SMART CAR PARKING SYSTEM

A MINI-PROJECT REPORT

Submitted by

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BONAFIDE CERTIFICATE

Certified that this project **"SMART CAR PARKING SYSTEM"** is the bonafide work of **"G PRISCILLA RACHEL(210701196) , J RACHEL SHERIN (210701200)"** who carried out the project work under my supervision..

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Submitted to Project Viva-Voce Examination held on ______________________________

INTERNAL EXAMINER **EXTERNAL EXAMINER**

ABSTRACT

The rapid growth of urban areas has led to increased demand for efficient parking management solutions. This project presents the development and implementation of a smart car parking system using Internet of Things (IoT) technologies. The system leverages Arduino microcontrollers, infrared (IR) sensors, an LCD display, and servomotors to automate and streamline the parking process.IR sensors are strategically placed at entry and exit points to detect the incoming and outgoing vehicles. These sensors transmit real-time data to the Arduino, which processes the information to determine the number of available parking slots. The current availability status is then displayed on an LCD screen, providing clear and immediate information to drivers. Additionally, servomotors are utilized to control barriers or gates, granting access to the parking area when a slot is available and preventing entry when the parking lot is full. The proposed system aims to reduce the time spent by drivers searching for parking spaces, thus alleviating traffic congestion and reducing fuel consumption. The integration of IoT components ensures real-time monitoring and management, making the system scalable and adaptable to various parking environments. Experimental results demonstrate the effectiveness of the system in accurately monitoring parking slot occupancy and providing reliable information to users. This smart parking solution represents a significant step towards smarter cities and more efficient urban mobility.

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CHAPTER 1
INTRODUCTION

Urbanization and the consequent increase in the number of vehicles have created significant challenges in managing parking spaces efficiently. Traditional parking systems often fail to provide real-time information about parking availability, leading to congestion, wasted fuel, and frustration among drivers. To address these issues, the development of a smart car parking system leveraging Internet of Things (IoT) technology presents a promising solution. This project focuses on designing and implementing a smart car parking system using Arduino microcontrollers, infrared (IR) sensors, an LCD display, and servomotors. The system is engineered to automatically monitor and manage the availability of parking slots, providing real-time updates to drivers and streamlining the parking process.

The core components of the system include IR sensors, which are deployed at each parking slot to detect the presence of vehicles. These sensors continuously send data to an Arduino microcontroller, which processes the information to determine the status of each parking slot. The number of available slots is dynamically displayed on an LCD screen located at the entrance of the parking area, giving drivers immediate access to essential information. Additionally, servomotors are employed to control access barriers, allowing or denying entry based on the availability of parking slots. This automated control mechanism not only enhances security but also optimizes the use of parking space, ensuring that only vehicles with available slots are permitted to enter.

By integrating IoT technology, this smart parking system aims to reduce the time drivers spend searching for parking, thereby decreasing traffic congestion and lowering carbon emissions. The system's real-time monitoring capability makes it a scalable and adaptable solution for various urban environments, contributing to the development of smarter cities and improved urban mobility. This introduction sets the stage for a detailed exploration of the design, implementation, and benefits of the smart car parking system.

CHAPTER 2

LITERATURE SURVEY

The burgeoning field of smart parking systems has seen substantial research interest due to the escalating challenges posed by urbanization and increasing vehicular traffic. IoT-based solutions have emerged as a pivotal approach to addressing these issues by providing real-time data and automating parking management processes. The integration of Arduino microcontrollers in smart parking systems is well-documented, owing to their versatility and compatibility with a variety of sensors and actuators. Research by Wang et al. (2018) demonstrated that IR sensors are highly effective in detecting vehicle presence with precision, which is crucial for real-time monitoring of parking slot occupancy. This study highlighted the reliability and accuracy of IR sensors in dynamic urban environments. Further advancements are noted in the incorporation of LCD displays to convey real-time parking information to drivers. Sharma and Purohit (2019) showed that such displays significantly reduce the time drivers spend searching for available parking slots, thus easing traffic congestion and lowering emissions. Their study underlined the importance of clear and immediate information dissemination in enhancing the overall efficiency of parking systems.

Servomotors have also been extensively studied for their role in controlling parking barriers, adding an additional layer of automation and security to the system. Lee et al. (2020) implemented a smart parking system incorporating servomotors, which effectively managed access control and optimized space utilization. Their findings indicated that automated barriers controlled by servomotors could significantly enhance user experience by ensuring that only authorized vehicles enter the parking area.Moreover, Kumar et al. (2021) explored the broader integration of IoT components, emphasizing the benefits of real-time data processing and transmission for dynamic and responsive parking management. Their research highlighted how IoT-enabled systems could adapt to varying demand patterns and improve overall operational efficiency.Collectively, these studies illustrate the potential of IoT-based smart parking systems to revolutionize urban parking management. By utilizing Arduino microcontrollers, IR sensors, LCD displays, and servomotors, these systems provide a comprehensive solution that addresses the multifaceted challenges of urban parking. The existing literature underscores the efficacy of these technologies in reducing congestion, optimizing space usage, and enhancing user convenience. This project aims to build on these insights to develop a robust, scalable smart parking system that contributes to smarter urban mobility solutions. These studies collectively illustrate the transformative potential of IoT-based smart parking systems. By leveraging Arduino microcontrollers, IR sensors, LCD displays, and servomotors, these systems offer a comprehensive solution to the challenges of urban parking. The literature consistently shows that such technologies can reduce congestion, optimize space usage, and enhance the overall user experience. This project builds on these foundational insights to develop an advanced smart parking system aimed at improving urban mobility and contributing to the development of smarter cities.

. 2.1 EXISTING SYSTEM

Current parking systems, particularly in urban environments, largely rely on traditional, non-automated methods of managing parking spaces. These systems typically involve manual operations such as attendants directing traffic, physical signs indicating parking availability, and drivers manually searching for available slots. The limitations of these conventional systems are increasingly apparent, especially in densely populated areas where the demand for parking far exceeds the available spaces.In many cases, drivers rely on visual inspections to find available slots, often leading to extended search times, increased traffic congestion, and higher fuel consumption. This inefficiency not only causes frustration for drivers but also contributes to environmental pollution. Some parking facilities have implemented basic automated solutions, such as ticketing machines and boom barriers, but these systems generally do not provide real-time information on parking availability..

CHAPTER 3

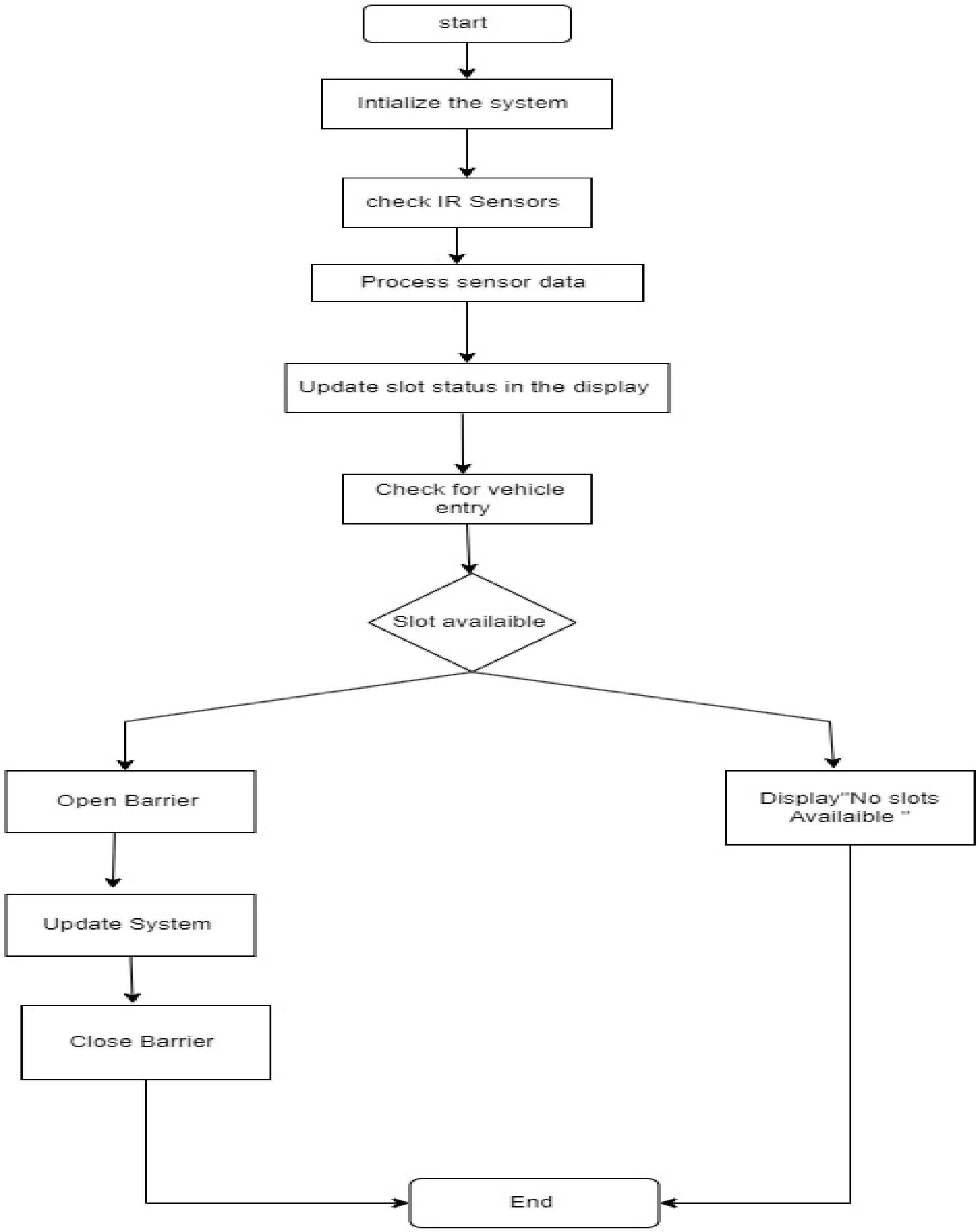
PROJECT DESCRIPTION

The smart car parking system operates by leveraging IoT components such as Arduino microcontrollers, infrared (IR) sensors, an LCD display, and servomotors to automate and streamline the process of managing parking spaces. Initially, the system is powered on, initializing the Arduino and connected sensors. IR sensors, placed at each parking slot, continuously monitor and detect the presence of vehicles. This sensor data is transmitted to the Arduino, which processes the information to determine the occupancy status of each parking slot. The Arduino then updates the total count of available parking slots, which is displayed on an LCD screen at the entrance of the parking area, providing real-time information to incoming drivers.

When a vehicle approaches the parking facility, the system checks the availability of slots. If slots are available, the servomotor operates to open the barrier, allowing the vehicle to enter. The Arduino updates the slot status to reflect the new occupancy and closes the barrier after the vehicle has passed. If no slots are available, the LCD display shows a "No Slots Available" message, preventing the barrier from opening. This real-time monitoring and automated control help reduce the time drivers spend searching for parking, minimize traffic congestion, and optimize the utilization of parking spaces. The system continuously loops through these steps, ensuring up-to-date information is always available, thereby enhancing the efficiency and convenience of the parking process.5

3.1 PROPOSED SYSTEM

The proposed smart car parking system is designed to enhance the efficiency and convenience of urban parking management using a combination of Arduino microcontrollers, infrared (IR) sensors, an LCD display, and servomotors. The system starts with the initialization of the Arduino and the connected components, including IR sensors positioned at each parking slot to detect vehicle presence. These sensors send real-time occupancy data to the Arduino, which processes the information to determine the availability of parking slots. This availability data is then dynamically displayed on an LCD screen at the parking facility's entrance, providing immediate, real-time information to drivers seeking parking spaces.When a vehicle arrives, the system checks for available slots. If a slot is available, the Arduino signals the servomotor to open the entry barrier, allowing the vehicle to enter. The system updates the slot status accordingly and closes the barrier once the vehicle has passed through. If no slots are available, the LCD display updates to show "No Slots Available," preventing the barrier from opening and guiding the driver to seek parking elsewhere. This automation reduces the need for manual intervention, decreases the time drivers spend searching for parking, and helps mitigate traffic congestion. The continuous loop of monitoring, updating, and displaying ensures that the system remains responsive and efficient, providing a scalable solution for modern urban parking challenges.


start
Intialize the system
check IR Sensors
Process sensor data
Update slot status in the display
Check for vehicle entry
Slot availaible
Open Barrier
Update System
Close Barrier
Display"No slots Availaible "
End

3.2 REQUIREMENTS

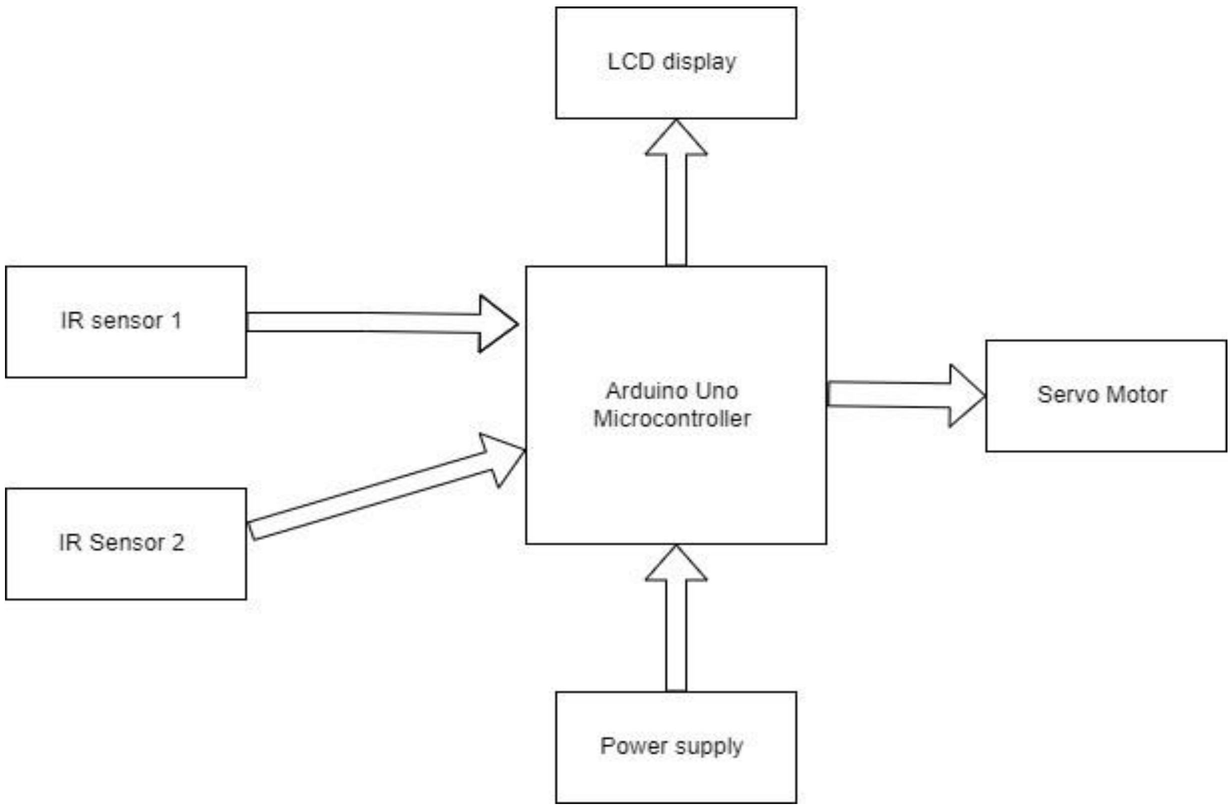
3.2.1 HARDWARE REQUIREMENTS

- Arduino Uno
- Infrared IR Sensor
- 16 X 2 LCD Display
- Servo Motor
- Bread Board
- Jumper Wires

3.2.2 SOFTWARE REQUIREMENTS

- Arduino IDE

3.3 ARCHITECTURE DIAGRAM



The architecture diagram for the smart car parking system showcases a clear depiction of the system's hardware components and their interactions. At its core lies the Arduino microcontroller, serving as the central processing unit that receives data from infrared (IR) sensors positioned at entry and exit points. These sensors detect the presence or absence of vehicles and relay this information to the Arduino for processing. The Arduino then updates the status of available parking slots, which is displayed in real-time on the LCD display located at the entrance of the parking facility. Additionally, the Arduino controls the servomotors that operate the barriers or gates, regulating vehicle entry and exit based on parking slot availability.

3.4 CIRCUIT DIAGRAM

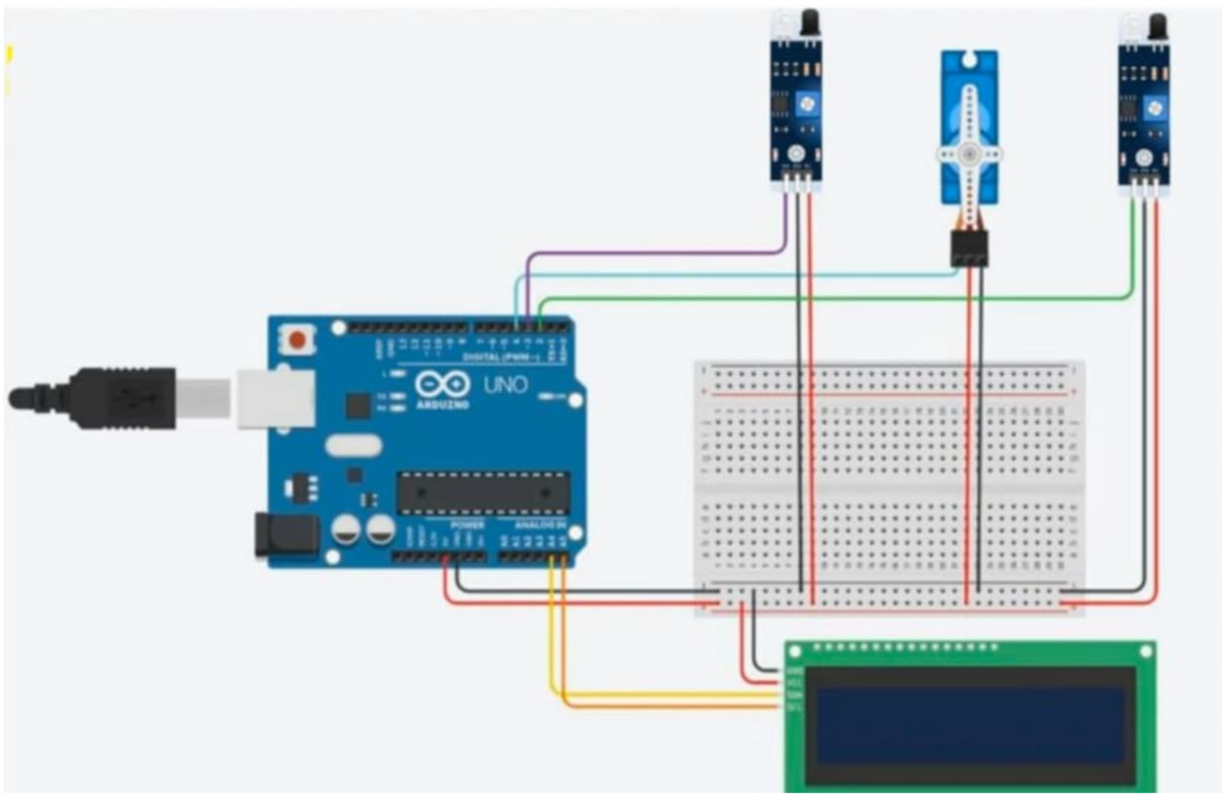


Figure 3

Figure 3 is the circuit Diagram of the smart Car Parking System with Arduino , IR sensors, LCD Display, Servomotor.

OUTPUT:

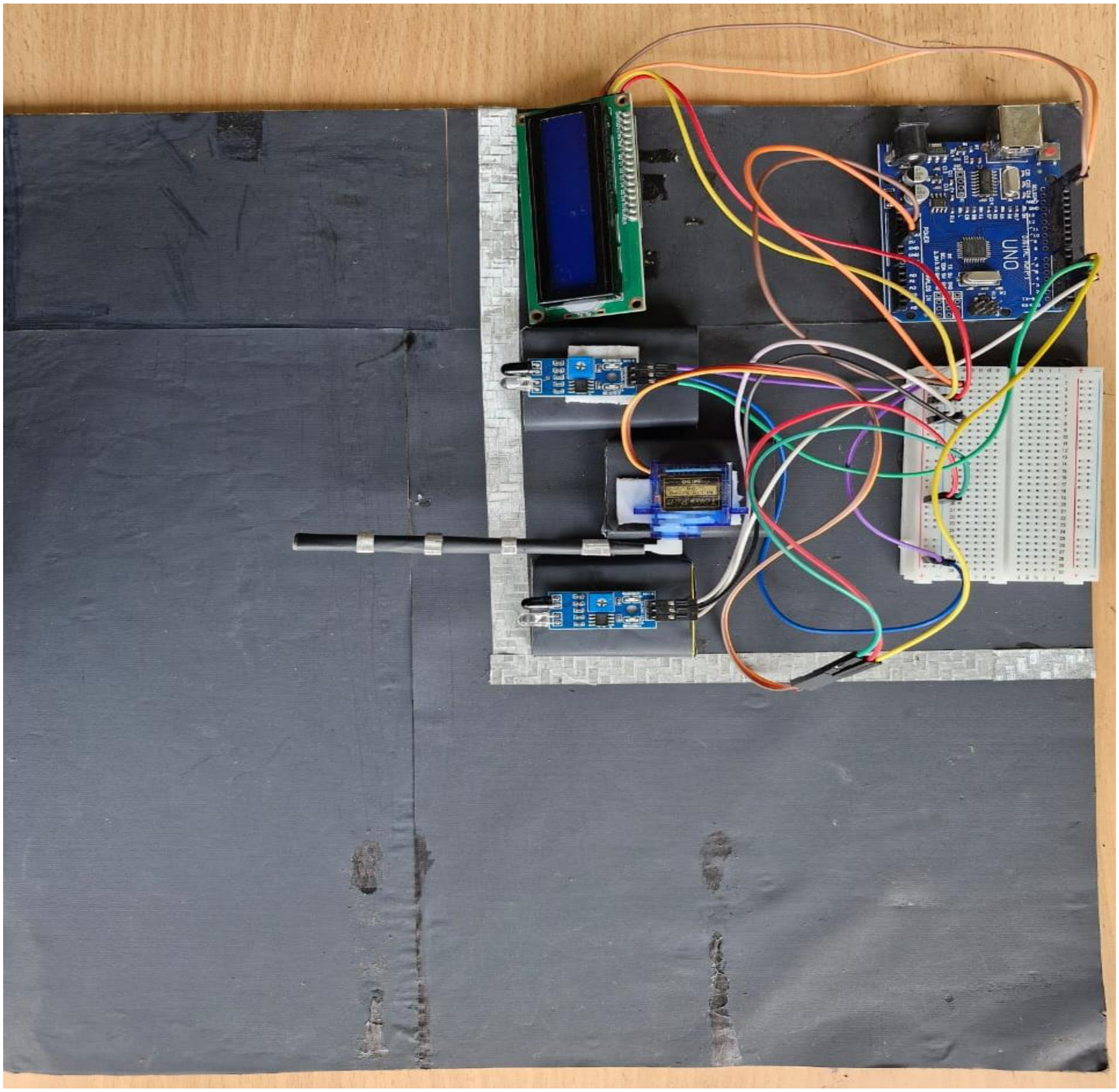


Figure 4

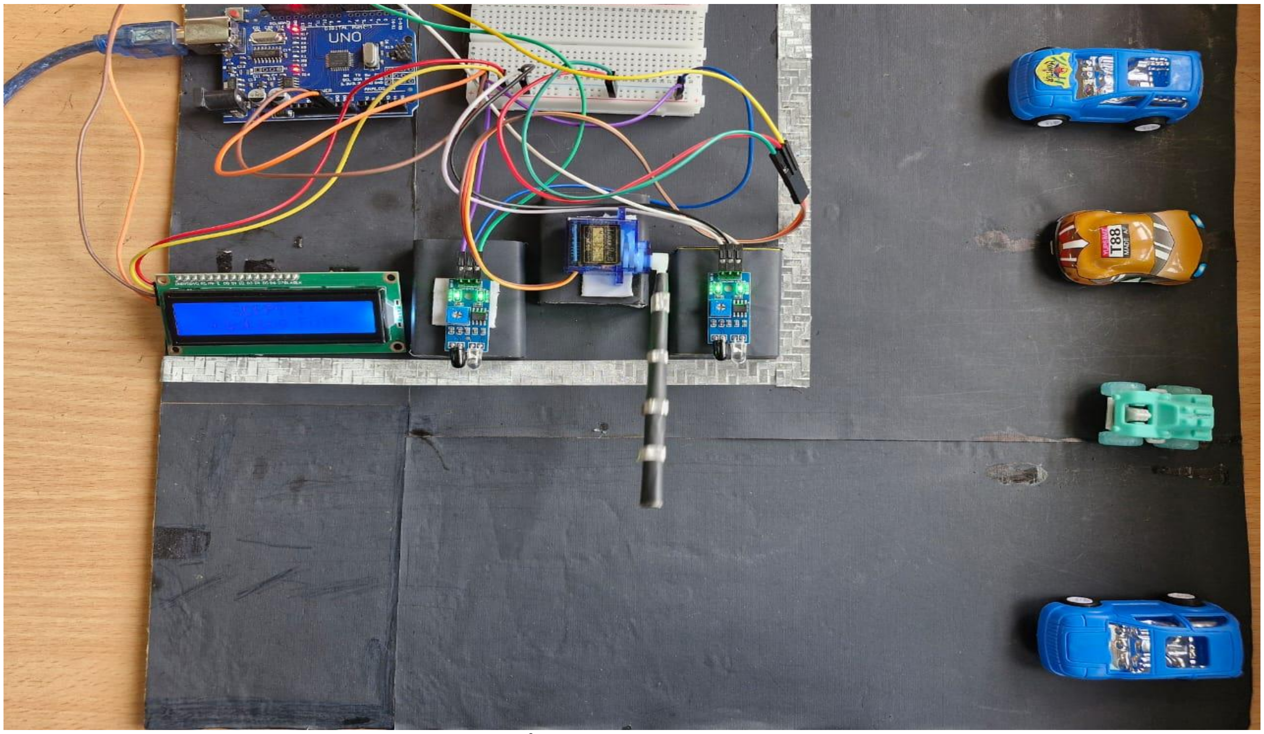
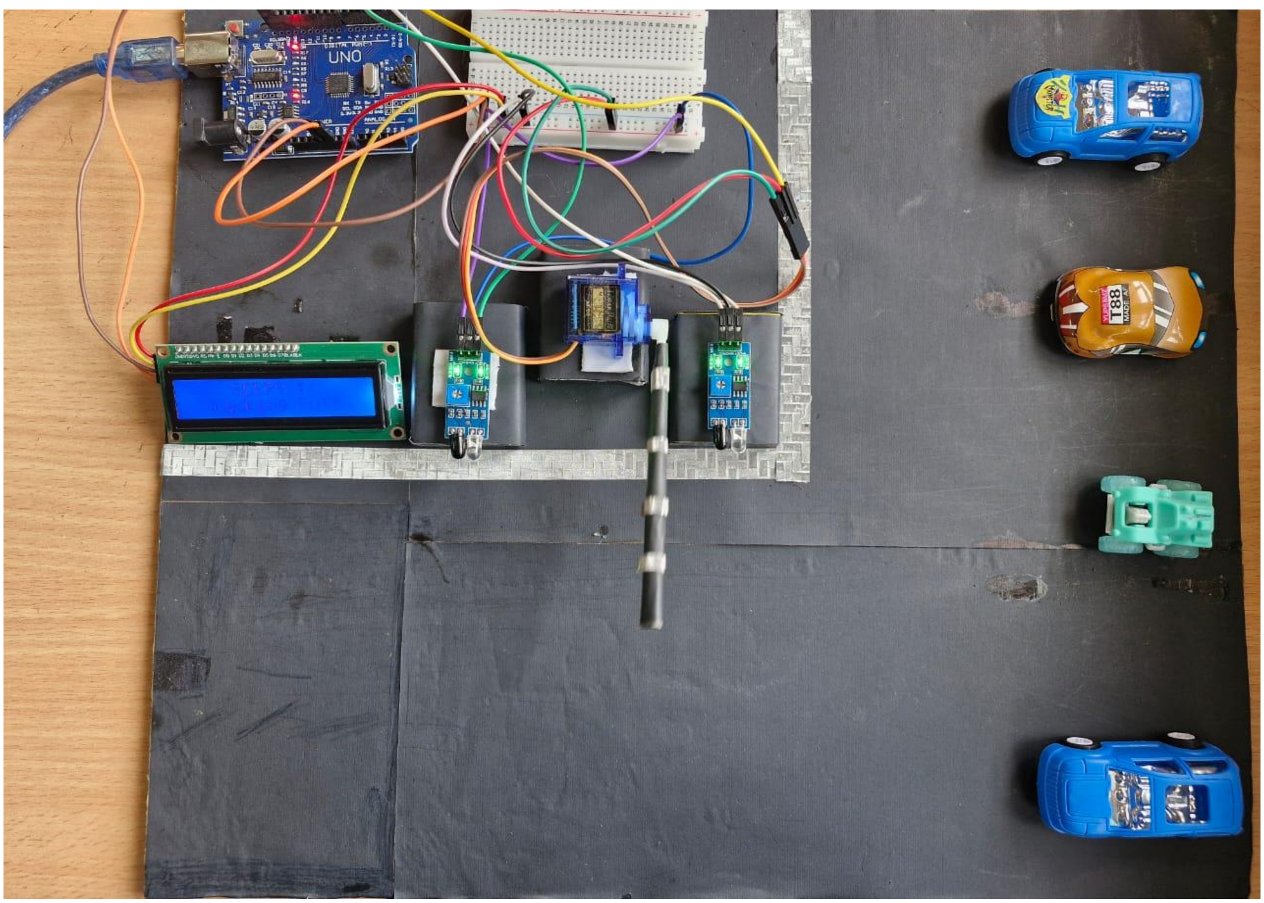


Figure 5



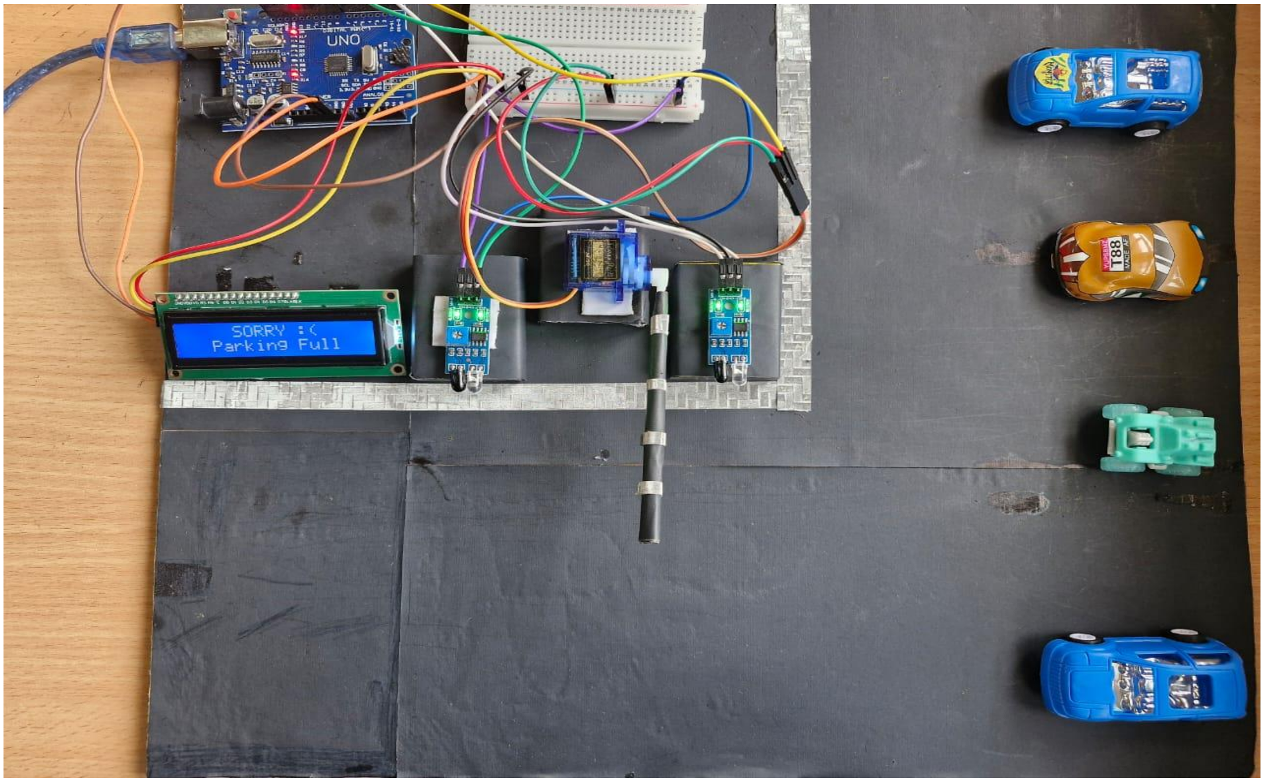


Figure 6

CHAPTER 4
CONCLUSION AND FUTURE WORK

The implementation of a smart car parking system using Arduino microcontrollers, infrared (IR) sensors, LCD displays, and servomotors has shown promising results in addressing the inefficiencies of traditional parking management. This system provides real-time monitoring of parking slot availability, dynamically updates information for drivers, and automates access control, thereby reducing search time for parking spaces, easing traffic congestion, and optimizing space utilization. The integration of IoT components has created an efficient, scalable, and user friendly solution that enhances the overall parking experience and contributes to smarter urban infrastructure. Looking ahead, the system can be further refined and expanded in several ways. Integrating a mobile application could allow drivers to check real-time parking availability remotely and reserve spots in advance. Enhanced sensor technologies, such as ultrasonic or camera based systems, could improve detection accuracy. Data analytics and machine learning could predict parking patterns and optimize slot allocation. Scaling the system to accommodate larger and multi-level facilities, integrating automated payment systems, and incorporating energy efficient or renewable energy sources would further enhance the system's functionality. Adding security features like license plate recognition and developing centralized dashboards for remote monitoring and management could significantly improve security and operational efficiency. Vehicle guidance systems with dynamic signage could assist drivers in navigating to available slots more efficiently. These future developments will transform the smart parking system into a more comprehensive and intelligent solution, further improving urban mobility and contributing to the development of smarter, more sustainable cities.

APPENDIX I

Source code

write_detail.py

```
import RPi.GPIO as GPIO

from mfrc522 import SimpleMFRC522
reader = SimpleMFRC522()
try:
 studid = input ("sid :")
 reader.write(studid)
 print ("Remove card")
finally:
 GPIO.cleanup()
```

read_user.py

```
import RPi.GPIO as GPIO
from mfrc522 import SimpleMFRC522
from datetime import datetime
def attendance():
 reader = SimpleMFRC522()
 print ("Place card")
 try:
 studid = reader.read()
 print ("Remove card")
 finally:
 GPIO.cleanup()
 return studid
def gettime():
 now = datetime.now()
```

```
 time = now.strftime("%d/%m/%Y %H:%M:%S")
 return time
```

firebase.py

```
import pyrebase
from read_user import attendance
from read_user import gettime


config = {
 "apiKey": "AIzaSyD-08Q9dtetWvqmKTPPE0HLmF04s5jDW94",
"authDomain": "sas-rfid.firebaseapp.com",
 "databaseURL": "https://sas-rfid-default-rtdb.asia-southeast1.firebasedatab>
"projectId": "sas-rfid",
 "storageBucket": "sas-rfid.appspot.com",
 "messagingSenderId": "418323613946",
 "appId": "1:418323613946:web:d3fe32333b980b7868a143",
"measurementId": "G-YCDL3Z0640"
 }

firebase = pyrebase.initialize_app(config)

storage = firebase.storage()
database = firebase.database()
sid = attendance()
time = gettime()

s = database.child("Attendance").child(sid[0])
od = s.get().val()

if od is None:
 data = {"sid": sid[1],"time": time, "status":"in" }
elif (list(od.values())[1] == "out"):
 data = {"sid": sid[1],"time": time, "status":"in" }
else:
 data = {"sid": sid[1],"time": time, "status":"out"}

database.child("Attendance").child(sid[0]).set(data)
```

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