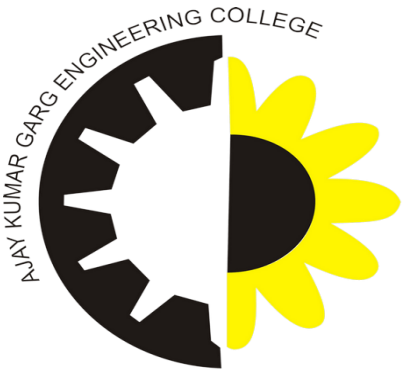
AJAY KUMAR GARG ENGINEERING COLLEGE, GHAZIABAD



DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

A project report on

"Smart Parking System"

Under the guidance of,

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MINI PROJECT CERTIFICATE

This is to certify that ANUJ AGARWAL student of AJAY KUMAR GARG ENGINEERING COLLEGE B. Tech IIrd year ECE branch, has completed Mini Project on SMART PARKING SYSTEM in the duration 10th September 2022 to 24th JANUARY 2023.

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Ms. SULEKHA SAXENA

Assoc Professor

Dept. of ECE, AKGEC

DECLARATION

We, the students of ELECTRONICS AND COMMUNICATION ENGINEERING, AJAY KUMAR GARG ENGINEERING COLLEGE, GHAZIABAD declare that the work entitled " SMART PARKING SYSTEM " has been successfully completed under the guidance of Asst Prof. Ms. SULEKHA SAXENA, ELECTRONICS AND COMMUNICATION Engineering Department, AJAY KUMAR GARG ENGINEERING COLLEGE, GHAZIABAD. This dissertation work is submitted in fulfilment of the requirements for the MINI PROJECT during the academic year 2022-2023.

ABSTRACT

We propose a new “SMART PARKING” system for an urban environment. The system assigns and reserves an optimal parking space for a driver based on the user's requirements that combine proximity to destination and parking cost, while also ensuring that the overall parking capacity is efficiently utilized. Our approach solves a Mixed Integer Linear Program (MILP) problem at each decision point in a time-driven sequence. The solution of each MILP is an optimal allocation based on current state information and subject to random events such as new user requests or parking spaces becoming available. The allocation is updated at the next decision point ensuring that there is no resource reservation conflict and that no user is ever assigned a resource with higher than the current cost function value. Implementation issues including parking detection, reservation guarantee and Vehicle-to-Infrastructure (V2I) or Infrastructure-to-Vehicle (I2 V) communication are resolved in the paper. Our system can save driver time, fuel and expense, while reducing the traffic congestion and environment pollution.

ACKNOWLEDGEMENT

I would like to express my deepest thanks to Ms SULEKHA SAXENA, our mini project advisor, for his cooperative attitude and consistent guidance, due to which I was able to complete my project successfully.

I would like to express my sincere gratitude to Dr P.K CHOPRA (H.O.D. ECE Department), Ajay Kumar Garg Engineering College, Ghaziabad and Dr R. K. Aggarwal (Director General), Ajay Kumar Garg Engineering College for allowing me to pursue my choice of project. They gave me valuable guidance and support.

I wish to thank various people in my college, Ajay Kumar Garg Engineering College, for their valuable guidance. I received practical as well as theoretical knowledge and experience in this project. Finally, last but by no means least, a paper is not enough for me to express the support and guidance I received from them.

ANUJ AGARWAL

2rd Year ECE

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CHAPTER 1: INTRODUCTION

In smart cities, there is a greater need for new and effective technology to tackle many of the problems that are visible on the surface, as well as to make cities less crowded. Finding a parking spot is one of the most aggravating issues for drivers. Particularly in public venues such as shopping malls, 5-star hotels, and multiplex cinema halls. Even within the park, drivers waste time and fuel hunting for a spot to park their cars. This will damage the driver's emotions as well as pollute the environment while searching for a parking spot. In this study, we create and design a smart parking system that effectively addresses these issues. Many research has been conducted in recent years with the goal of reducing car parking issues and making it more convenient and humane. It has recommended a smart parking system survey. They concentrate on practical smart parking technologies developed to address existing issues through the use of a wireless sensor network and real-time data processing from the sensors. The system appears to be unfixable and employs a complicated access technology; additionally, there is no guidance mechanism for parking places. The Arduino Uno is used to create a smart car parking system. The device uses IR sensors mounted in the parking slots to detect empty slots and assists the driver in finding parking in a new city. The system lacks a payment mechanism as well as guide technology that can automatically find available parking spaces. The goal of the smart auto parking initiative is to make parking simple and straightforward. This project assists car drivers in parking their vehicles with the least amount of wasted time by providing reliable information on the availability of parking spaces. The servo motors, LCD display, and IR sensor are all connected to an Arduino Uno microcontroller unit. The LCD shows how much space is available, and the IR sensors keep track of how many automobiles enter and exit the parking place. The IR sensors identify whether or not a parking place is available.

BACKGROUND THEORY:

Currently, the majority of current parking lots lack a well-organized framework. The majority of them are run by hand and are inefficient. The issue that constantly arises in the car park is the time spent looking for available parking spaces. Users will continue to circle the parking lot until they find a vacant spot. This problem is most common in urban locations, where the number of automobiles exceeds the number of parking places available. These ineffective situations occurred as a result of a lack of implementation in already accessible technologies. To provide space for car drivers, many local car parks are now developed inside retail malls or multipurpose buildings. Because it is user-friendly and prevents cars from being exposed to the sun, parking within a structure is becoming increasingly popular in many shopping malls. This sort of parking lot typically has a parking guidance system that primarily relies on the usage of message signs to notify drivers about parking availability inside the lot. The availability of a parking lot within a car park is typically determined by sensors that measure the number of automobiles entering and exiting the parking lot, or, in other situations, by comparing the tickets issued by machines. On the display board at the car park's entrance, this information about parking lot availability is often expressed in terms of full or empty the actual number of parking spaces available within a parking garage is rarely provided. Hundreds of cars enter the parking lot every day, hoping for an empty parking spot. As a result, finding an empty parking space is tough. Car drivers still have to find an empty parking spot in most local parking lots. They will undoubtedly waste slot time looking for empty parking slots if they don't know where they are, especially if each row of parking slots only has a few empty parking spaces. As a result, having an effective empty parking slot tracking system that displays vacant space availability at each row of parking slots and directs automobile drivers there is critical. The development of this project prototype can operate as a way-finder, directing automobile drivers inside the car park to available parking slots and directing them there. It's a project that uses an Arduino microcontroller. It employs an infrared sensor to detect the vacancy of each parking space at a car park level, then sends a wireless signal to a microprocessor, which processes and shows the total number of available parking slots on 16x2 LCD displays. The project's main goal is to figure out the best way to direct drivers and vehicle users to a free parking lot in a short amount of time.

CHAPTER 2: PROBLEM STATEMENT

Finding Vacant Spaces Is Difficult, finding an empty place in a multilevel parking garage quickly is difficult, if not impossible, especially on weekends or during public events. For almost 66 percent of customers, finding places at the end of the week or during open events can take more than 10 minutes. At peak times, stadiums and shopping centres are swamped, and clients have a difficult time finding empty spaces in these locations. Inadequate automobile parking spaces cause activities to be stifled and drivers to be dissatisfied. We can get around this by utilising Smart Parking Assistance

As the cost of gasoline continues to rise, drivers will do all possible to conserve energy in their vehicles. They must wait a long time at the entrance gate during busy hours before finding an empty parking space. As a result, users will waste time and energy looking for a spare area. Last but not least, the main problem with the parking system is the lack of available parking places. This could be due to developers' poor planning of the areas. Aside from that, the user-friendly system lacked useful information.

When the parking bay is at its busiest, the user will seek the same location for a parking place several times before finding it, if they are lucky. The car park operator did not always post a notice that the area was filled and there was no more parking available.

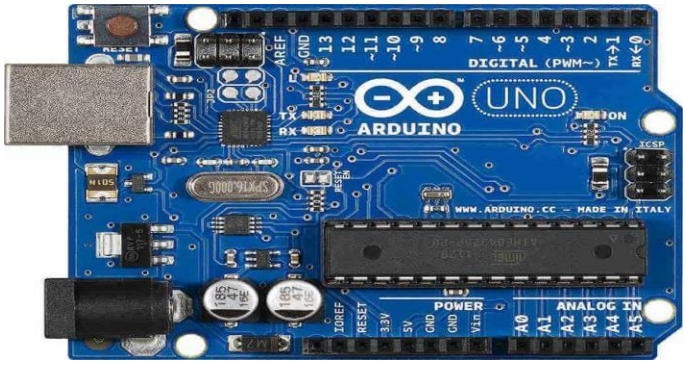
CHAPTER 3: SOFTWARE & HARDWARE REQUIREMENT

COMPONENTS:

1) **Arduino:**

The Arduino Uno is an open-source microcontroller board designed by Arduino.cc and based on the Microchip ATmega328P microprocessor. The board includes digital and analogue input/output (I/O) pins that can be used to connect to expansion boards (shields) and other circuits.

The board features 14 digital I/O pins (six of which are capable of PWM output), 6 analogue I/O pins, and is programmable through a type B USB cable using the Arduino IDE (Integrated Development Environment). It can be powered by a USB cable or an external 9-volt battery, with voltages ranging from 7 to 20 volts. It's similar to the Arduino Nano and Leonardo microcontrollers the hardware reference design is available on the Arduino website under a Creative Commons Attribution Share-Alike 2.5 licence. Some versions of the hardware have layout and manufacturing files available as well. The Italian word "uno" means "one" and was chosen to represent the first release of Arduino Software. The Arduino Uno board is the first in a series of USB-based Arduino boards; it, along with version 1.0 of the Arduino IDE, served as the standard version of Arduino, which has since been superseded by newer releases.



1) **IR Sensor:**

An infrared (IR) sensor is a type of electrical gadget that detects and measures infrared radiation in its surroundings. In the year 1800, an astronomer named William Herchel made an unintentional discovery of infrared light. He found that the temperature just beyond the red light was the highest while measuring the temperature of each hue of light (separated by a prism). Because its wavelength is longer than visible light (though it is still on the same electromagnetic spectrum), IR is invisible to the naked eye. Infrared radiation is emitted by anything that emits heat (anything that has a temperature).

Infrared sensors are divided into two categories: active and passive. Infrared radiation is emitted and detected by active infrared sensors. A light emitting diode (LED) and a receiver make up active infrared sensors. When an object approaches the sensor, the LED's infrared light reflects off of it and is recognised by the receiver. Active infrared sensors are often utilised in obstacle detection systems as proximity sensors (such as in robots).

2) Servo motor:

A servomotor is a linear or rotatory actuator that permits exact control of angular or linear position, velocity, and acceleration. It is made comprised of an appropriate motor and a position feedback sensor. It also necessitates a complex controller, which is frequently a separate module created exclusively for servomotors. Although the term servomotor is typically used to refer to a motor appropriate for use in a closed loop control system, it is not a specific type of motor. Stepper motors have some inherent capacity to regulate position, as they have built-in output steps. Servomotors are often employed as a high-performance alternative to the Because their driving signal specifies the number of steps of movement to rotate, they may often be utilised as an open-loop position control without the necessity of a feedback encoder.

However, the controller must 'know' the position of the stepper motor on power up in order to do so. As a result, when the controller initially turns on, it must activate the stepper motor and turn it to a known point, such as until an end limit switch is activated. When an inkjet printer is turned on, the controller will shift the ink jet carrier to the far left and far right to set the end locations. Regardless of the original position at power up, a servomotor will instantaneously pivot to whatever angle the controller commands position, such as until an end limit switch is activated. When an inkjet printer is turned on, the controller will shift the ink jet carrier to the far left and far right to set the end locations. Regardless of the original position at power up, a servomotor will instantaneously pivot to whatever angle the controller commands. A stepper motor's performance is limited by its lack of feedback, as it can only drive a load that is well within its capacity; otherwise, skipped steps under load might cause positioning issues, requiring the system to be restarted or recalibrated.

The encoder and controller of a servomotor are an extra cost, but they improve the total system's performance (in terms of speed, power, and accuracy) in comparison to the basic motor's capabilities. Servomotors offer an advantage in larger systems, where a powerful motor represents a rising fraction of the total cost. Closed loop stepper motors have been increasingly common in recent years.] They function similarly to

servomotors; however, their software control differs in order to achieve smooth motion. The biggest advantage of a closed loop stepper motor is its low price. A closed loop stepper system also eliminates the need for tuning. Many applications, such as laser cutting machines, may be supplied in two price ranges: a low-cost stepper motor range and a high-performance servomotor range.

3) Soldering Iron:

A soldering iron is a **hand tool used to heat solder**, usually from an electrical supply at high temperatures above the melting point of the metal alloy. This allows for the solder to flow between the workpieces needing to be joined. This soldering tool is made up of an insulated handle and a heated pointed metal iron tip.

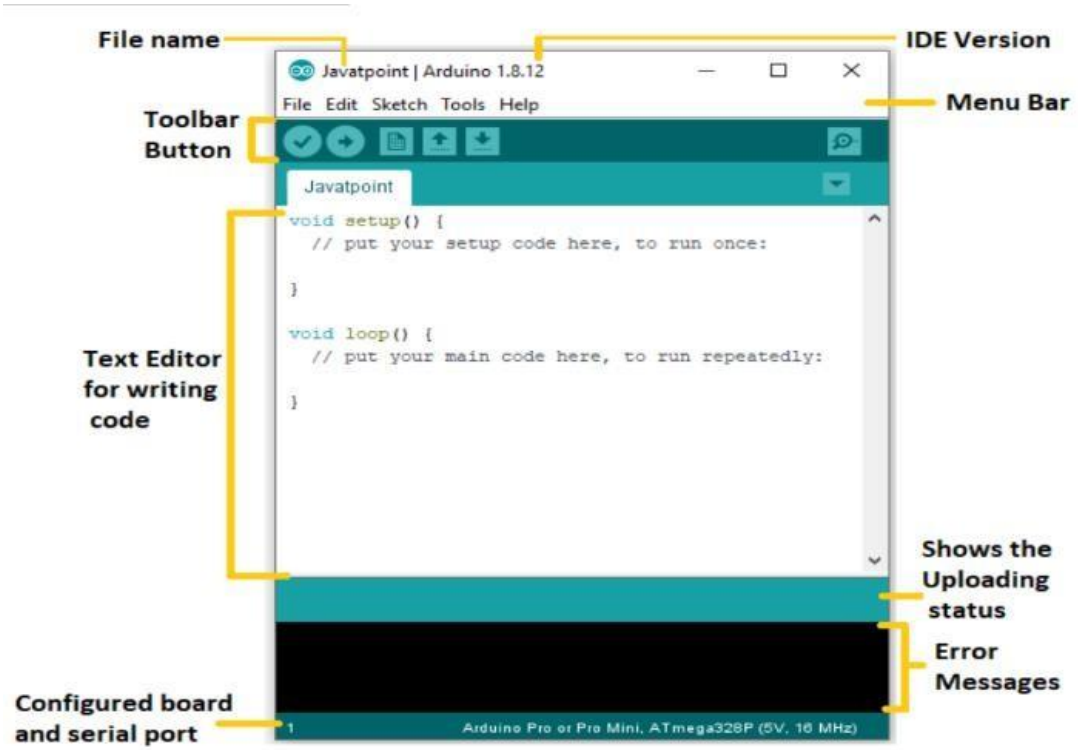
4) LCD Display:

A liquid crystal display, or LCD, gets its name from its definition. It is made up of two different states of matter: solid and liquid. A liquid crystal is used to create a visible image on an LCD. Liquid crystal displays (LCDs) are ultra-thin display screens that are commonly seen in laptop computers, televisions, cell phones, and portable video games. When opposed to cathode ray tube (CRT) technology, LCD technology allows for significantly thinner displays. Two polarised panel filters and electrodes are among the components that make up a liquid crystal display. LCD technology is utilised in notebooks and other electronic devices such as small computers to display images. A lens projects light onto a layer of liquid crystal.

Rather than emitting light, the liquid crystal display screen works on the idea of blocking light. Because LCDs do not emit light, they require a backlight. We constantly utilise devices with LCD displays, which have replaced the use of cathode ray tubes. In comparison to LCDs, cathode ray tubes consume more energy and are also heavier and larger.

5) Arduino Ide:

The Arduino IDE is an open-source software, which is used to write and upload code to the Arduino boards. The IDE application is suitable for different operating systems such as **Windows, Mac OS X, and Linux**. It supports the programming languages C and C++. Here, IDE stands for **Integrated Development Environment**. The program or code written in the Arduino IDE is often called as sketching. We need to connect the Genuine and Arduino board with the IDE to upload the sketch written in the Arduino IDE software. The sketch is saved with the extension '. ino.' The Arduino IDE will appear as:



6) PCF8574T I2C:

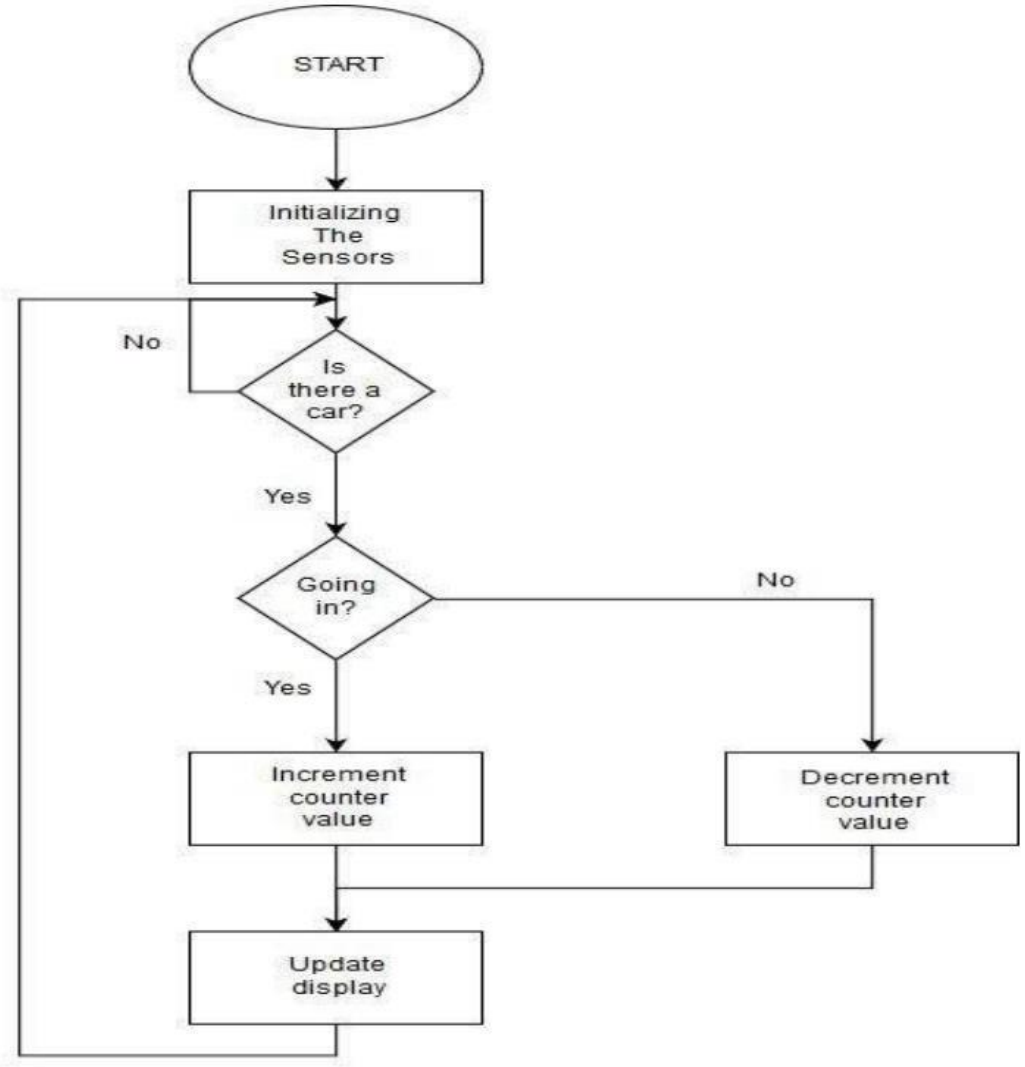
The PCF8574T/3,518 is a 8-bit remote I/O Expander for I²C-bus with interrupt. It provides general-purpose remote I/O expansion via the two-wire bidirectional I²C-bus (serial clock (SCL), serial data (SDA)). The devices consist of eight quasi-bidirectional ports, 100KHz I²C-bus interface, three hardware address inputs and interrupt output operating between 2.5 and 6V. The quasi-bidirectional port can be independently assigned as an input to monitor interrupt status or keypads or as an output to activate indicator devices such as LEDs. The low current consumption of 2.5µA (typical, static) is great for mobile applications and the latched output ports directly drive LEDs.

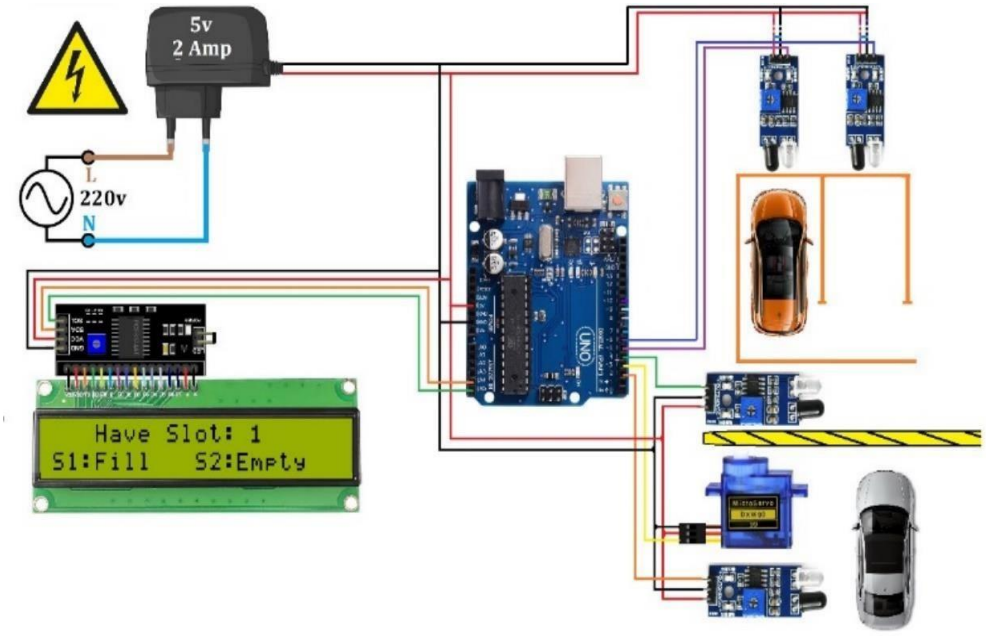
The I2C-bus allows easy two-line communication between two devices using a serial data line (SDA) and a serial clock line (SCL) and, as a result, is a popular choice for computing, consumer electronics, communication, and industrial systems. I2C-Bus GPIO Expander Application Example.

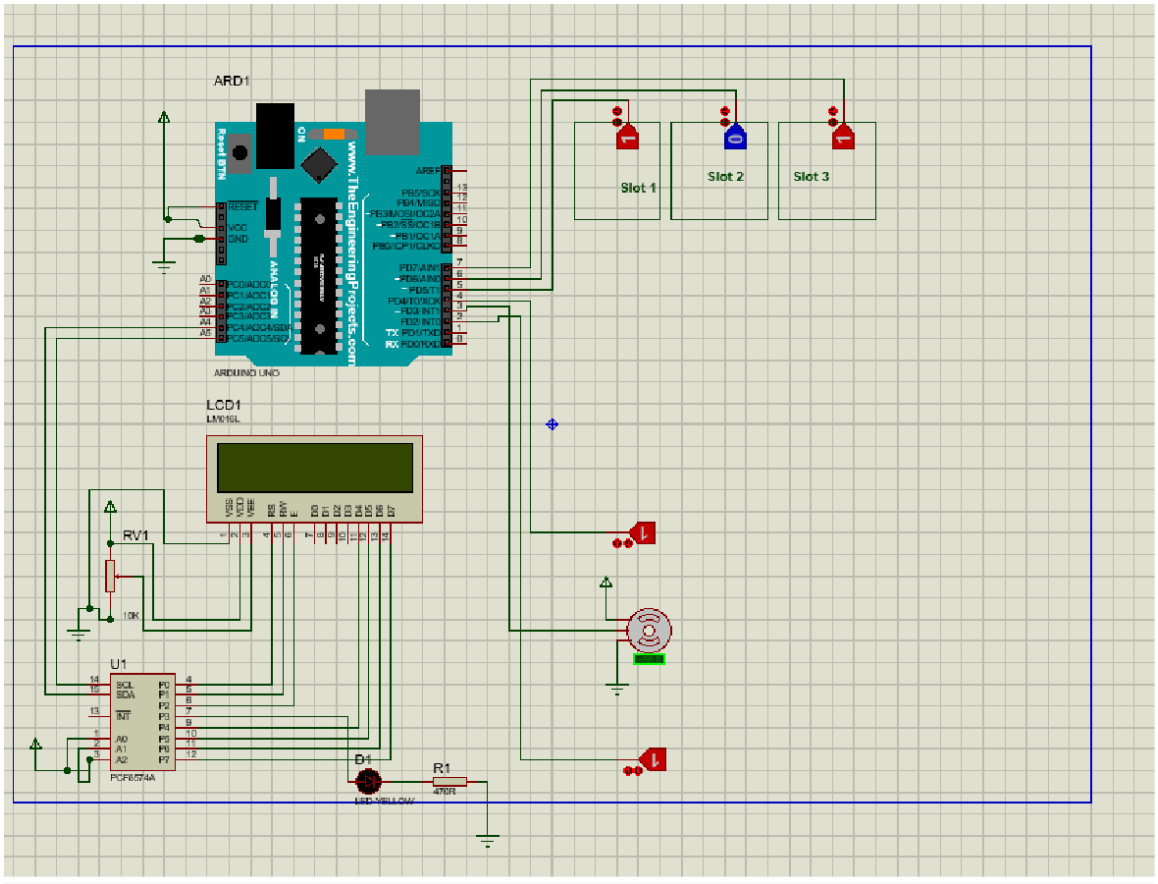
CHAPTER 4: DESIGN IMPLEMENTATION

The microcontroller Arduino UNO is utilised. The Arduino digital pins are connected to the infrared sensors. The entry IR sensor delivers a signal to Arduino, which sends a command to operate the motor when a vehicle approaches the entry gate. The motor functions as a checkpoint/gate, allowing or disallowing actions based on the presence of a car detected. The total number of parking spaces available has already been determined. The vehicle is detected by both IR sensors when it enters the parking area. If the IR sensor-1 (outside the check post) detects the vehicle first, it means the vehicle is entering the parking area, and the number of total parking slots available will be reduced by one unit. If the IR sensor-2 (inside the check post) detects the vehicle first, the number of total parking slots available will be increased by one unit. The motor continuously opening and shutting the check post based on the vehicle detection. To keep track of available parking slots, we need to make sure that all of the parking lots are filled in a specific order, rather than parking randomly.

FLOWCHART:




5v
2 Amp
L
220v
N
Have Slot: 1
S1:Fill S2:Empty

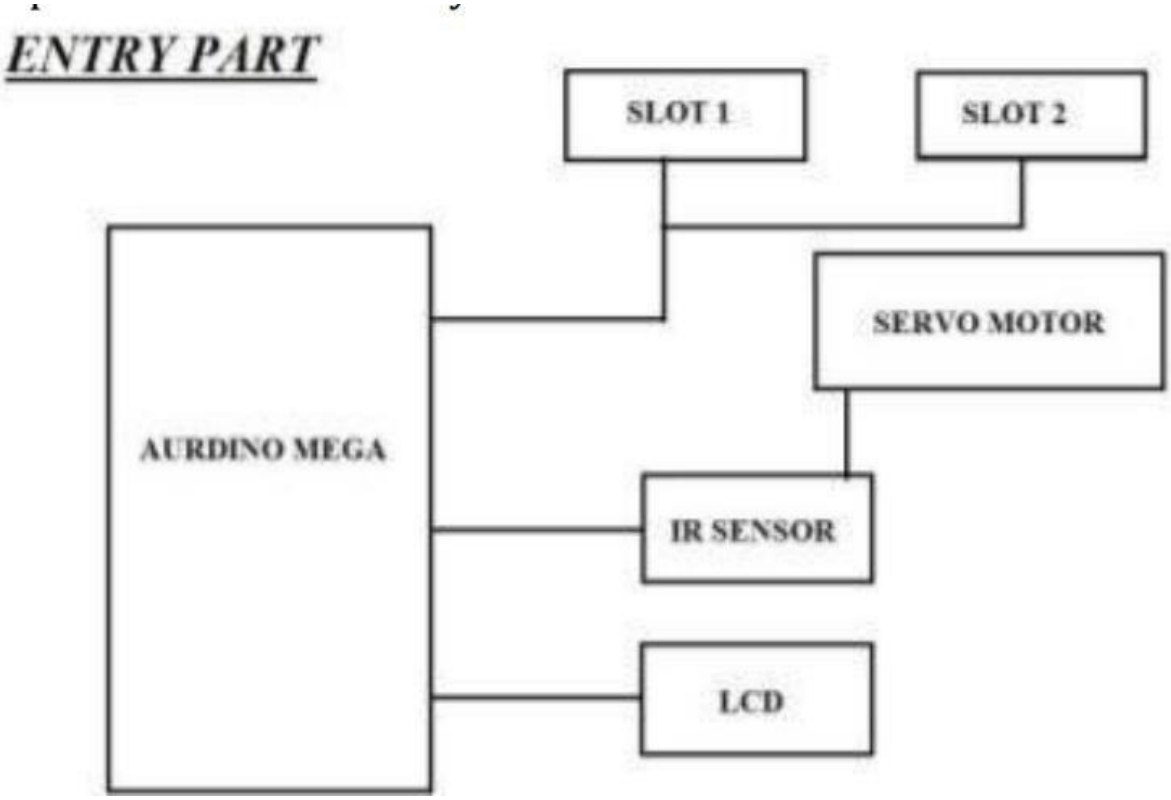

ARD1
ARDUINO UNO
LCD1
LM016L
RV1
10K
U1
PCF8574A
D1
LED-YELLOW
R1
470R
Slot 1
Slot 2
Slot 3

CHAPTER 4: WORKING

The project is divided into two sections for construction and operation: -

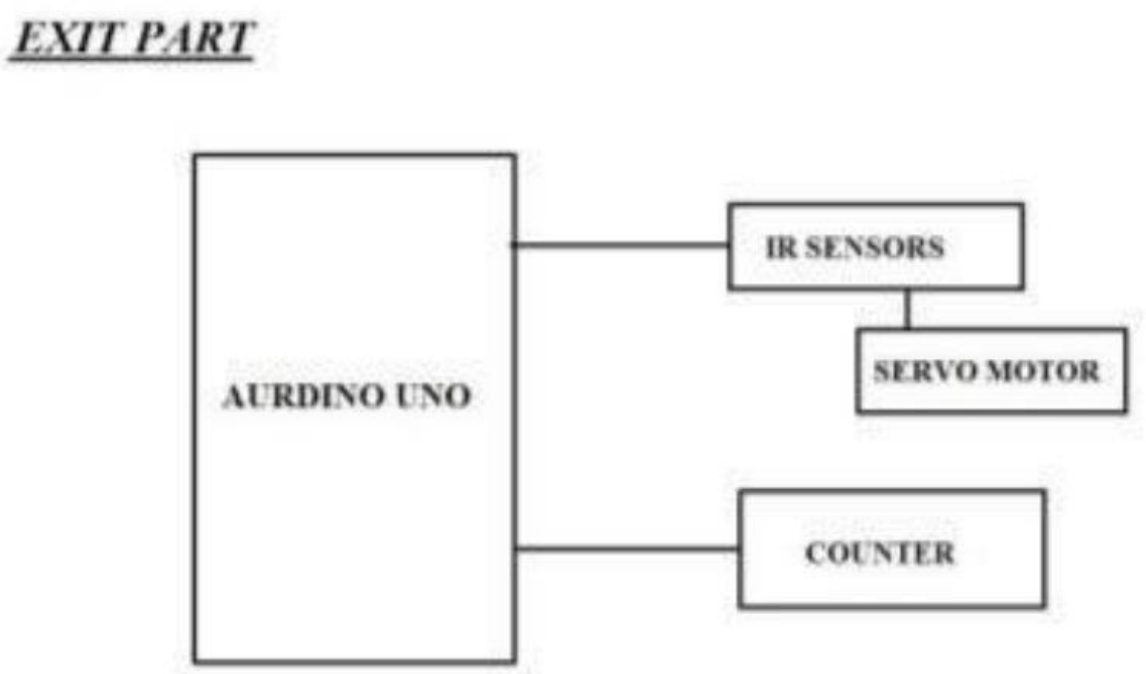
Entry part:

The Submission A servo motor, IR sensor, LCD, and ultrasonic sensor are all connected to an Arduino Mega microcontroller as part of the project. When the IR sensor detects the presence of a car, the servo motor operates as a gate at the entrance, opening and closing. The parking places that are available for car drivers are displayed on the LCD. The presence is detected by the infrared sensors.



Exit part:

The Exit Part of the project consists of Arduino Uno to which a servo motors, IR sensor and the object counter are interfaced. The servo motor acts as a gate at the entrance and it opens and closes when the IR sensor detects presence of car. The object counter circuit is designed using IC 555 and IC 4026 to count the number of cars exiting the parking space. This will help the operator to calculate the amount collected.



CHAPTER 4: RESULT AND DISCUSSION

The smart Car Parking Management System with IR sensor was able to identify the presence or absence of a car, show the availability status of parking slots, and save the IR sensor data into a database. Furthermore, the suggested parking system has the advantage of being able to show the user the actual position of a parking place. According to the findings, the proposed car parking system with IR sensor was a good idea and a great system to develop, and it indicates that the respondents positively accepted the proposed parking system in order to minimise and reduce the problem of vehicle parking, particularly the time spent looking for available parking spaces.

CHAPTER 5: CONCLUSION

The Internet of Things (IoT) was the key concept used to construct the proposed parking system employing an infrared sensor, and this study proposes an effective way for identifying a parking space. The IoT-based Car Parking Management System with IR Sensor was created as a prototype to help drivers locate a vacant or available parking spot. This parking system presented employed an infrared sensor to detect the presence and absence of a car in order to determine the state of a parking slot's availability.

The parking places are continuously monitored, and the data on the LCD screen is updated on a regular basis. The LCD screen shows the exact location of the parking slot availability status. In the meantime, the data from the infrared sensor is also saved in the database. The suggested parking system's prototype was designed for a single storage parking space, but the concept can be expanded to accommodate several storage spaces. In addition, for administrative purposes, a car parking management system interface was created to record the state of a parking spot as well as the precise time a car enters or quits a parking slot. The proposed parking system's conclusion is beneficial for implementing in any parking zone region to assist drivers in finding a vacant parking spot quickly

Furthermore, the proposed parking system was evaluated utilising a user acceptance test to determine public acceptance of the proposed parking system. The majority of respondents thought the proposed parking system with IR sensor was a wonderful concept and that developing a parking system that can help cars find a vacant parking spot quickly was a terrific idea. As a result, it provides convenience to users by allowing them to save time, energy, and fuel. This work might be expanded by creating a mobile app that allows users to navigate, identify, and reserve a parking spot online.