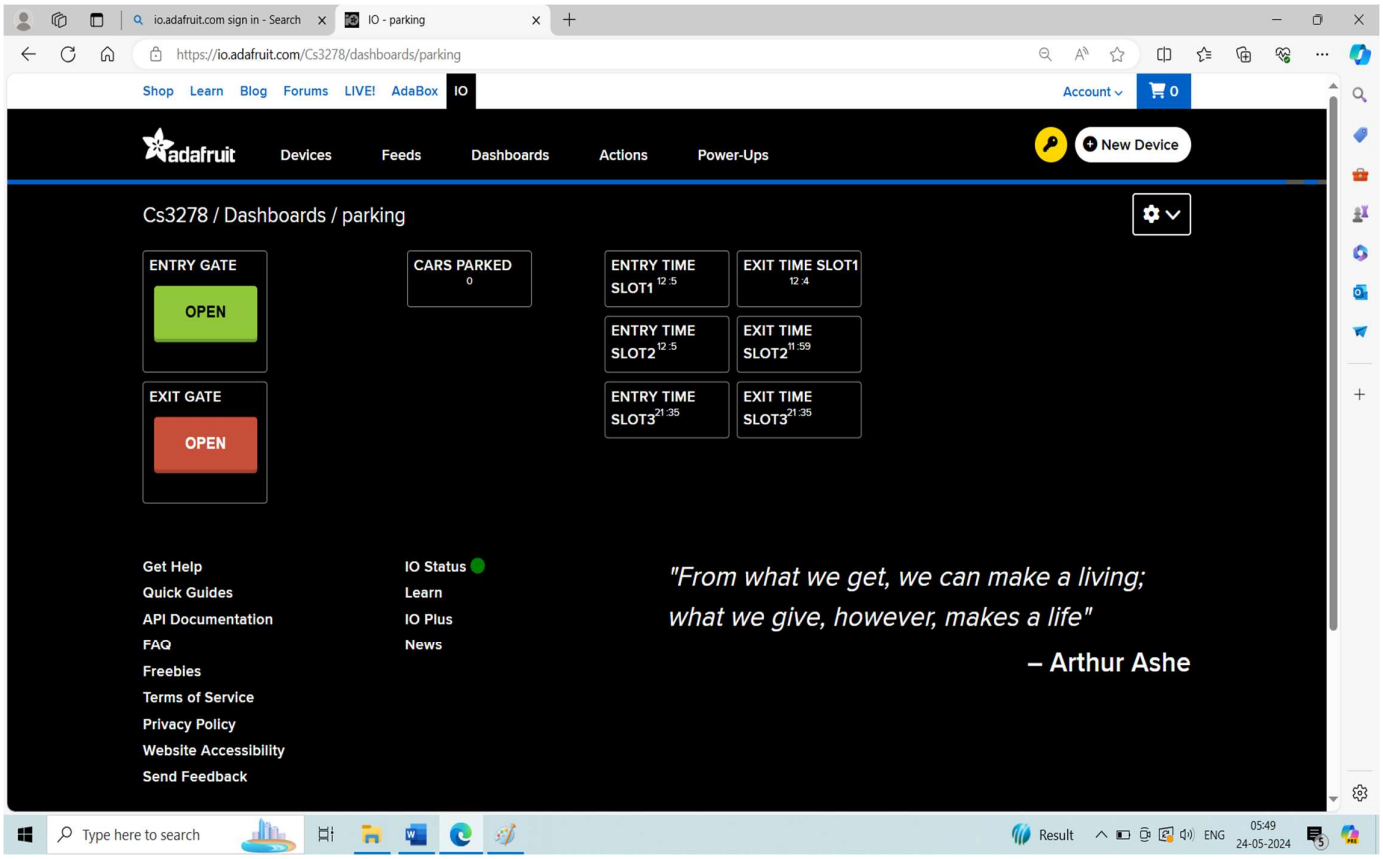
```
void setup() {
  delay(1000);
  Serial.begin (9600);
  mqtt.subscribe(&EntryGate);
  mqtt.subscribe(&ExitGate);
  timeClient.begin();
  myservo.attach(D4);      // servo pin to D6
  myservos.attach(D5);       // servo pin to D5
  pinMode(carExited, INPUT);    // ir as input
  pinMode(carEnter, INPUT);     // ir as input
  pinMode(slot1, INPUT);
  pinMode(slot2, INPUT);
  pinMode(slot3, INPUT);
  pinMode(slot4, INPUT);
  WiFi.begin(ssid, pass);                              //try to connect with wifi
  Serial.print("Connecting to ");
  Serial.print(ssid);                        // display ssid
  while (WiFi.status() != WL_CONNECTED) {
    Serial.print(".");                       // if not connected print this
    delay(500);
  }
  Serial.println();
  Serial.print("Connected to ");
  Serial.println(ssid);
  Serial.print("IP Address is : ");
  Serial.println(WiFi.localIP());                                    //print local IP address
}

void loop() {

 MQTT_connect();
 timeClient.update();
 hh = timeClient.getHours();
 mm = timeClient.getMinutes();
 ss = timeClient.getSeconds();
 h= String(hh);
 m= String(mm);
 h +" :" + m;

 entrysensor= !digitalRead(carEnter);
 exitsensor = !digitalRead(carExited);
 s1 = digitalRead(slot1);
 s2 = digitalRead(slot2);
 s3 = digitalRead(slot3);
 s4 = digitalRead(slot4);

   if (entrysensor == 1) {                  // if high then count and send data
   count=  count+1;                         //increment count
   myservos.write(OPEN_ANGLE);
   delay(3000);
   myservos.write(CLOSE_ANGLE);
    }

   if (exitsensor == 1) {                       //if high then count and send
   count= count-1;                              //decrement count
   myservo.write(OPEN_ANGLE);
   delay(3000);
   myservo.write(CLOSE_ANGLE);
  }
```

```
  if (! CarsParked.publish(count)) {}

  if (s1 == 1 && s1_occupied == false) {
        Serial.println("Available1 ");
        EntryTimeSlot1 =  h +" :" + m;
        //Serial.print("EntryTimeSlot1");
        //Serial.print(EntryTimeSlot1);

        s1_occupied = true;
        if (! EntrySlot1.publish((char*) EntryTimeSlot1.c_str())){}
     }
  if(s1 == 0 && s1_occupied == true) {
       Serial.println("Occupied1 ");
       ExitTimeSlot1 =  h +" :" + m;
       //Serial.print("ExitTimeSlot1");
       //Serial.print(ExitTimeSlot1);

       s1_occupied = false;
        if (! ExitSlot1.publish((char*) ExitTimeSlot1.c_str())){}
}
  if (s2 == 1&& s2_occupied == false) {
      Serial.println("Available2 ");
      EntryTimeSlot2 =  h +" :" + m;
      //Serial.print("EntryTimeSlot2");
      //Serial.print(EntryTimeSlot2);

      s2_occupied = true;
      if (! EntrySlot2.publish((char*) EntryTimeSlot2.c_str())){}
     }
  if(s2 == 0 && s2_occupied == true) {
       Serial.println("Occupied2 ");
       ExitTimeSlot2 =  h +" :" + m;
       //Serial.print("ExitTimeSlot2");
       //Serial.print(ExitTimeSlot2);

       s2_occupied = false;
        if (! ExitSlot2.publish((char*) ExitTimeSlot2.c_str())){}
  }
  if (s3 == 1&& s3_occupied == false) {
      Serial.println("Available3 ");
      EntryTimeSlot3 =  h +" :" + m;
     //Serial.print("EntryTimeSlot3: ");
      //Serial.print(EntryTimeSlot3);
      s3_occupied = true;
       if (! EntrySlot3.publish((char*) EntryTimeSlot3.c_str())){}
     }
  if(s3 == 0 && s3_occupied == true) {
       Serial.println("Occupied3 ");
       ExitTimeSlot3 =  h +" :" + m;
       //Serial.print("ExitTimeSlot3: ");
       //Serial.print(ExitTimeSlot3);
       s3_occupied = false;
        if (! ExitSlot3.publish((char*) ExitTimeSlot3.c_str())){ }
  }
    if (s4 == 1 && s4_occupied == false) {
        Serial.println("Available4 ");
        //EntryTimeSlot1 =  h +" :" + m;
        //Serial.print("EntryTimeSlot1");
        //Serial.print(EntryTimeSlot1);
```

```
        s4_occupied = true;
        //if (! EntrySlot4.publish((char*) EntryTimeSlot4.c_str())){}
    }
  if(s4 == 0 && s4_occupied == true) {
      Serial.println("Occupied4 ");
      //ExitTimeSlot1 =  h +" :" + m;
      //Serial.print("ExitTimeSlot1");
      //Serial.print(ExitTimeSlot1);

      s4_occupied = false;
       //if (! ExitSlot1.publish((char*) ExitTimeSlot1.c_str())){}
}

  Adafruit_MQTT_Subscribe * subscription;
  while ((subscription = mqtt.readSubscription(5000)))
     {

   if (subscription == &EntryGate)
     {
     //Print the new value to the serial monitor
     Serial.println((char*) EntryGate.lastread);

   if (!strcmp((char*) EntryGate.lastread, "ON"))
     {
      myservos.write(OPEN_ANGLE);
      delay(3000);
      myservos.write(CLOSE_ANGLE);
    }
}
  if (subscription == &ExitGate)
     {
     //Print the new value to the serial monitor
     Serial.println((char*) EntryGate.lastread);

   if (!strcmp((char*) ExitGate.lastread, "ON"))
     {
      myservo.write(OPEN_ANGLE);
      delay(3000);
      myservo.write(CLOSE_ANGLE);
    }
}
}
}
void MQTT_connect()
{
  int8_t ret;

  // Stop if already connected.
  if (mqtt.connected())
  {
    return;
  }

  uint8_t retries = 3;
  while ((ret = mqtt.connect()) != 0) // connect will return 0 for connected
  {
      mqtt.disconnect();
      delay(5000);  // wait 5 seconds
      retries--;
      if (retries == 0)
```

```
    {
      // basically die and wait for WDT to reset me
      while (1);
    }
  }
}
```

4.2 SCREENSHOTS


io.adafruit.com sign in - Search
IO - parking
https://io.adafruit.com/Cs3278/dashboards/parking
Shop Learn Blog Forums LIVE! AdaBox IO
Account 0
adafruit
Devices Feeds Dashboards Actions Power-Ups
New Device
Cs3278 / Dashboards / parking
ENTRY GATE
OPEN
EXIT GATE
OPEN
CARS PARKED
0
ENTRY TIME SLOT1 12:5
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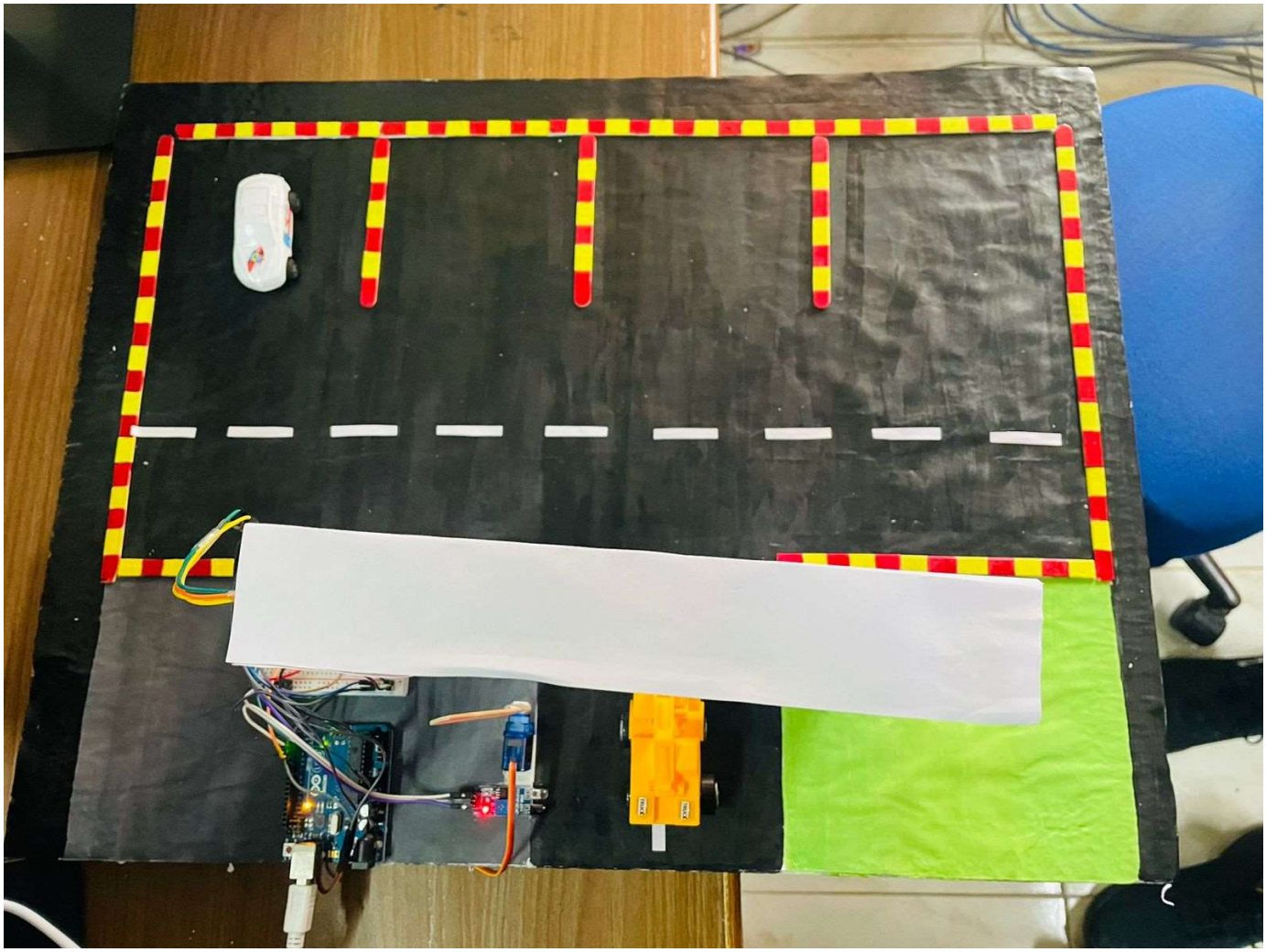
ENTRY TIME SLOT2 12:5
EXIT TIME SLOT2 11:59
ENTRY TIME SLOT3 21:35
EXIT TIME SLOT3 21:35
Get Help
Quick Guides
API Documentation
FAQ
Freebies
Terms of Service
Privacy Policy
Website Accessibility
Send Feedback
IO Status
Learn
IO Plus
News
"From what we get, we can make a living; what we give, however, makes a life"
– Arthur Ashe
Type here to search
Result
ENG
05:49
24-05-2024


WELCOME!
Slot Left: 1
TRUCK
TRUCK



CHAPTER 5

CONCLUSION

5.1 CONCLUSION

The Smart Parking System project represents a pivotal advancement in urban mobility, addressing the critical challenges posed by traditional parking management systems. By leveraging cutting-edge technologies such as IoT sensors, data analytics, artificial intelligence, and mobile applications, this project aims to create a more efficient, user-friendly, and sustainable parking infrastructure. The integration of real-time monitoring, predictive analytics, and smart payment systems will not only streamline the process of finding and securing parking spaces but also significantly reduce traffic congestion, fuel consumption, and emissions.

One of the most notable benefits of the Smart Parking System is its potential to enhance the overall user experience. Drivers will no longer need to spend excessive time searching for parking, as the system will provide accurate, up-to-date information on available spaces and guide them directly to their destinations. The convenience of reserving spots in advance and making contactless payments further simplifies the parking experience, reducing stress and saving time.

Beyond individual benefits, the Smart Parking System also supports broader urban planning and sustainability goals. By optimizing the utilization of existing parking resources and providing valuable data insights, the system enables city planners to make informed decisions about infrastructure development and traffic management. This data-driven approach facilitates more efficient use of urban spaces and promotes greener, more livable cities.

Moreover, the project's emphasis on integration with existing city infrastructure ensures a holistic approach to urban mobility. Coordinating with traffic management systems and public transportation networks allows for seamless connectivity and enhances the overall efficiency of urban transportation. This integrated approach not only improves the functionality of the Smart Parking System but also contributes to a more cohesive and well-managed urban environment.

In summary, the Smart Parking System project is a forward-thinking initiative that addresses the multifaceted challenges of urban parking management. By implementing a comprehensive, technology-driven solution, the project aims to improve the quality of life for city dwellers, support sustainable urban development, and pave the way for smarter, more efficient cities. As urban areas continue to grow and evolve, the Smart Parking System will play a crucial role in shaping the future of urban transportation, making our cities more accessible, sustainable, and enjoyable for everyone.

5.2 FUTURE SCOPE

The Smart Parking System project has immense potential for future expansion and enhancement, paving the way for greater efficiencies and benefits in urban mobility and infrastructure management. As cities continue to evolve and technology advances, several key areas offer promising avenues for the future development of this project.

The system can initially be deployed in densely populated urban areas where parking challenges are most acute. Over time, it can be scaled to include suburban and rural areas, adapting to different environmental and infrastructural contexts. This expansion will broaden the impact of the system, bringing its benefits to a wider population.

The future scope also includes integration with emerging technologies such as autonomous vehicles and smart city initiatives. As self-driving cars become more prevalent, the system can be adapted to interact with these vehicles, providing automated parking solutions and further reducing traffic congestion and emissions. Additionally, integration with broader smart city frameworks will enhance urban planning and resource management.

Future iterations of the Smart Parking System will leverage advancements in data analytics and artificial intelligence to provide even more sophisticated insights and predictions. Machine learning algorithms can be refined to better analyze parking patterns and predict demand, enabling even more efficient use of parking resources. Enhanced AI capabilities will also allow for more dynamic and responsive management of parking spaces.

The project can also explore additional features such as electric vehicle (EV) charging stations integrated with parking spots, encouraging the use of sustainable transportation options. Furthermore, the system can be expanded to include multi-modal transportation planning, assisting users in combining parking with public transportation or bike-sharing options to complete their journeys.

In conclusion, the future scope of the Smart Parking System is vast and varied, with significant potential to enhance urban mobility, support sustainable development, and improve the quality of life in cities worldwide. By continuously integrating new technologies and expanding its reach, the system will remain a critical component of smart urban infrastructure.

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