Smart Parking System

Department of Computer Science and Engineering

BANGLADESH UNIVERSITY OF BUSINESS & TECHNOLOGY (BUBT)

Dhaka-1216

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A Project report

Smart Parking System

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Submitted to:
Nourin Khandaker
Lecturer
Dept. of CSE, BUBT

Submitted by:

NAME	ID	Intake
Faisal Ahmed	20215103052	47
Mahin Dhrubo	20215103065	47
Tahmid Jawwad	20215103096	47
Md Ariful Islam Rifat	20215103099	47
S.M Touhidur Rahman	21224103139	48

in partial fulfilment of the requirements of the degree
of
BACHELOR OF SCIENCE
in
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at

BANGLADESH UNIVERSITY OF BUSINESS AND TECHNOLOGY (BUBT)
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ABSTRACT

Nowadays congestion of traffic level increases with the increasing development of population rapidly. With respect to the amount of population, the utilization of personal vehicles also increased. Due to more use of cars, traffic congestion occurred on the road. Most people choose personal vehicles over public transportation. It is very difficult and time-consuming to find parking space in most metropolitan areas, and commercial areas, especially during rush hours. It is often costly in almost every big city all over the world to find proper and secure parking spaces. The proposed project is a smart parking system that delivers information to people finding a parking space online. It overcomes unnecessary time consuming for finding the problem of parking space in parking areas. Hence, the website is provided by this project-based system where users can view various parking areas and choose the space from available slots.

DECLARATION

This project “Smart parking System” report submitted by Faisal Ahmed, Tahmid Jawwad, Md Ariful Islam Rifat, S.M Touhidur Rahman, And Mahin Dhrubo students of the Department of Computer Science and Engineering, Bangladesh University of Business and Technology(BUBT), has been successfully completed under the guidance of Lecturer Nourin Khandaker Bangladesh University of Business and Technology(BUBT)

Faisal Ahmed
Id: 20215103052
Intake:47
Section:2

Tahmid Jawwad
ID: 20215103096
Intake:47
Section:2

Md Ariful Islam Rifat
ID: 20215103099
Intake:47
Section:2

S.M Touhidur Rahman
Id: 21224103139
Intake:48
Section:2

—---
Mahin Dhrubo
Id: 20215103065
Intake: 47
Section:2

CERTIFICATION

This project “Smart parking System” report submitted by Faisal Ahmed, Tahmid Jawwad, Md Ariful Islam Rifat,S.M Touhidur Rahman and Mahin Dhrubo students of the Department of Computer Science and Engineering, Bangladesh University of Business and Technology(BUBT), under the supervision of Nourin Khandaker, Lecturer, Department of Computer Science and Engineering has been accepted as satisfactory for the partial requirements for the degree of Bachelor of Science Engineering in Computer Science and Engineering.

(Nourin Khandaker)
Lecturer
Department of CSE

(MD. Saifur Rahman)
Assistant Professor & Chairman
(Acting)
Department of CSE

Dedication

Our Loving Parents and Teachers whose Support gives us Strength and determination to accomplish our Goal…!!

ACKNOWLEDGEMENTS

We would like to express our heartfelt gratitude to the almighty Allah who offered our family and us kind care throughout this journey until the fulfilment of this research. Also, we express our sincere respect and gratitude to our supervisor, Chairman, and Associate Professor, Department of Computer Science and Engineering, Bangladesh University of Business and Technology (BUBT). Without his guidance, this research work would not exist. We are grateful to him for his excellent supervision and for putting his utmost effort into developing this project. We owe him a lot for his assistance, encouragement, and guidance, which has shaped our mentality as a researcher. Finally, we are grateful to all our faculty members of the CSE department, BUBT, for making us compatible to complete this research work with the proper guidance and support throughout the last four years.

APPROVAL

This Thesis “Smart parking System” Submitted by Faisal Ahmed ID: 20215103052, Tahmid Jawwad ID: 20215103096, Md Ariful Islam Rifat ID: 20215103099,S.M Touhidur Rahman ID:21224103139, and Mahin Dhrubo ID:20215103065 Department of Computer Science and Engineering (CSE), Bangladesh University of Business and Technology (BUBT) under the supervision of Samsuddin Ahmed, Assistant Professor and, Department of Computer Science and Engineering has been accepted as satisfactory for the partial fulfilment of the requirement for the degree of Bachelor of Science (B.Sc. Eng.) in Computer Science and Engineering and approved as to its style and contents.

Supervisor:
Nourin Khandaker
Lecturer
Department of Computer Science and Engineering (CSE)
Bangladesh University of Business and Technology (BUBT)
Mirpur-2, Dhaka-1216, Bangladesh

MD. Saifur Rahman
Assistant Professor and Chairman (Acting)
Department of Computer Science and Engineering (CSE)

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CHAPTER 1
INTRODUCTION

1.1 Introduction

This report presents a comprehensive overview and analysis of the IoT car parking project, which aims to revolutionize the traditional car parking system using Internet of Things (IoT) technology. The project focuses on deploying smart parking solutions to optimize parking operations, enhance user experience, and improve overall efficiency. In urban areas, parking congestion is a common problem that leads to wasted time, increased traffic, and frustration for drivers. The implementation of IoT-enabled car parking solutions offers a promising approach to address these challenges. By leveraging real-time data collection, communication networks, and intelligent algorithms, the IoT car parking project aims to provide accurate parking availability information, efficient space allocation, and seamless user interaction.

1.2 Existing System

At present some countries have portals in which users can gain information about parking areas via the Internet. This system can give users information about parking spaces, but it won't be able to give which parking slot is vacant and occupied. Hence, such a system cannot smartly handle the issue. Car lifts along with an automated robotic system, which auto- matically takes the car to a particular parking spot as soon as the car enters on a platform. This system can not be installed by medium-scale shopping malls, or movie the- atres as it can cost them a huge amount. At many public places, the system only shows the availability but it cannot show the exact slot and path to the slot available. Hence, there is the need to smartly find the path to the vacant spot [2],[3].

1.3 Motivation

The main motivation of this project is to reduce the traffic jam that occurs in the urban areas which are caused by vehicles searching for parking. In the newspapers, we saw many articles regarding the parking problem all over Dhaka City. In Bangladesh, we are still using the manual vehicle parking system that why we are facing problems like a waste of time and energy finding free space across the parking surface when we need to park our car which requires a good amount of fuel. We proposed an automated system where the parking ground will only open if it has free slots for parking. The user can also check it before arriving there on a website. It will save time as well as reduce the gathering in front of the parking area.

1.4 Objective of the project

- To develop an IoT-based smart parking system that optimizes parking space utilization.
- To provide real-time information to users about parking availability and guidance to vacant parking spots.
- To enhance the overall parking experience by reducing congestion and minimizing the time spent searching for parking spaces.
- To enable efficient parking space management and revenue optimization for parking lot owners.

1.5 Methodology

The project followed the following methodology:

- Requirement gathering: Conducted interviews and surveys to understand the pain points and requirements of users and parking lot owners.
- System design: Designed an architecture incorporating IoT devices, sensors, connectivity, and a cloud-based platform for data processing and analysis.
- Hardware implementation: Deployed sensors in parking spaces to detect occupancy and relay information to the central system.
- Software development: Developed a mobile application and web-based dashboard for users and parking lot owners to access parking information.
- Integration and testing: Integrated the hardware and software components, performed extensive testing, and refined the system based on feedback.

1.6 Conclusion

The IoT Smart Parking project aims to leverage the power of Internet of Things (IoT) technology to improve the efficiency and convenience of parking management systems. This report provides an overview of the project, its objectives, methodology, implementation details, and outcomes. The IoT car parking project represents a significant advancement in modernizing and optimizing the traditional car parking system. By harnessing the power of Internet of Things (IoT) technology, the project aims to address the challenges of parking congestion, inefficient space allocation, and lack of real-time information for drivers.

CHAPTER 2
SYSTEM REQUIREMENTS SPECIFICATION

2.1 Introduction

An IoT-based parking system is a vehicle parking management system to ease the search for a vacant parking spot in a parking lot through a smartphone. The system utilizes various sensors and microcontrollers with internet capability for detecting parked vehicles and updating the data in real-time on the Internet. The IOT-Based Smart Car Parking System Is the Basic Idea to reduce the society jam that occurs in and around the metropolitan areas scheduled by vehicles looking for parking. The anticipated scheme is the amalgamation of smart parking and slot allotment through the network appliance.

2.2 Implementation details

- Hardware: Utilized IoT devices such as ultrasonic sensors or magnetic field sensors to detect vehicle presence in parking spaces. These sensors were connected to microcontrollers or single-board computers for data processing and transmission.
- Connectivity: Employed wireless communication protocols like Wi-Fi, Bluetooth, or LoRaWAN to transmit data from sensors to the central system.
- Cloud Platform: Utilized a cloud-based platform for data storage, processing, and analysis. This enabled real-time monitoring and decision-making.
- User Interface: Developed a mobile application for users to view parking availability, reserve parking spots, and navigate to the nearest available spot. Created a web-based dashboard for parking lot owners to manage their parking spaces, monitor usage, and generate reports.

2.3 System Features and Functionality:

- Real-time parking availability: Users can check the availability of parking spaces in real time through the mobile application.
- Reservation system: Users can reserve parking spots in advance to ensure availability upon arrival.
- Navigation guidance: Users receive turn-by-turn navigation to the nearest vacant parking space.
- Payment integration: Integrated payment gateways to enable seamless and cashless transactions.
- Analytics and reporting: Provided comprehensive analytics and reports to parking lot owners to optimize their operations and revenue.

2.4 Outcomes and Benefits:

- Improved parking efficiency: The IoT smart parking system reduced the time spent searching for parking spaces, resulting in increased efficiency.
- Enhanced user experience: Users benefited from real-time parking availability information and navigation guidance, leading to a seamless parking experience.

- Reduced congestion and emissions: By directing users to available parking spaces promptly, the system minimized congestion and associated carbon emissions.
- Revenue optimization: Parking lot owners could optimize their revenue by efficiently managing parking spaces and implementing dynamic pricing strategies.
- Data-driven decision-making: The system generated valuable data and insights, enabling parking lot owners to make data-driven decisions for process improvement.

2.5 Components and Modules:

1 NodeMCU (ESP-8266)

2 ARDUINO UNO

3 Ultrasonic Sensor SRF- 04

4 Servo Motor SG90

5 Infrared Sensor (IR)

6 LCD Monitoring

2.6 Software Development

1 Arduino IDE

2 Blynk Platform

CHAPTER 3
System Architecture

3.1 INTRODUCTION

The system architecture plays a crucial role in the design and implementation of the IoT car parking project. It provides a framework for organizing and integrating the various components and technologies involved in the project. The system architecture defines how different elements, such as smart parking sensors, communication networks, data processing modules, and user interfaces, interact and work together to achieve the project's objectives. In this section, we will present a comprehensive introduction to the system architecture of the IoT car parking project. We will explore the key components, their functionalities, and their interconnections, providing a high-level overview of the system's structure and operation.

3.2 SYSTEM DESIGN

System design for car parking:

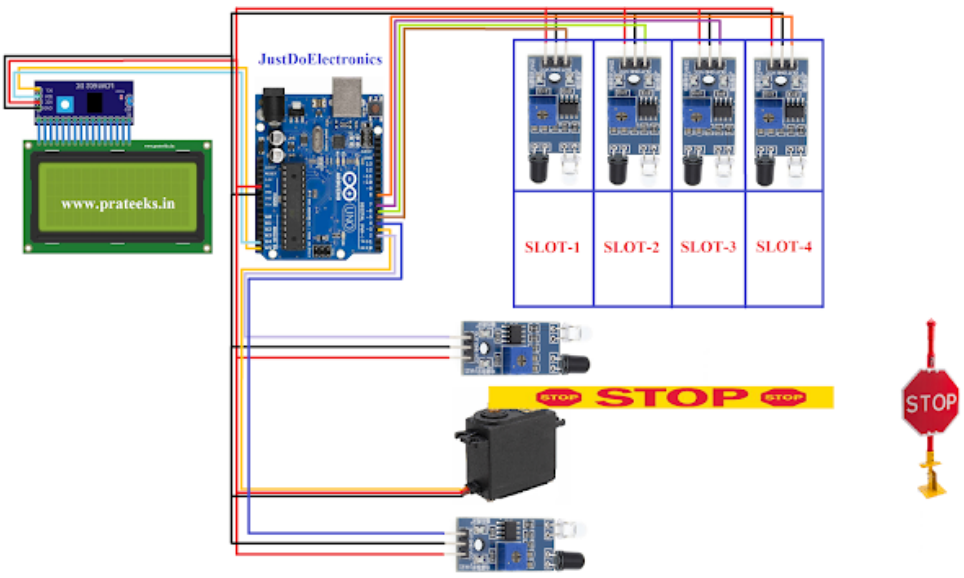


Figure 3.2: Car parking slot

3.2.1 FLOW CHART

Below we show a flowchart of our proposed system that will be clarifying the system very well.

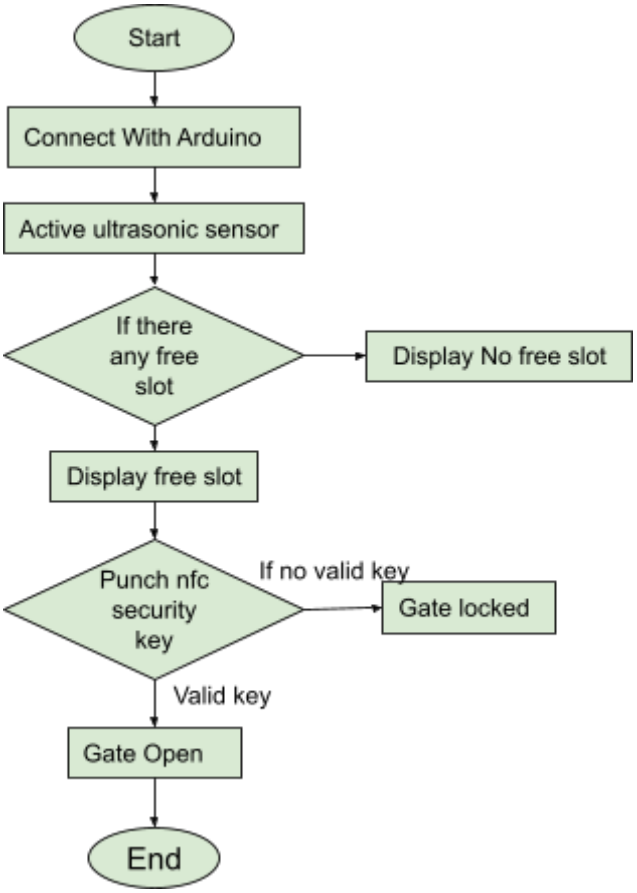


Figure 3.4.4: Flow chart

3.2.2 Circuit Diagram

Below we show a circuit diagram of our system that will be clarifying the system very well. The circuit we are going to build will be based on the above architecture.

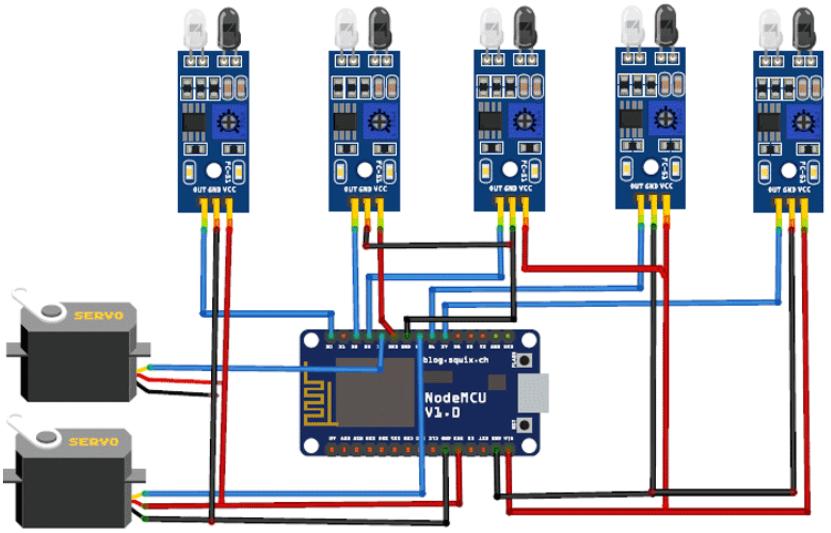


Figure 3.2.2: Circuit Diagram

CHAPTER 4
IMPLEMENTATION

4.1 INTRODUCTION

This chapter provides a comprehensive overview of the implementation process for the car parking IoT project. The project aims to revolutionize the traditional car parking system by leveraging Internet of Things (IoT) technology. By deploying smart parking sensors and establishing a robust communication infrastructure, the implementation seeks to optimize the parking experience, improve efficiency, and provide real-time parking availability information to users. In this chapter, we will delve into the various steps involved in the implementation, highlighting the key components and technologies utilized. We will explore the installation of smart parking sensors, the establishment of a communication network, data collection and analysis, as well as the integration with user interfaces and management systems.

4.2 HARDWARE COMPONENTS

The hardware realization of the proposed IoT-based smart parking system using a LAN Server and Arduino is detailed below.

4.2.1 Arduino R3

The Arduino Uno R3 is a microcontroller board based on a removable, dual-inline-package (DIP) ATmega328 AVR microcontroller. It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analogue inputs). Programs can be loaded on to it from the easy-to-use Arduino computer program.

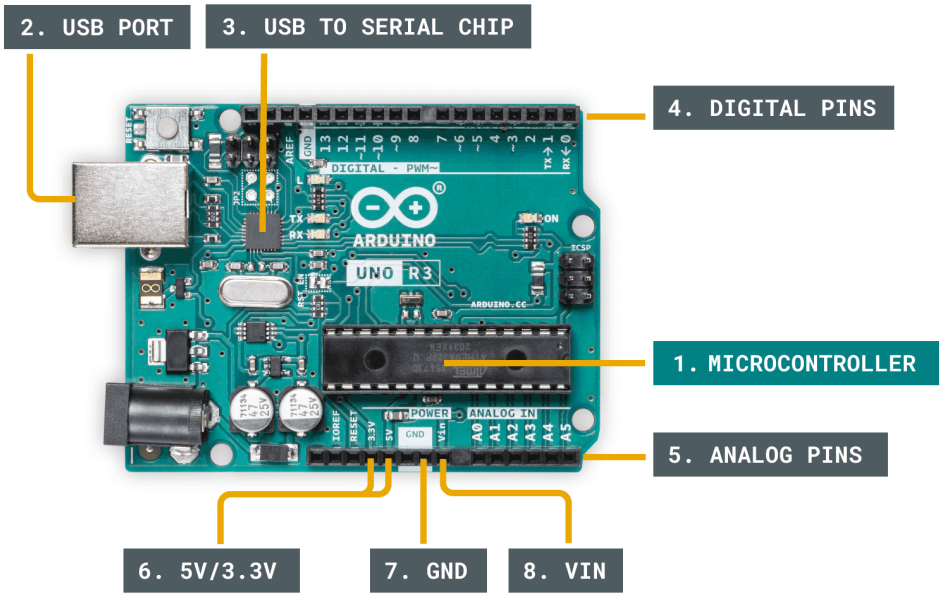
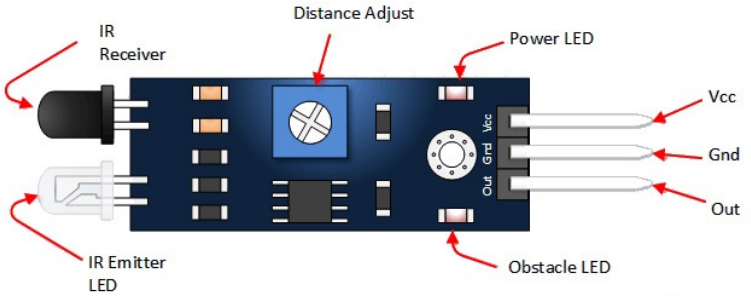


Figure 4.2.1: Arduino R3

4.2.2 Ir sensor

IR proximity sensor works by applying a voltage to the onboard Infrared Light Emitting Diode which in turn emits infrared light. This light propagates through the air and hits an object, after that, the light gets reflected in the photodiode sensor. If the object is close, the reflected light will be stronger, if the object is far away, the reflected light will be weaker. If you look closely at the module. When the sensor becomes active it sends a corresponding Low signal through the output pin that can be sensed by an Arduino or any kind of microcontroller to execute a particular task. The one cool thing about this module is that it has two onboard LEDs built-in, one of which lights on when power is available and another one turns on when the circuit gets triggered.



4.2.3 Power Supply

The board can operate on an external supply from 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may become unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts. The Arduino Uno features a USB port that allows it to be powered directly from a computer or a USB power source, such as a USB wall charger or a power bank. By connecting a USB cable from the computer or power source to the Arduino Uno's USB port, it can receive power and be programmed and operated.

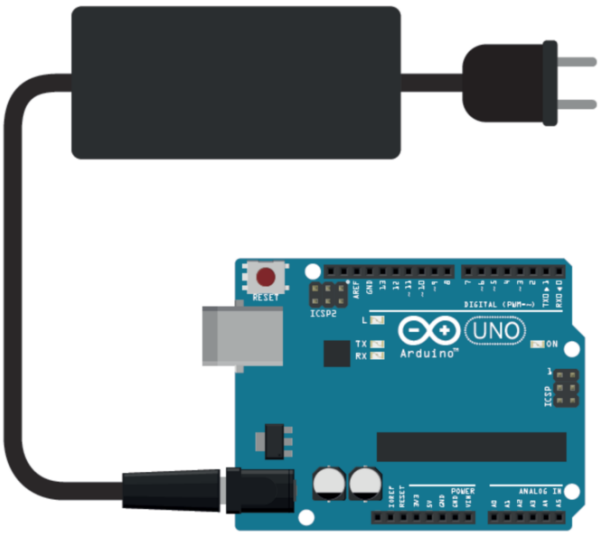


Figure 3.10.2: Power supply in arduino

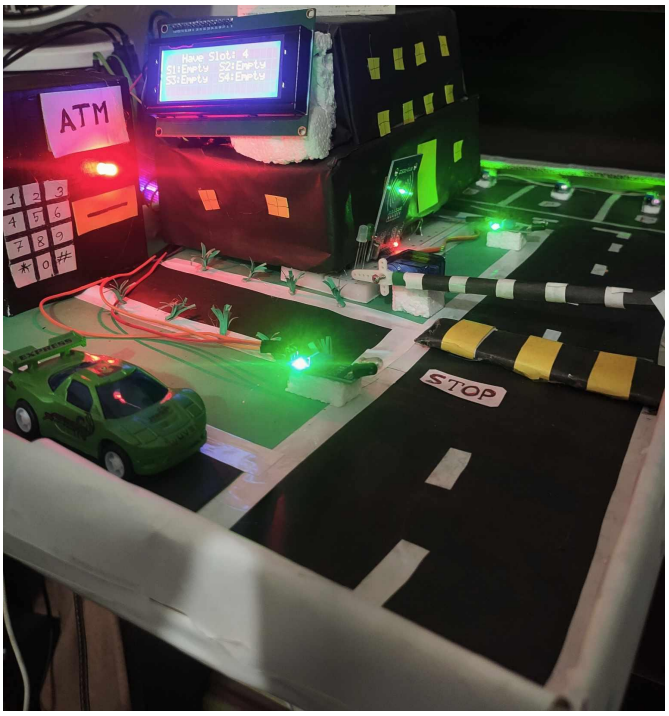
4.2.4 LCD Monitoring

In this project we are using a 16 x 2 LCD display for displaying the parking lot's data locally without the need for the internet. The LCD is driven by an I2C adapter module to reduce the number of wires to four; otherwise, you need to connect up to 16 wires to Arduino just to drive the display. If the LCD occupies most of the I/O pins, then there won't be any pins left for the sensors.

Figure 3.10.2 LCD Monitoring system

4.3 PROJECT IMPLEMENTATION

The picture shows the model of the Automated Car Parking Lot.



This model has the capacity of containing four cars. There are two sensors at the entrance to detect the presence of a car before going inside or outside of the parking lot. The other four sensors are plotted inside the parking lot to detect the car individually for each parking slot. A DC Servo motor has been used at the entrance to open and close the gate according to the signals sent by the sensors through Arduino. The projection on the screen corresponds to the system model parking slots. This is a real-time display regarding the status of the parking lot. The model of the parking lot has four parking slots.

4.4 Project Code

```
#include <Servo.h> //includes the servo library
#include <Wire.h>
#include <LiquidCrystal_I2C.h>
#include <MFRC522.h>
LiquidCrystal_I2C lcd(0x27, 20, 4);
#define ir_enter 6
#define ir_back  7
#define ir_car1 5
#define ir_car2 3
#define ir_car3 2
#define ir_car4 4
#define card1 "41 42 04 47"
#define card2 "23 F5 90 56"
#define card3 "63 7C 2E 10"
#define card4 "53 E3 68 A0"
#define card5 "B3 D1 5A A0"
#define card1_user "FAISAL"
#define card2_user "RIFAT"
#define card3_user "TAHMID"
#define card4_user "TOWHID"
#define card5_user "MAHIN"
#define SS_PIN 10
#define RST_PIN 9

Servo myservo;
MFRC522 mfrc522(SS_PIN, RST_PIN);

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

void setup(){
Serial.begin(9600);
  lcd.init();
  lcd.backlight();
  SPI.begin();      // Initiate  SPI bus
  mfrc522.PCD_Init();

pinMode(ir_car1, INPUT);
```

```
pinMode(ir_car2, INPUT);
pinMode(ir_car3, INPUT);
pinMode(ir_car4, INPUT);

pinMode(A0,OUTPUT);
pinMode(A1,OUTPUT);
pinMode(A2,OUTPUT);
pinMode(A3,OUTPUT);
digitalWrite(A3,HIGH);

pinMode(ir_enter, INPUT);
pinMode(ir_back, INPUT);

myservo.attach(8);
myservo.write(90);

lcd.begin(20, 4);
lcd.setCursor (0,0);
lcd.print("CAR PARKING SYSTEM");
delay (500);
lcd.setCursor (0,1);
lcd.print("    DEVELOPED BY");
delay (500);
lcd.setCursor (0,2);
lcd.print("FAISAL RIFAT TOWHID");
delay (500);
lcd.setCursor (0,3);
lcd.print("    TAHMID MAHIN");
delay (3000);
lcd.clear();

Read_Sensor();

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

void loop(){

Read_Sensor();
if(!digitalRead (ir_enter) == 0){
  if(count==1)
      {
        lcd.clear();
      }
      count=0;
lcd.setCursor (0,0);
lcd.print("   Have Slot: ");
lcd.print(slot);
lcd.print("    ");

lcd.setCursor (0,1);
```

```
if(S1==1){lcd.print("S1:Fill ");}
    else{lcd.print("S1:Empty");}

lcd.setCursor (10,1);
if(S2==1){lcd.print("S2:Fill ");}
    else{lcd.print("S2:Empty");}

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

lcd.setCursor (10,2);
if(S4==1){lcd.print("S4:Fill ");}
    else{lcd.print("S4:Empty");}

}

if(digitalRead (ir_enter) == 0 && flag1==0){
   if(flag2==1)
        {
         delay (500);
         myservo.write(90);
         flag2=0;
         lcd.clear();
         lcd.setCursor (4,0);
         lcd.print("GOODBYE");
         lcd.setCursor (0,1);
         lcd.print("HAVE A NICE DAY");
         lcd.setCursor (4,2);
         lcd.print("VISIT AGAIN");
         lcd.setCursor (4,3);
         lcd.print("GOOD LUCK");
         delay(3000);
         lcd.clear();
        }
   else if(slot>0){

       if(count==0)
      {
       lcd.clear();
      }
      count=1;
       lcd.setCursor (0,0);
       lcd.print("    PLEASE ENTER   ");
       lcd.setCursor (0,1);
       lcd.print("                   ");
       lcd.setCursor (0,2);
       lcd.print("    YOUR CARD      ");
       lcd.setCursor (0,3);
       lcd.print("                   ");
```

```
      if(flag2==0){

        authy();

        }
   }
   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 && digitalRead (ir_back)==1){
delay(500);
myservo.write(90);
flag1=0, flag2=0;
digitalWrite(A1,LOW);
digitalWrite(A2,LOW);
}

delay(500);
}
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;}
}
void authy()
{
     String content= "";
     byte letter;
     if ( ! mfrc522.PICC_IsNewCardPresent())
     {
       return;
     }
     if ( ! mfrc522.PICC_ReadCardSerial())
     {
       return;
```

```
    }
    for (byte i = 0; i < mfrc522.uid.size; i++)
    {
     //  Serial.print(mfrc522.uid.uidByte[i] < 0x10 ? " 0" : " ");
     // Serial.print(mfrc522.uid.uidByte[i], HEX);
     tone(A0,2500,1000);

      content.concat(String(mfrc522.uid.uidByte[i] < 0x10 ? " 0" : " "));
      content.concat(String(mfrc522.uid.uidByte[i], HEX));
    }
    Serial.println(content.substring(1));
    content.toUpperCase();
      if (content.substring(1) == card1) //change here the UID of the card/cards that you want to
give access
    {
      lcd.clear();
      lcd.setCursor (0,0);
      lcd.print("WELCOME");
      lcd.setCursor (0,1);
      lcd.print(card1_user);
      flag1=1;
      myservo.write(180);
      slot = slot-1;
      digitalWrite(A1,HIGH);
      delay(2000);
      lcd.clear();
    }
      else if (content.substring(1) == card2) //change here the UID of the card/cards that you want
to give access
    {
      lcd.clear();
      lcd.setCursor (0,0);
      lcd.print("WELCOME");
      lcd.setCursor (0,1);
      lcd.print(card2_user);
      flag1=1;
      myservo.write(180);
      slot = slot-1;
      digitalWrite(A1,HIGH);
      delay(2000);
      lcd.clear();


    }
      else if (content.substring(1) == card3) //change here the UID of the card/cards that you want
to give access
    {
      lcd.clear();
      lcd.setCursor (0,0);
      lcd.print("WELCOME");
      lcd.setCursor (0,1);
      lcd.print(card3_user);
```

```
      flag1=1;
      myservo.write(180);
      slot = slot-1;
      digitalWrite(A1,HIGH);
      delay(2000);
      lcd.clear();
    }
     else if (content.substring(1) == card4) //change here the UID of the card/cards that you want
to give access
    {
      lcd.clear();
      lcd.setCursor (0,0);
      lcd.print("WELCOME");
      lcd.setCursor (0,1);
      lcd.print(card4_user);
      flag1=1;
      myservo.write(180);
      slot = slot-1;
      digitalWrite(A1,HIGH);
      delay(2000);
      lcd.clear();
    }
     else if (content.substring(1) == card5) //change here the UID of the card/cards that you want
to give access
    {
      lcd.clear();
      lcd.setCursor (0,0);
      lcd.print("WELCOME");
      lcd.setCursor (0,1);
      lcd.print(card5_user);
      flag1=1;
      myservo.write(180);
      slot = slot-1;
      digitalWrite(A1,HIGH);
      delay(2000);
      lcd.clear();
    }
   else if(content.substring(1) !="" )
   {
      lcd.clear();
      lcd.setCursor (0,0);
      lcd.print("Access denied");
      tone(A0,500,1200);
      digitalWrite(A2,HIGH);
      delay(2000);
      lcd.clear();
      digitalWrite(A2,LOW);

    }

}
```

CHAPTER 5

CONCLUSION

6.1 Conclusion

After doing a study on the smart parking project it is found that this system can be introduced in our country and it will be beneficiary in the context of our country. The main benefits are time and fuel savings. It can also provide sustainable parking management in an eco-friendly manner. There is less maintenance cost for this system so it helps the property developer in cost saving. It provides security to the parking ground. It reduces the hassle in parking grounds and traffic jams. It will also encourage Automation Engineering in our country which will make advancements in increasing the usage of technology. Therefore, we should implement this project and help to develop our city. The implementation of the car parking IoT project holds great potential for transforming parking operations, reducing congestion, and enhancing user convenience. By providing accurate and up-to-date information on parking availability, both drivers and parking lot operators can benefit from improved decision-making and resource allocation. The following sections will outline the implementation process in detail, offering insights and guidelines for successfully deploying the car parking IoT solution.

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Object Detection System

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By,

Faisal Ahmed	**Id: 20215103052**
Mahin Dhrubo	**Id: 20215103065**
Tahmid Jawwad	**Id: 20215103096**
Md Ariful Islam Rifat	**Id: 20215103099**
S.M Touhidur Rahman	**Id: 21224103139**

Supervised by,

Nourin Khandaker
Lecturer
Department of Computer Science and Engineering (CSE)
Bangladesh University of Business and Technology (BUBT)
Mirpur-2, Dhaka-1216, Bangladesh