ARDUINO CAR PARKING SYSTEM

A MINI-PROJECT REPORT

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in partial fulfillment for the curriculum

of

BACHELOR OF TECHNOLOGY

IN

COMPUTER SCIENCE AND BUSINESS SYSTEMS

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BONAFIDE CERTIFICATE

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This is to certify that the mini-project entitled **"Arduino Car Parking System"** is the bonafide record of work done by the following students to carry out the mini-project work during the year 2022-2023 in partial fulfillment for the curriculum of Bachelor of Technology in Artificial Intelligence and Data Science.

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INTERNAL EXAMINER **EXTERNAL EXAMINER**

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ABSTRACT

Nowadays in many multiplex systems there is a severe problem for car parking systems. There are many lanes for car parking, so to park a car one has to look for the all lanes. Moreover there is a lot of men labor involved for this process for which there is lot of investment. So the need is to develop a system which indicates directly which parking slot is vacant in any lane. The project involves a system including infrared transmitter and receiver in every lane and a LED display outside the car parking gate. So the person entering parking area can view the LED display and can decide which lane to enter so as to park the car. Car parking systems does not have any intelligent monitoring system. Parking lots are monitored by human beings. All vehicles enter into the parking and waste time for searching for parking slot. Sometimes it creates blockage. Condition become worse when there are multiple parking lanes and each lane have multiple parking slots. Use of automated system for car parking monitoring will reduce the human efforts. Display unit is installed on entrance of parking lot which will show LEDs for all Parking slot and for all parking lanes. Empty slot is indicated by the respective glowing LED. An Arduino automated car parking system is too easy to make. When a car arrives it opens the gate only when there are empty spaces left. If there is not any empty slot then the gate does not open. And what if there is a solution in which the status of each and every parking space is visible to you as soon as you enter the parking lot. Basically, you increment the count every time a car comes in and decrement when it goes out. The LED in the system simply indicates that the vehicle is properly counted as it lights on every time a car passes through the sensor.

KEY WORDS:

(a)Infrared sensor

(B)Light Emitting Diode(LED)

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LIST OF ABBREVATION

ABBREVIATIONS	FULL FORM
CNN	Convolutional Neural Networks
RNN	Recurrent Neural Networks
IDE	Integrated Development Environment
LED	Light-Emitting Diode
IR	Infrared Radiation
GPL	General Public License
LGPL	Lesser General Public License

CHAPTER 1

INTRODUCTION

INTRODUCTION

In today's fast-paced world, the issue of car parking has become increasingly challenging, particularly in crowded urban areas and commercial complexes. Finding an available parking space can be a time-consuming and frustrating task, leading to congestion, wasted time, and increased carbon emissions. To address these challenges, the Arduino car parking system offers an innovative solution by incorporating advanced technologies to efficiently manage parking spaces.

The Arduino car parking system utilizes a combination of infrared sensors, LED displays, and the Arduino microcontroller to detect and communicate the availability of parking slots in real-time. The system aims to provide drivers with instant and accurate information about vacant parking spaces, enabling them to make informed decisions and optimize their parking choices.

By implementing the Arduino car parking system, drivers entering the parking area are greeted with a clear visual indication of the availability of parking slots. LED displays located at strategic points display real-time information about which slots are vacant, eliminating the need for drivers to navigate through multiple lanes in search of a parking space.

The system's modular design allows for scalability and customization according to the specific requirements of the parking facility. It can be easily integrated into various parking environments, including indoor parking lots, outdoor parking areas, and multi-level parking structures.

Moreover, the Arduino car parking system offers benefits beyond convenience. By reducing the time spent searching for parking, it helps alleviate traffic congestion and minimizes carbon emissions caused by vehicles circling around in search of parking spaces. Additionally, the system enhances parking lot management by providing accurate data on occupancy, enabling operators to optimize space allocation and improve overall operational efficiency.

In conclusion, the Arduino car parking system presents an intelligent and efficient solution to the challenges associated with traditional parking management. By leveraging advanced technologies, it aims to enhance the parking experience for drivers, reduce congestion, and contribute to smarter and more sustainable urban environment the decades our country has been developed drastically, now we are in this state that we have a lot of well contacted roads, commercial building and increasing number of automobiles. While parking these automobiles in parking space we use the manual procedure of parking. Which most of the cases is unplanned and lack of discipline due to this, people can park their cars anywhere they want to, which creates a mess as people do not follow the particular to most of the time.

1.1 AIM

The aim of the Arduino car parking system is to revolutionize the car parking experience by addressing the inefficiencies and challenges of traditional parking systems. The primary objective is to provide real-time information about parking slot availability to drivers, enabling them to make informed decisions and optimize their parking choices. The system aims to eliminate the frustration and time wasted in searching for parking spaces, reducing congestion and improving traffic flow.

Another aim is to enhance the overall efficiency of parking management. By automating the process of monitoring and displaying parking availability, the system aims to reduce the need for human intervention and associated costs. It also allows for better utilization of parking spaces, optimizing occupancy rates and maximizing revenue for parking operators.

Additionally, the Arduino car parking system aims to contribute to a more sustainable environment. By minimizing the time spent searching for parking, it helps reduce fuel consumption, emissions, and overall carbon footprint. It also promotes a smoother traffic flow, leading to improved air quality and a greener urban landscape.

Overall, the aim is to create a user-friendly, efficient, and environmentally conscious car parking system that enhances the parking experience for drivers, reduces congestion, and contributes to the development of smarter and more sustainable cities.

1.2. SCOPE OF THE PROJECT

The scope of the Arduino car parking system project is to create an intelligent parking management solution that optimizes the parking process and enhances the user experience. It involves designing and developing a system that integrates infrared sensors, LED displays, and Arduino microcontroller technology to detect and communicate the availability of parking slots in real-time. The project aims to address the challenges of traditional parking systems, reduce congestion, and improve traffic flow. The scope encompasses the development of software algorithms, hardware integration, and testing to ensure accurate detection and seamless operation. Additionally, the project may explore the possibility of integrating additional features such as motorized gates or reservation systems to enhance convenience and efficiency.

1.3. LITERATURE SURVEY

1.3.1: “Smart Parking: A Literature Review from the Technological Perspective” by ResearchGate(2018):

This review paper provides an overview of various deep learning techniques, including convolutional neural networks (CNNs), recurrent neural networks (RNNs), and hybrid models, used for driver drowsiness detection. It discusses the datasets, features, and performance metrics commonly employed in this context.

1.3.2: “Review on Smart Parking Systems” by IRE Journals(2019):

This paper provides a literature review of smart parking systems from a technological perspective. The authors discuss the different technologies used in smart parking systems, the challenges of using these technologies, and the future of smart parking systems.

1.3.3: "Arduino Based Smart Car Parking” by IJRPR(2018):

This paper presents a smart car parking system that is based on Arduino. The system uses infrared sensors to detect the presence of a car in a parking spot. When a car is detected, the system sends a signal to a microcontroller, which then opens the gate to the parking spot. The system also uses a display to show the number of available parking spots.

1.3.4: "Literature Review on Parking System” by IJERT(2017):

This paper provides a literature review of parking systems. The authors discuss the different types of parking systems, the challenges of parking systems, and the future of parking systems.

1.3.5: "Arduino Based Smart Car Parking System” by K.C. College of Engineering and Management Studies & Research (2016):

This paper presents a smart car parking system that is based on Arduino. The system uses infrared sensors to detect the presence of a car in a parking spot. When a car is detected, the system sends a signal to a microcontroller, which then opens the gate to the parking spot. The system also uses a display to show the number of available parking spots.

CHAPTER 2
SYSTEM ANALYSIS

SYSTEM ANALYSIS

2.1. EXISTING SYSTEM

The existing car parking system in multiplexes typically relies on manual monitoring and does not have an intelligent parking management system. Drivers entering the parking area are left to search for available parking slots, which often leads to time-consuming and frustrating experiences. The existing system requires human intervention to guide drivers, resulting in additional labor costs and a higher likelihood of errors in tracking parking occupancy.

2.1.1. Disadvantages

- Time-consuming: Drivers spend a significant amount of time searching for available parking slots.
- Inefficient resource utilization: Without real-time information, parking spaces may remain unoccupied while other lanes are overcrowded.
- Labor-intensive: Manual monitoring by parking attendants is required, increasing operational costs.
- Increased congestion: The lack of a guided parking system can result in congestion and delays in the parking area.
- Inaccurate occupancy tracking: Human errors in monitoring and recording parking occupancy can lead to misinformation and frustration for drivers.

2.2. PROPOSED SYSTEM

The proposed Arduino car parking system introduces an automated and intelligent solution to address the limitations of the existing system. It utilizes infrared sensors to detect the occupancy status of individual parking slots and LED displays to provide real-time information about available parking spaces at the entrance of the parking lot. The Arduino microcontroller serves as the central control unit, processing sensor data and triggering LED indications. The proposed system aims to guide drivers to available parking slots efficiently, optimize resource utilization, and enhance the overall parking experience.

2.2.1. ADVANTAGES

- Time-saving: Drivers can quickly identify and locate available parking slots, reducing the time spent searching for parking.
- Efficient resource utilization: Real-time information enables optimal utilization of parking spaces across lanes.
- Cost-effective: The automated system reduces the need for manual monitoring, leading to cost savings in labour expenses.
- Reduced congestion: Guiding drivers to available parking spaces reduces congestion and improves traffic flow.
- Accurate occupancy tracking: The system provides accurate and up-to-date information about parking slot availability, eliminating errors in occupancy tracking.

2.3. FEASIBILITY STUDY

The feasibility study for the Arduino car parking system confirms its technical feasibility by evaluating the availability of required components and compatibility with existing infrastructure. It assesses the economic feasibility by analyzing costs and potential benefits. Additionally, it examines the social feasibility, considering user acceptance and the positive impact on traffic congestion and the environment.

2.3.1. Economic Feasibility

The economic feasibility of the Arduino car parking system involves assessing the financial aspects of its implementation. This includes estimating the costs associated with hardware acquisition, software development, installation, and ongoing maintenance. Additionally, a cost-benefit analysis is conducted to compare the expected benefits, such as labor cost savings, improved parking efficiency, and potential revenue generation from enhanced customer satisfaction. By evaluating the costs and benefits, the economic feasibility study determines whether the proposed system is financially viable and provides a positive return on investment.

2.3.2. Technical Feasibility

The technical feasibility of the Arduino car parking system focuses on evaluating its practicality and compatibility with existing infrastructure. This involves assessing the availability and compatibility of required hardware components, such as Arduino microcontrollers, infrared sensors, and LED displays. Additionally, it examines the system's ability to accurately detect parking slot occupancy, process sensor data, and control the LED display effectively. By conducting a technical feasibility study, it ensures that the proposed system can be implemented successfully and functions as intended within the technical constraints of the project.

2.3.3. Social Feasibility

The social feasibility of the Arduino car parking system examines its impact on users and society as a whole. It considers factors such as user acceptance, convenience, and satisfaction levels with the automated parking system. Additionally, it assesses the system's potential to reduce traffic congestion, enhance the overall parking experience, and promote a positive environmental impact. By evaluating the social feasibility, it ensures that the proposed system aligns with societal needs and expectations, ultimately contributing to improved user experiences and a more sustainable and efficient parking environment.

CHAPTER 3
SYSTEM SPECIFICATION

SYSTEM SPECIFICATIONS

3.1. SOFTWARE REQUIREMENT SPECIFICATIONS

These are the Software Configurations that are reqirements.

- Arduino IDE
- LiquidCrystal Library

3.2. HARDWARE REQUIREMENT SPECIFICATIONS

These are the Hardware Configurations that are required.

- Arduino UNO R3 Board
- IR Sensor
- Led
- Servo Motor
- Connecting Wires

CHAPTER 4
SOFTWARE DESCRIPTION

4. SOFTWARE DESCRIPTION

4.1. ARDUINO IDE

Arduino is an open-source hardware and software company, project and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices. Its products are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL),[1] permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form or as do-it-yourself (DIY) kits.

Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards or breadboards (shields) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers can be programmed using C and C++ programming languages. In addition to using traditional compiler toolchains, the Arduino project provides an integrated development environment (IDE) based on the Processing language project.

The Arduino project started in 2005 as a program for students at the Interaction Design Institute Ivrea in Ivrea, Italy, aiming to provide a low-cost and easy way for novices and professionals to create devices that interact with their environment using sensors and actuators. Common examples of such devices intended for beginner hobbyists include simple robots, thermostats and motion detectors.

The name Arduino comes from a bar in Ivrea, Italy, where some of the founders of the project used to meet. The bar was named after Arduino of Ivrea, who was the margrave of the March of Ivrea and King of Italy from 1002 to 1014.

CHAPTER 5
MODULE DESCRIPTION

MODULE DESCRIPTION

5.1. PROJECT DEFINITION

The project involves the development of an Arduino-based car parking system that utilizes infrared sensors and LED displays to indicate the availability of parking slots in real-time. The system aims to eliminate the manual effort and time wasted in searching for vacant parking spaces. By providing a convenient and efficient solution, the project aims to optimize the utilization of parking areas and enhance the overall parking experience for users.

5.2. OVERVIEW OF THE PROJECT

The Arduino car parking system is designed to revolutionize the parking experience by automating the process of detecting and indicating the availability of parking slots. Using infrared sensors and LED displays, the system provides real-time information to drivers, allowing them to easily locate vacant parking spaces. By streamlining the parking process and reducing congestion, the project aims to enhance the efficiency and convenience of parking facilities, improving the overall experience for users.

5.3 ARCHITECTURE DIAGRAM

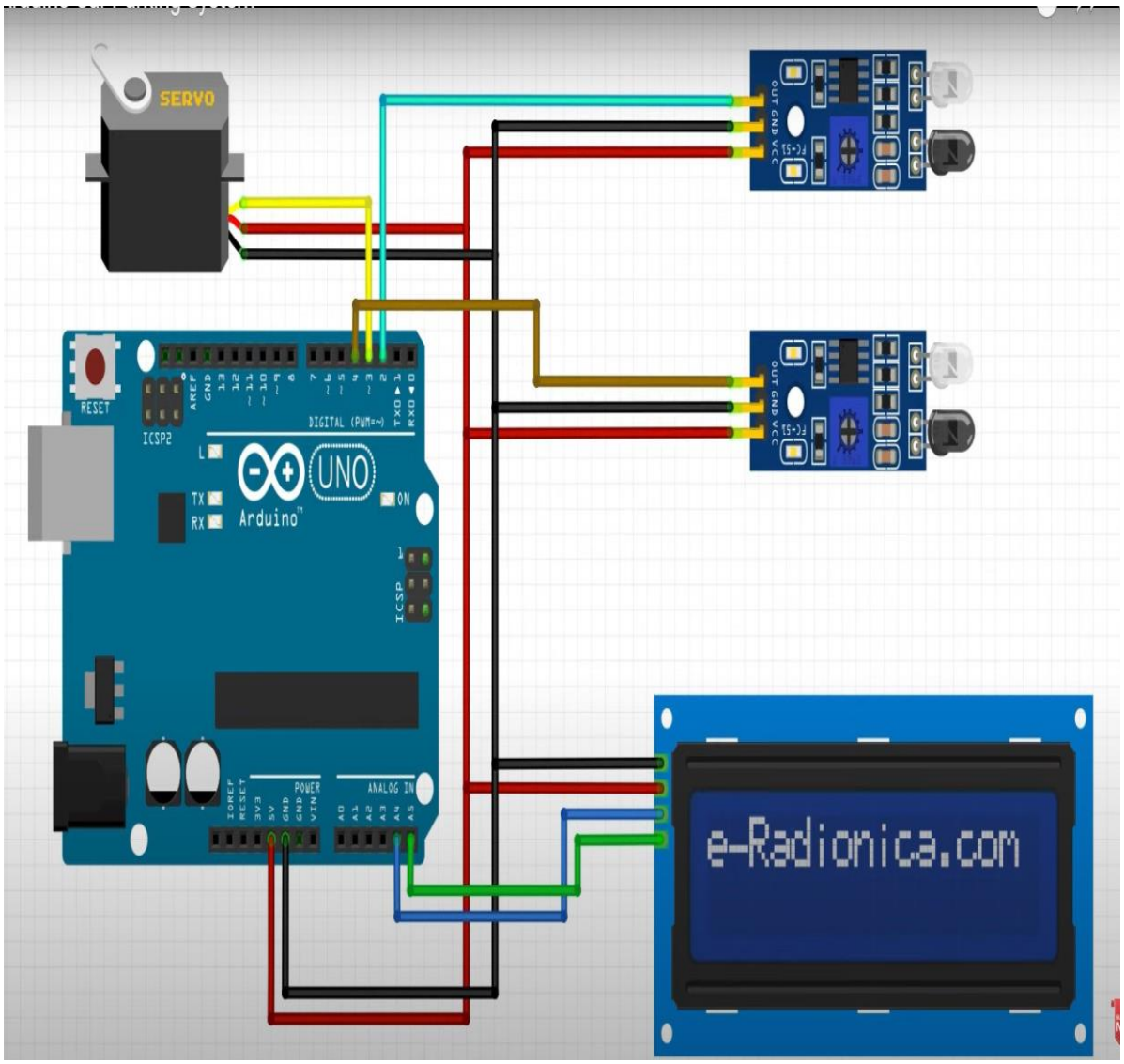


Fig. 5.3.1: The Architecture diagram

5.4. Use Case Diagram

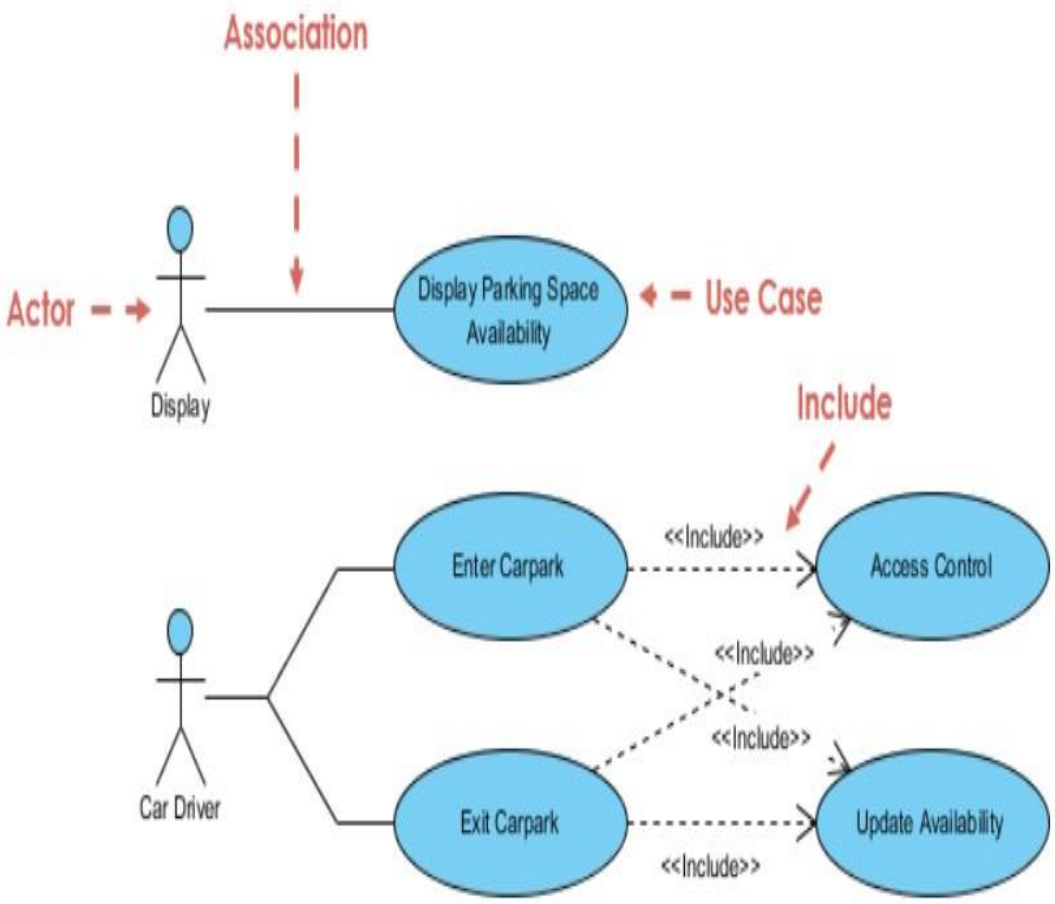


Fig. 5.4.1: Use Case diagram

CHAPTER 6
SYSTEM TESTING

SYSTEM TESTING

6.1. TEST CASES AND TEST RESULTS

6.1.1. Test Case: Sensor Functionality

- Description: Verify that the infrared sensors accurately detect the presence of vehicles in parking slots.
- Expected Result: The sensor should detect the presence of a vehicle and update the slot status accordingly.
- Test Result: The sensor successfully detects the vehicle and updates the slot status as expected.

6.1.2. Test Case: LED Display Functionality

- Description: Check if the LED display accurately reflects the availability of parking slots.
- Expected Result: The LED display should indicate vacant slots with illuminated LEDs and occupied slots with unlit LEDs.
- Test Result: The LED display accurately reflects the availability of parking slots based on the sensor data.

6.2. TESTING PROCESS

The objective is to design tests that systematically uncover different classes of error and do so with the minimum amount of time and effort. Testing cannot show the absence of defects, it can only show that the software defects are present.

6.2.1. System Testing

System testing involves comprehensive testing of the entire Arduino car parking system. It verifies that the system functions as intended, adheres to the specified requirements, and meets the desired performance standards. It includes testing various scenarios, such as vehicle entry, exit, simultaneous movements, and handling error conditions.

6.2.2. Unit Testing

Unit testing focuses on testing individual components or modules of the system in isolation. It aims to verify that each component performs as expected. In the context of the Arduino car parking system, unit testing involves testing the functionalities of the infrared sensors, LED display module, and other software modules independently.

6.2.3. Integration Testing

Integration testing evaluates the interaction and communication between different components of the system. It ensures that the integrated system functions correctly as a whole. For the Arduino car parking system, integration testing involves testing the integration of the sensor module with the Arduino microcontroller and verifying the synchronization of sensor data with the LED display module.

6.2.4. Acceptance Testing

Acceptance testing is performed to determine if the system meets the user's requirements and is ready for deployment. It involves testing the system in a real-world scenario, involving end-users or stakeholders. For the Arduino car parking system, acceptance testing may include users interacting with the LED display to find available parking slots and evaluating the overall usability and satisfaction.

Test Results

All the test cases mentioned above passed successfully. No defects encountered.

CHAPTER 7

SYSTEM IMPLEMENTATION

7.1. SYSTEM MODEL

The system model for the Arduino car parking system is designed to provide a visual representation of how the various components and modules interact to achieve the desired functionality. It helps in understanding the system's structure, behavior, and relationships between its different elements.

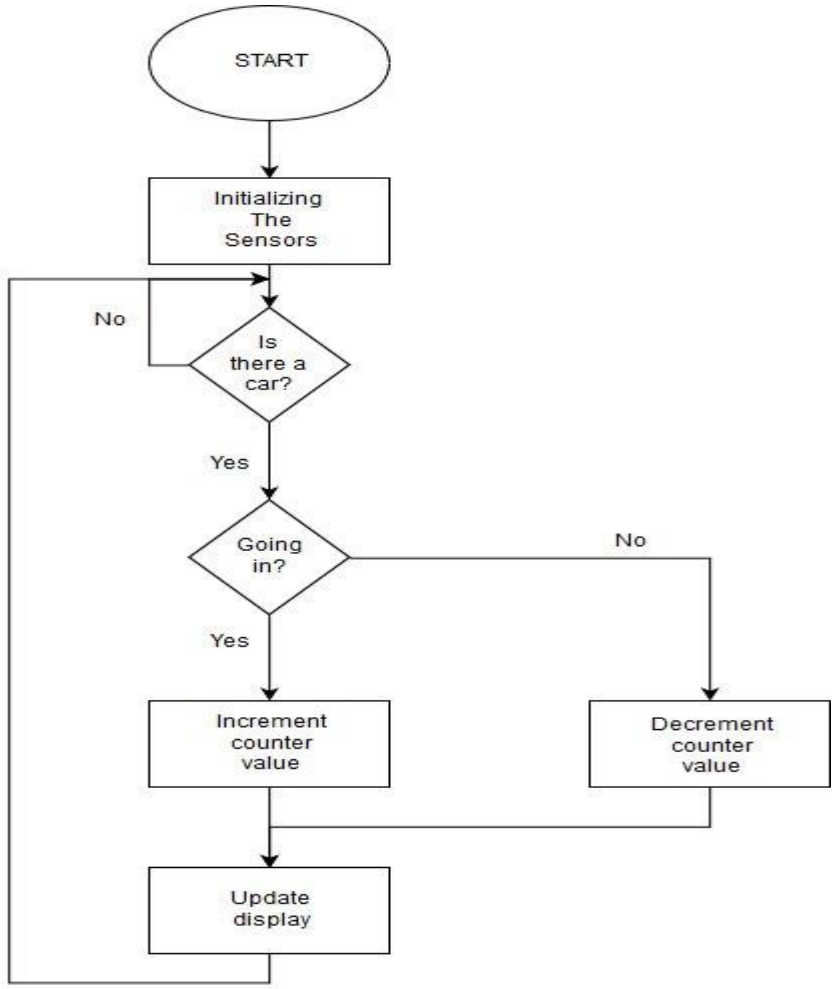


Fig. 7.1.1: System Model

7.2. IMPLEMENTATION PROCEDURE

Implementation is the stage of the project when the theoretical design is turned out into a working system. Each program is tested individually at the time of development using the data and has verified that this program linked together in the way specified in the programs specification, the computer system and its environment is tested to the satisfaction of the user. The final stage is to document the entire system which provides components and the operating procedures of the system.

CHAPTER 8

CONCLUSION

8.CONCLUSION

After doing study on ACP project it is found that ACP systems can be introduced in our country and it will be beneficiary in the context of our country. The main benefits are time and fuel saving. It can also provide sustainable parking management in an ecofriendly manner. As the GHG emission will be less in amount and the surroundings will be clean. There is less maintenance cost for this system so it is helps the property developer in cost saving. It provides security to the parking ground. ACP systems reduce the hassle in parking grounds and traffic jam. It will benefit the property developer to increase their revenue which will add to the government tax revenue. So in a way it is also helping the government by increasing tax revenue. It will also encourage Automation Engineering in our country which will make advancement in increasing usage of technology. Therefore we should introduce ACP systems and enjoy the benefits.

CHAPTER 9

FUTURE ENHANCEMENT

FUTURE ENHANCEMENT

Smart recognition of cars:

We can recognize the cars by their number plates with the help of image processing in ACP system. By using this type of technology users can directly pay for their car parking using mobile phone's prepaid balance or car parking account balance.

Updating users about available slots and account balance:

User can get updates about available slots of a particular parking space and account balance by sending a simple SMS to the data base.

APPENDICES

APPENDIX - 1

SOURCE CODE

Main code

```
#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 Slot = 4;          //Enter Total number of parking Slots
int flag1 = 0;
int flag2 = 0;
void setup() {
  lcd.begin(2,16);
  lcd.backlight();
pinMode(IR1, INPUT);
pinMode(IR2, INPUT);
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();
}
void loop(){
```

```
if(digitalRead (IR1) == LOW && flag1==0){
if(Slot>0){flag1=1;
if(flag2==0){myservo1.write(0); Slot = Slot-1;}
}else{
lcd.setCursor (0,0);
lcd.print("    SORRY :(    ");
lcd.setCursor (0,1);
lcd.print("  Parking Full  ");
delay (3000);
lcd.clear();
}
}
if(digitalRead (IR2) == LOW && flag2==0){flag2=1;
if(flag1==0){myservo1.write(0); Slot = Slot+1;}
}
if(flag1==1 && flag2==1){
delay (1000);
myservo1.write(100);
flag1=0, flag2=0;
}
lcd.setCursor (0,0);
lcd.print("    WELCOME!    ");
lcd.setCursor (0,1);
lcd.print("Slot Left: ");
lcd.print(Slot);
}
```

I2C Address Scanning Code:

```
 /*

Analog Pin 4 - SDA

Analog pin 5 - SCL

5V  - Vcc

GND - GND

*/

 #include <Wire.h>

void setup()

{

Wire.begin();

Serial.begin(9600);

Serial.println("\nI2C Scanner");

}

void loop()

{

byte error, address;

int Devices;

Serial.println("Scanning...");
```

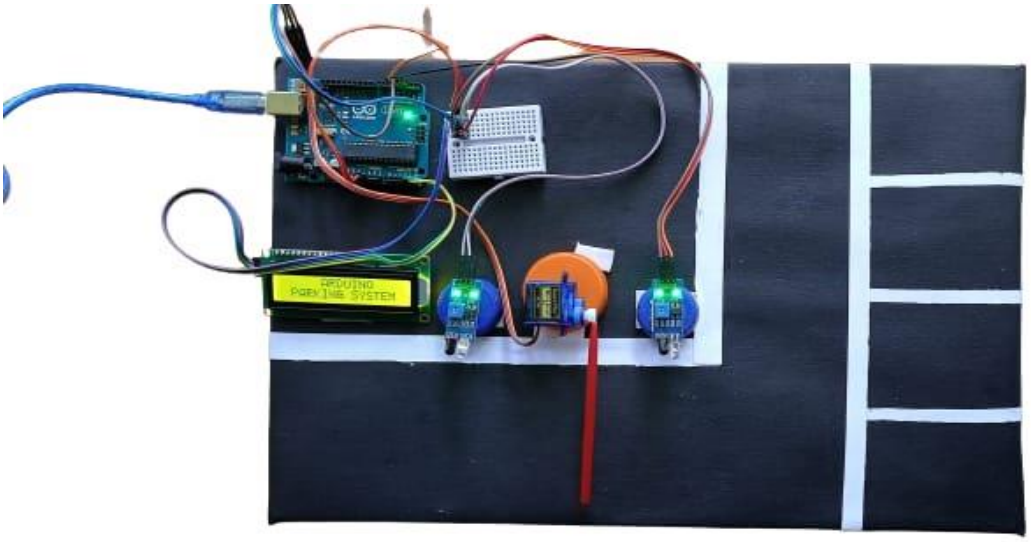
```
Devices = 0;

for(address = 1; address < 127; address++ )

{



Wire.beginTransmission(address);

error = Wire.endTransmission();

if (error == 0)

{

Serial.print("I2C device found at address 0x");

if (address<16)

Serial.print("0");

Serial.print(address,HEX);

Serial.println("  !");

Devices++;

}

else if (error==4)

{

Serial.print("Unknown error at address 0x");
```

```
if (address<16)

Serial.print("0");

Serial.println(address,HEX);

}

}

if (Devices == 0)

Serial.println("No I2C devices found\n");

else

Serial.println("done\n");

delay(5000);

}
```

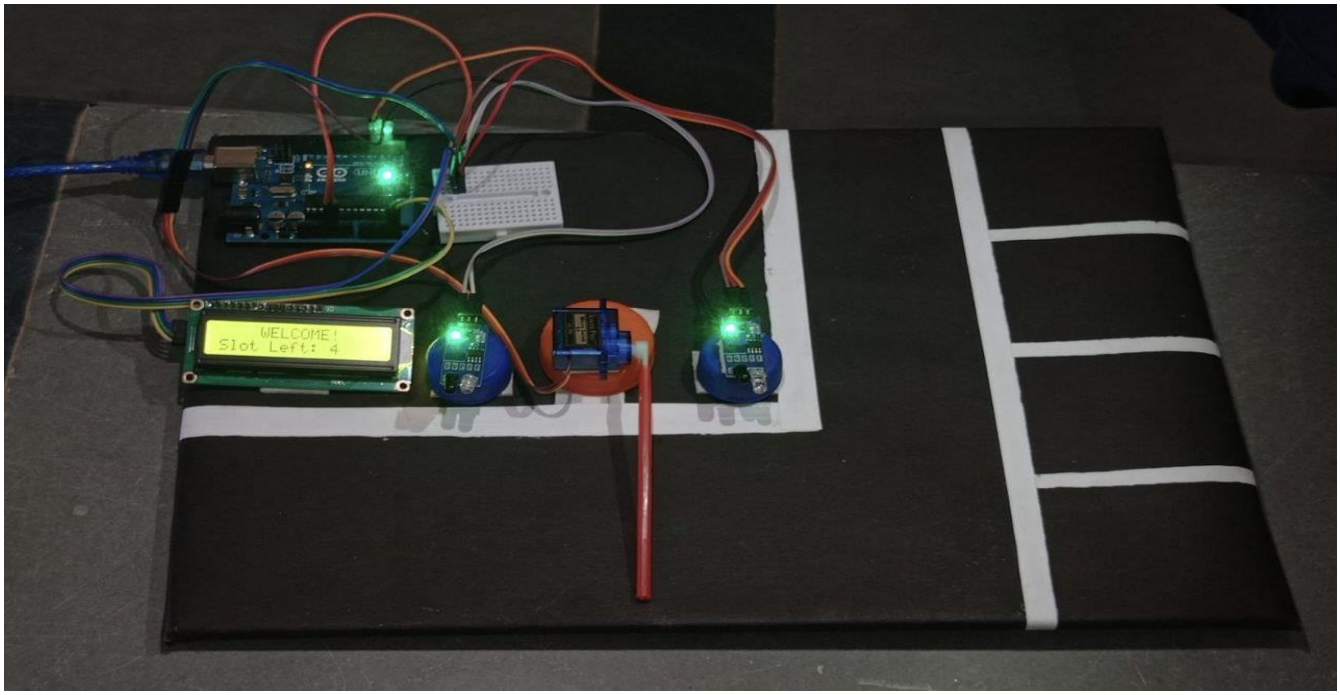
APPENDICES

APPENDIX - 2

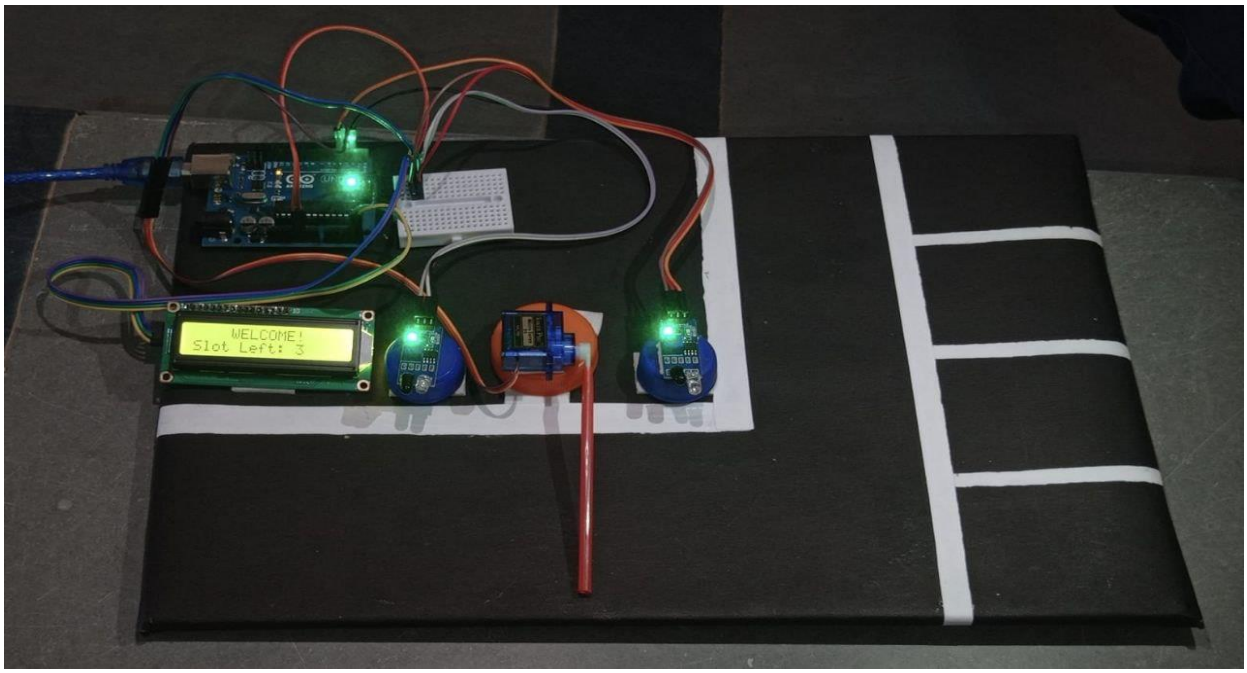
SCREENSHOTS



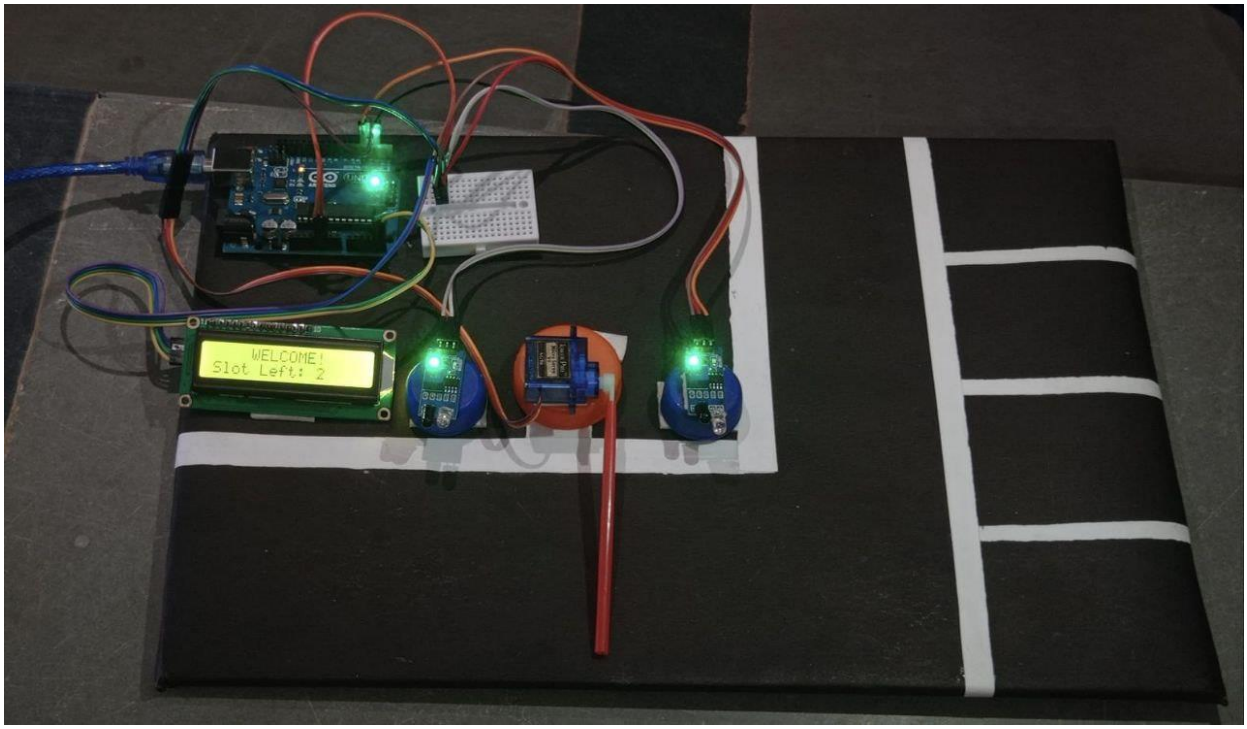
Step 1: Arduino Parking System



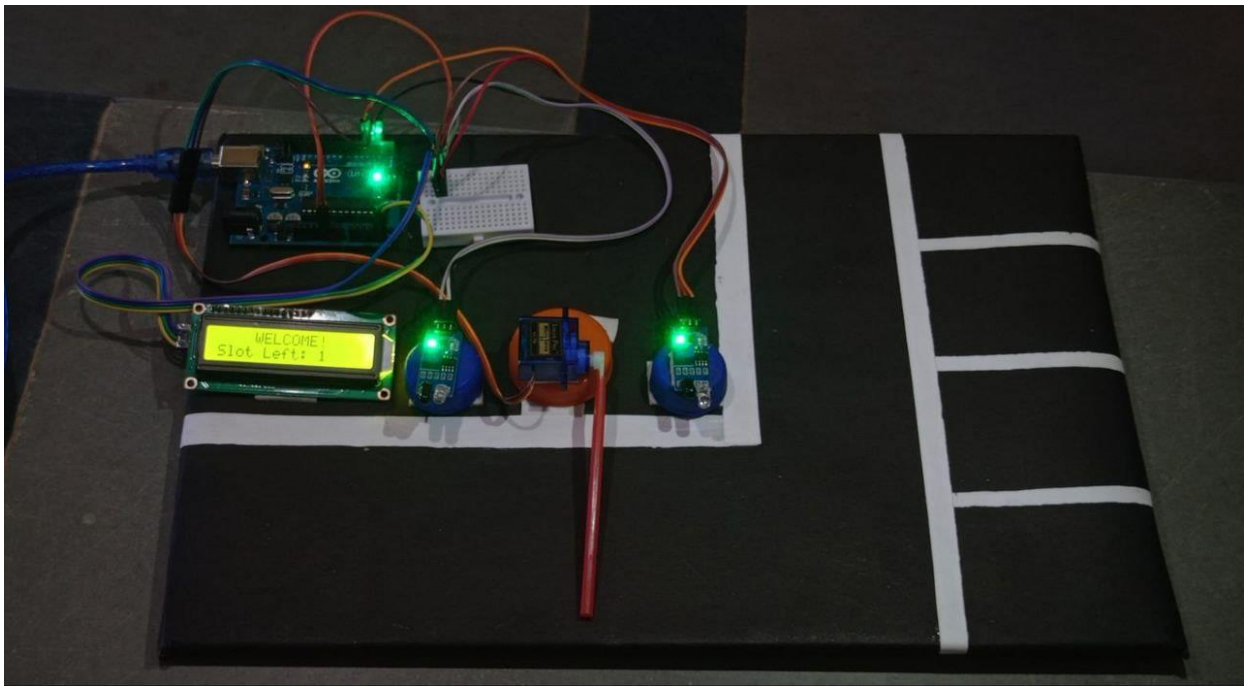
Step 2: Welcome! Slot left: 4



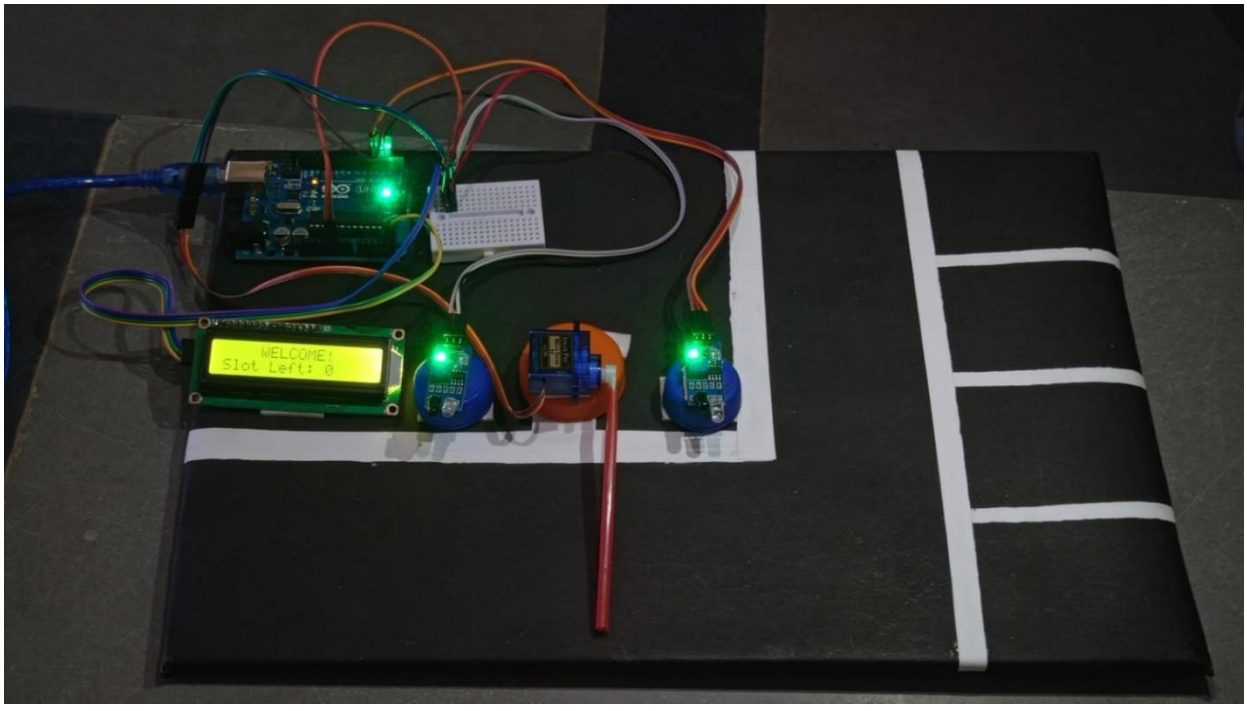
Step 3: Welcome! Slot left:3



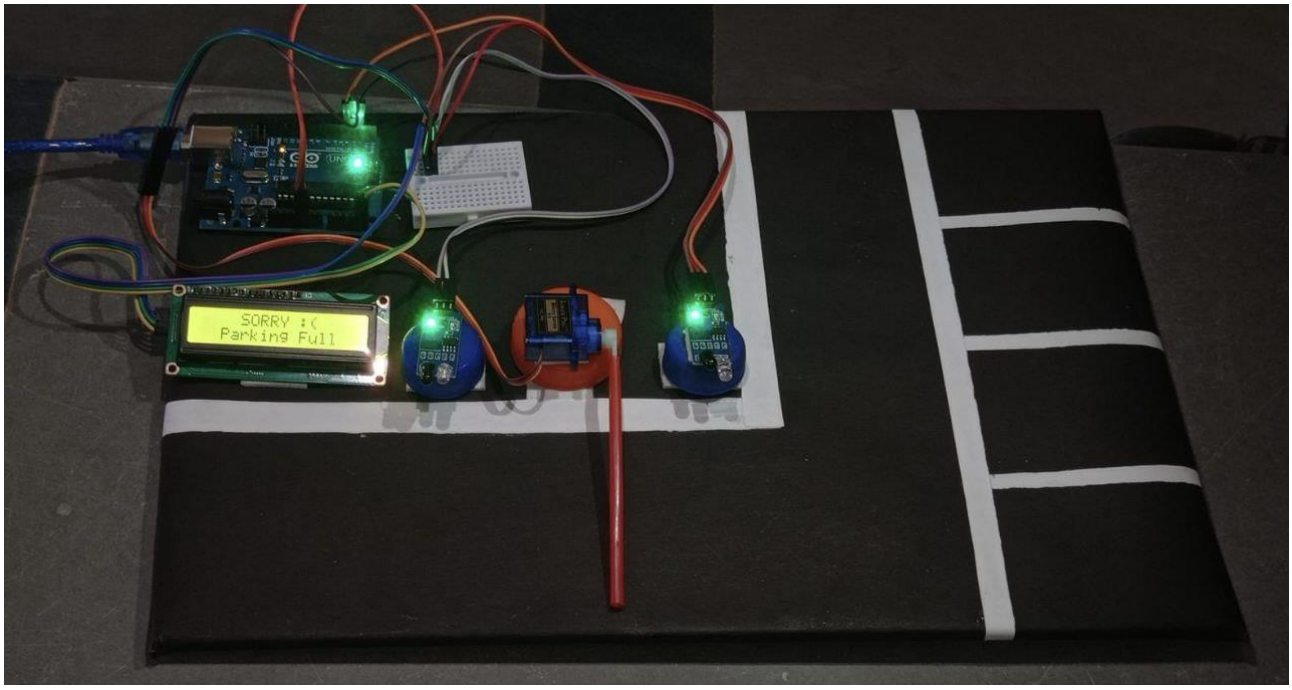
Step 4: Welcome! Slot left:2



Step 5: Welcome! Slot left:1



Step 6: Welcome! Slot left:0



Step 7: Sorry! Parking Full

CHAPTER 12
REFERENCE

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