INTERNET OF THINGS -GROUP 4

SMART PARKING

PHASE-5

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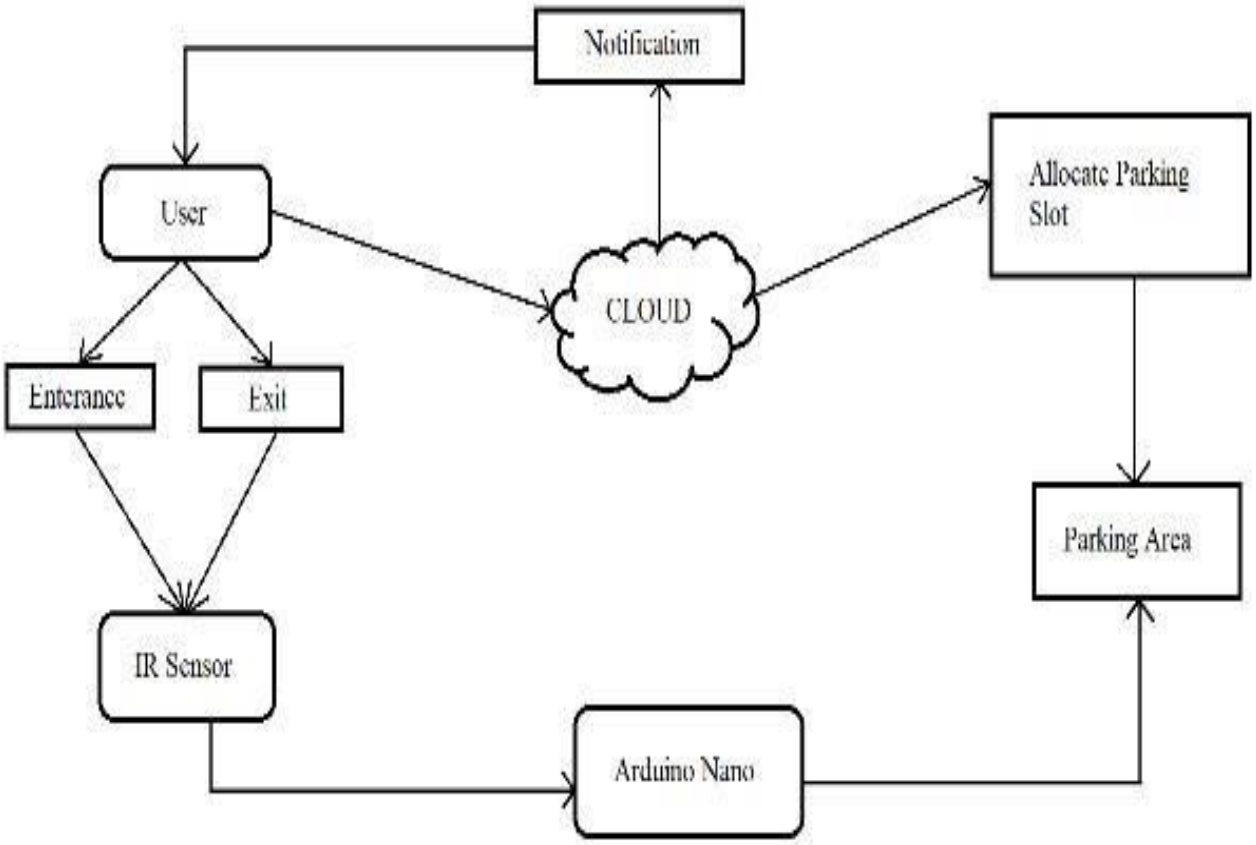
SYSTEM ARCHITECTURE

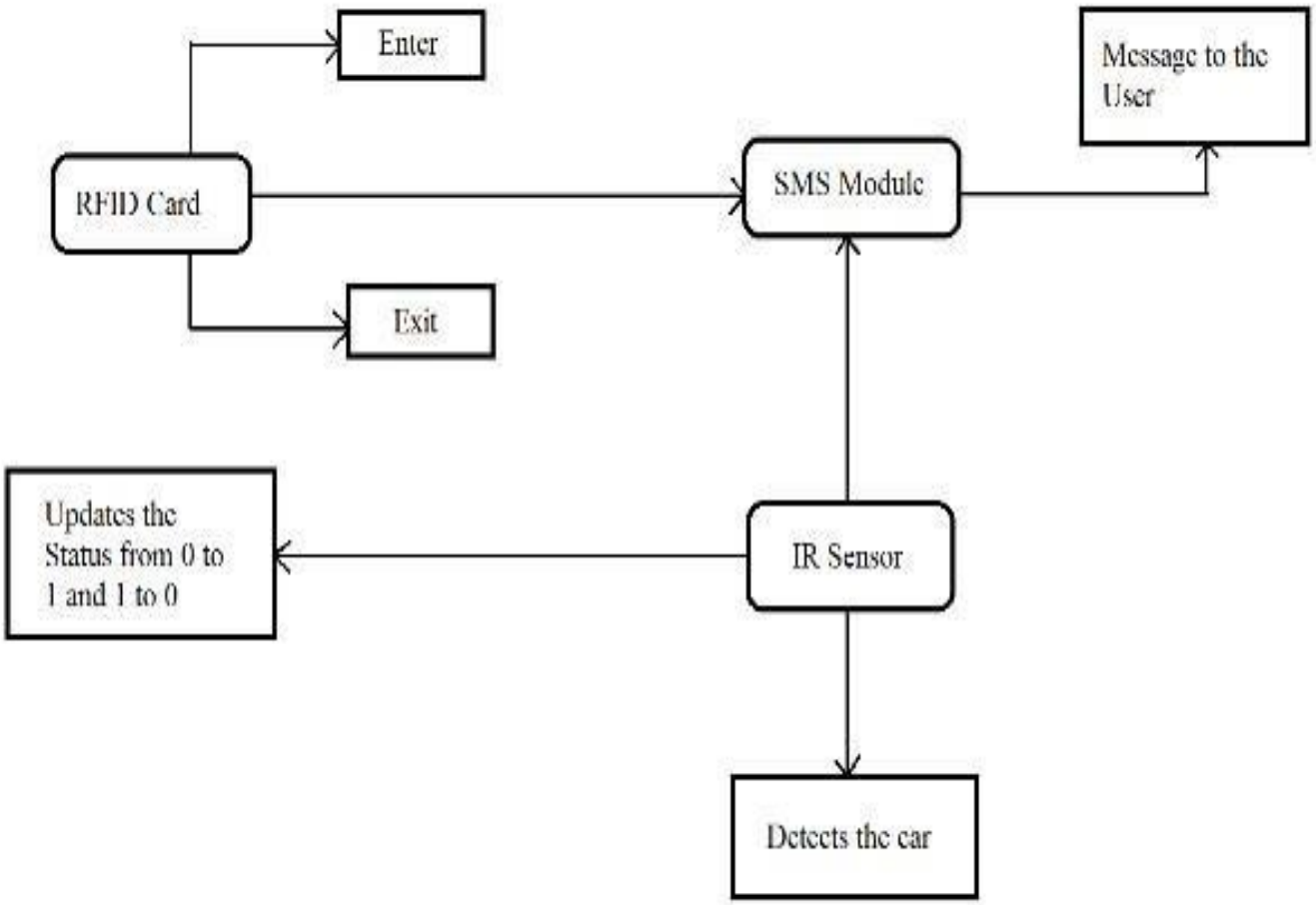
A. Proposed System

It consists of three sections: first section is the parking area which includes Arduino devices along with IR sensor. The user interacts with the parking area with the help of these devices. The user cannot enter the parking area without the help of RFID card. The second section contains the cloud-based web services which acts a mediator between the user and parking area. The cloud is updated depending upon the availability of the parking area. The admin administers the cloud services and it can also be viewed by the user for checking the availability. The third section is the user side. The user gets notification on the basis of the availability via SMS through GSM module.



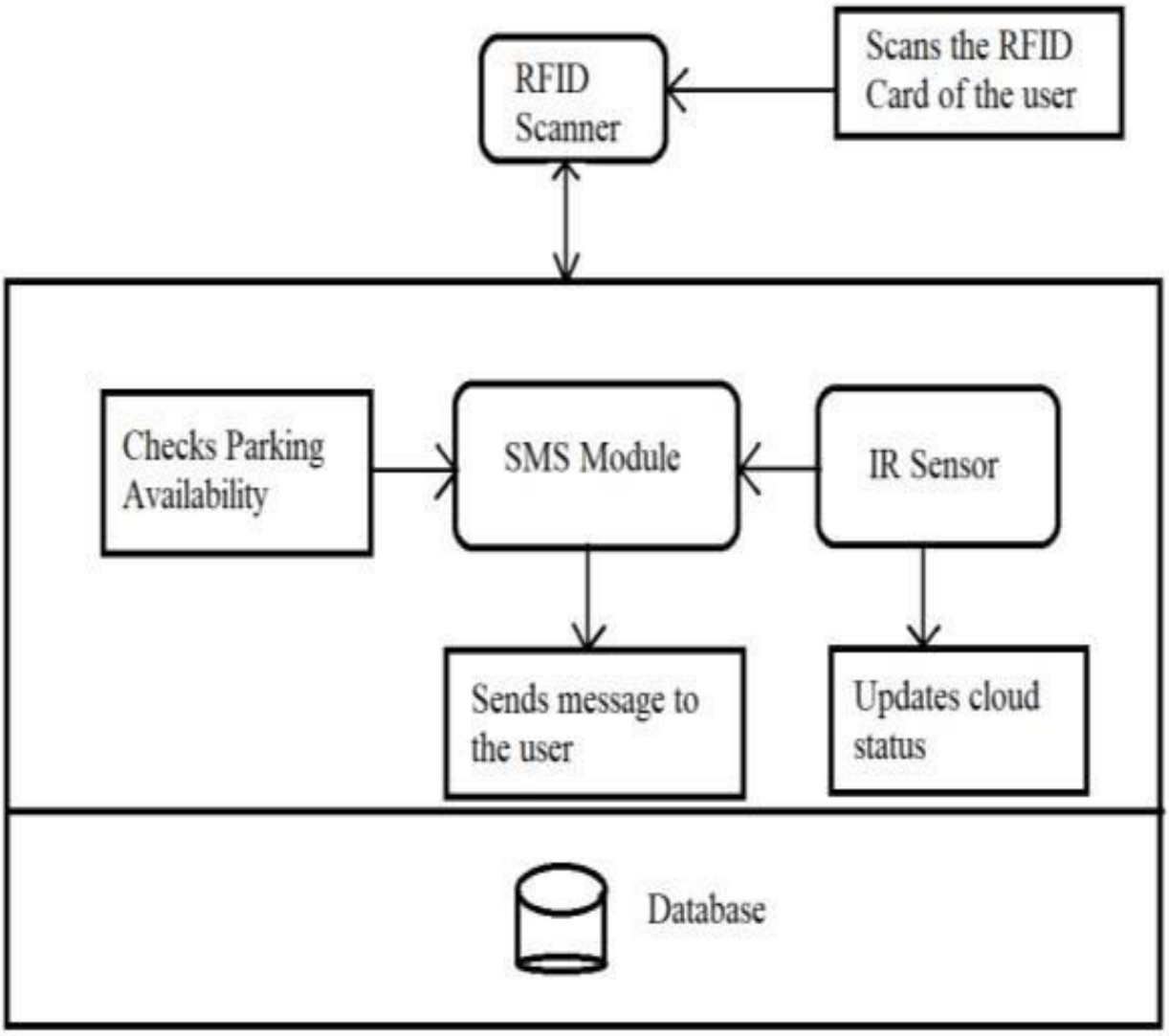
B. Hardware

The three main hardware components used are GMS module, RFID card, IR sensors. A user is allowed inside a parking space only if the user has a RFID card. RFID card contains the information of the registered user. As the car enters the parking slot, reader module scans the registered user's RFID tag. The data is sent to the ardunio for checking the availability of the car parking and simultaneously, the user is notified through SMS about the status of the parking area. The GSM module sends the message according to the availability. IR sensor sends the signals according to the presence of the vehicle.



C. Software

The cloud server acts as a mediator between the modules. The cloud server is connected to the Wi-Fi module. The user receives messagesthrough the SMS module while the car enters and exits the parking area using RFID card. The messages sent by the SMS module are managed by the cloud. As soon as the IR sensor detects the car, the status of the cloud will be updated from 0 to 1 and when the car leaves the parking area the status of the car will be updated from 0 to 1.



DETAILS OF THE MODULE

A. GSM Module

The GSM module is a circuit which is used to setup communication between mobile phones and microcontroller. It is used to send SMS, MMS and voice messages through mobile network. GPRS extension in GSM allows high data transmission. GSM uses time division multiple access approach for transmission.

C. RFID Card

RFID tags are made up of integrated circuit (IC), an antenna, and a substrate. It is an identification badge or credit card that transfers its contents about an object to the reader module. RFID tag transfers data about an object through radio waves.When RFID tags are attached to devices they can also be used for tracking.

D. READER Module

This module is a device which scans and gathers the information from the RFID Card. This card can be used to track objects. As the car enters the parking area, the user scans the RFID card and all the information stored in card is transferred to the admin through this module.

E. Servo Motor

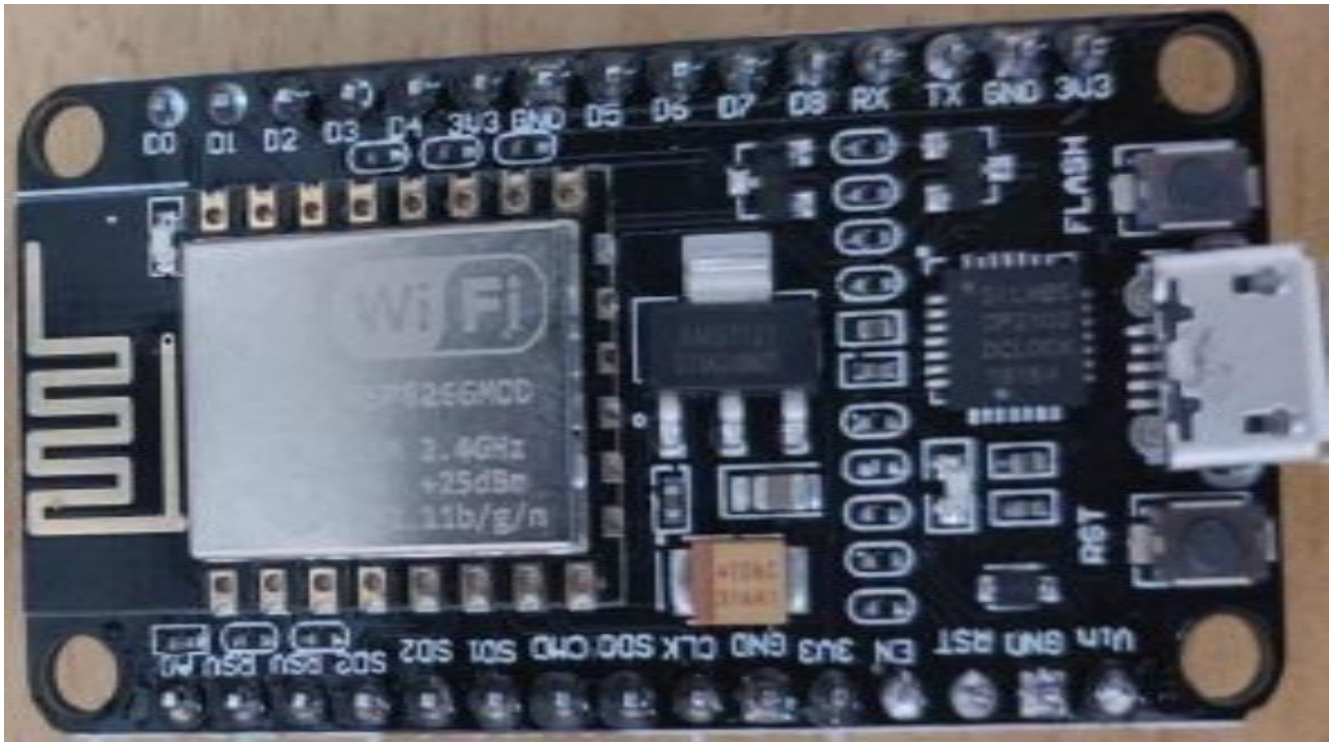
It is a rotator device that allows the control of angular as well as linear motion. A servo motor is used for the opening and closing of the gate.Servo drivetransmits electrical signals to the servo motor for producing motion.

F. Arduino Nano

It is a compact board which can be used in various devices and various field. It has overall 22 input/output pins out of which 14 pins are digital pins. It has a flash memory of about 32 kb. These pins can control the operations of digital pins as well as analogy pins. This module is a breadboard-friendly board which can be easily used anywhere.

G. WIFI Module

It is used to send data from embedded system to the internet using URL by HTTP POST method using TCP/IP protocol. It is developed by espressif systems. It is a 32 bit microcontroller with 80kb user data. It contains 16 gpio pins.


D0 D1 D2 D3 D4 3V3 GND D5 D6 D7 D8 RX TX GND 3V3
FLASH
RST
3.4GHz
+25dBm
11b/g/n

ArduinoProperties, Schematic Diagram, and Power

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.

Specifications and Features of Arduino Mega 2560

Some of the detailed technical specification is mentioned below:- • Operating voltage of 5 V.

• 16 MHz clock speed.

• The number of digital I/O's pins is 54.

• The number of analog input pins is 16.

• 4 hardware serial ports.

• Flash Memory: 32 KB

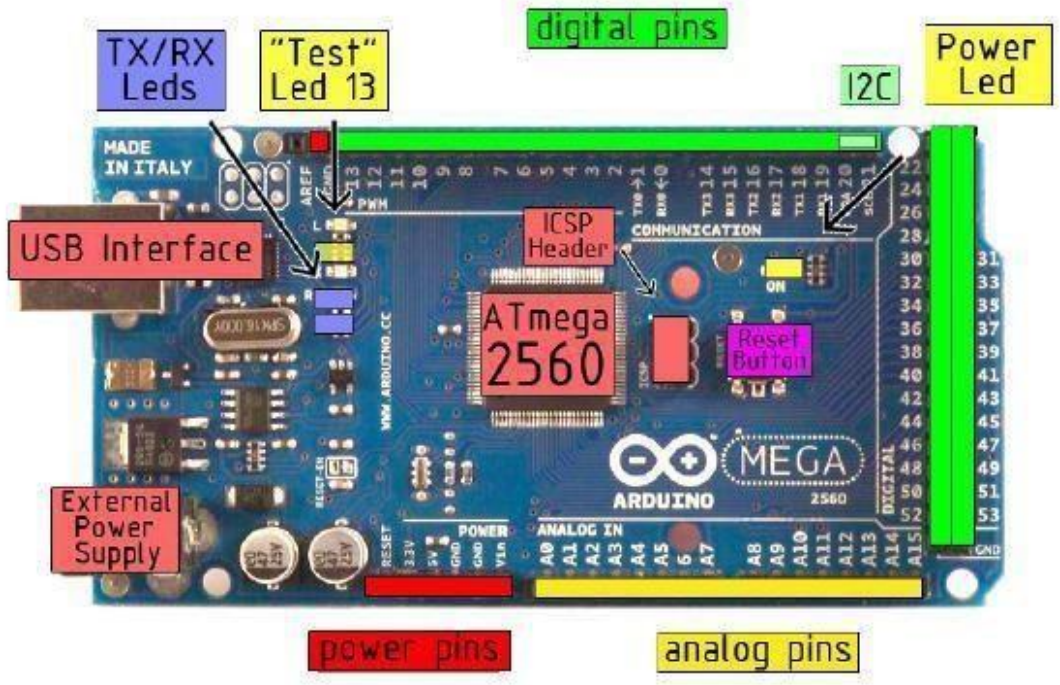
• SRAM: 2 KB

• EPROM: 1 KB

• Clock Speed: 16 MHZ

What sets a microcontroller apart from other processors are special circuits to deal with the needs of real time applications. There is an important feature of Arduino which is Software Serial library that allows for serial communication on any of the Mega‘s digital pins. The Arduino 2560 has a host of such features intended to maximize system reliability, minimize cost through elimination of external components, provide power saving operating modes and offer code protection. These features as illustrated in figure 2.1 next pageare:

- Reset button
- Digital I/O
- Power pins
- Analog inputs
- Voltage regulator
- In-circuit serial programming
- FTDI USB chip and USB jack
- Power jack
- ICSP header



The Arduino can be used to develop stand-alone interactive objects or it can be connected to a computer to retrieve or send data to the Arduino and then act on that data. The Arduino is an amazing device. Users can us to make many things from interactive works of art to robots. With a little enthusiasm to learn how to program the Arduino and make it interact with other components a well as a bit of imagination.Users can build many things.TheArduino can be connected to LED Matrix displays, RFID readers, buttons, switches,motors, temperature sensors, pressure sensors, distance sensors, webcams, printers, GPS receivers, and Ethernet modules. The Arduino board is made of an Atmel AVR Microprocessor, a crystal or oscillator (basically a crude clock that sends time pulses to the microcontroller to enable it to operate at the correct speed) and a 5-volt linear regulator. USB connector is used to connect to a PC or Mac to upload or retrieve data. The board exposes the microcontroller I/O (Input/Output) pins to enable you to connect those pins to other circuits or to sensors, etc.

Source Code:

```
import colorama


from termcolor import colored


options_message = """
Choose:
1. To park a vehicle
2. To remove a vehicle from parking
3. Show parking layout
4. Exit """




class Vehicle:


    def _init_(self, v_type, v_number):
self.v_type = v_type         self.v_number =
v_number         self.vehicle_types = {1:
'c', 2: 'b', 3: 't'}


    def _str_(self):
        return self.vehicle_types[self.v_type]
```

```
class Slot:


   def _init_(self):
self.vehicle = None


   @property     def
is_empty(self):
       return self.vehicle is None


class Parking:


   def _init_(self, rows, columns):
self.rows = rows         self.columns =
columns         self.slots =
self._get_slots(rows, columns)


   def start(self):
while True:
try:
               print(options_message)
```

```
            option = input("Enter your choice: ")
             if option ==
'1':
                self._park_vehicle()
             if option ==
'2':
                self._remove_vehicle()
             if option ==
'3':
                self.show_layout()
            if option == '4':
                break


        except ValueError as e:
            print(colored(f"An error occurred: {e}. Try again.", "red"))


    print(colored("Thanks for using our parking assistance system", "green"))


  def _park_vehicle(self):
    vehicle_type = self._get_safe_int("Available vehicle types: 1. Car\t2. Bike\t3.
Truck.\nEnter your choice: ")


    if vehicle_type not in [1, 2, 3]:
        raise ValueError("Invalid vehicle type specified")
```

```
        vehicle_number = input("Enter vehicle name plate: ")
if not vehicle_number:
            raise ValueError("Vehicle name plate cannot be empty.")
vehicle = Vehicle(vehicle_type, vehicle_number)


        print('\n')
        print(colored(f'Slots available: {self._get_slot_count()}\n",
"yellow"))        self.show_layout()        print('\n')

        col = self._get_safe_int("Enter the column where you want to park the vehicle: ")
if col <= 0 or col > self.columns:
            raise ValueError("Invalid row or column number specified")


        row = self._get_safe_int("Enter the row where you want to park the vehicle: ")
if row <= 0 or row > self.rows:
            raise ValueError("Invalid row number specified")


        slot = self.slots[row-1][col-1]
if not slot.is_empty:
            raise ValueError("Slot is not empty. Please choose an empty slot.")


        slot.vehicle = vehicle
```

```
    def _remove_vehicle(self):
        vehicle_number = input("Enter the vehicle number that needs to be removed from parking slot: ")        if not vehicle_number:
            raise ValueError("Vehicle number is required.")


        for row in self.slots:
for slot in row:
                if slot.vehicle and slot.vehicle.v_number.lower() == vehicle_number.lower():
                    vehicle: Vehicle = slot.vehicle
                    slot.vehicle = None
                    print(colored(f"Vehicle with number '{vehicle.v_number}' removed from parking", "green"))
                    return
else:
            raise ValueError("Vehicle not found.")


    def show_layout(self):
        col_info = [f'<{col}>' for col in range(1, self.columns + 1)]
print(colored(f"|{".join(col_info)}|columns", "yellow"))


        self._print_border(text="rows")


        for i, row in enumerate(self.slots, 1):
```

```
            string_to_printed = "|"
for j, col in enumerate(row, 1):
                string_to_printed += colored(f"[{col.vehicle if col.vehicle else ' '}]",
                                             "red" if col.vehicle else "green")
string_to_printed += colored(f"|<{i}>", "cyan")
print(string_to_printed)


        self._print_border()


    def _print_border(self, text=""):
        print(colored(f"|{'-' * self.columns * 3}|{colored(text, 'cyan')}", "blue"))


    def _get_slot_count(self):
        count = 0         for
row in self.slots:
for slot in row:
if slot.is_empty:
count += 1         return
count


    @staticmethod     def
_get_slots(rows, columns):
        slots = []         for row in
range(0, rows):             col_slot =
```

```
[]          for col in range(0,
columns):
col_slot.append(Slot())
slots.append(col_slot)        return
slots


   @staticmethod     def
_get_safe_int(message):
try:
          val =
int(input(message))
return val        except
ValueError:
          raise ValueError("Value should be an integer only")



def main():
try:
       print(colored("Welcome to the parking assistance system.",
"green"))        print(colored("First let's setup the parking system",
"yellow"))        rows = int(input("Enter the number of rows: "))
columns = int(input("Enter the number of columns: "))
```

```
        print("Initializing parking")
parking = Parking(rows, columns)
parking.start()


    except ValueError:
        print("Rows and columns should be integers only.")


    except Exception as e:
print(colored(f"An error occurred: {e}", "red"))



if _name_ == '_main_':
    colorama.init()  # To enable color visible in command prompt
main()
```

DESIGN OF THE SYSTEM:

Network Time protocol :-

The Network Time Protocol is a networking protocol for clock synchronization between computer systems over packet-switched, variable-latency data networks. We have used NTP for fetching time from the NTP server so that we can show the start time and end time for the user when he parks or unparks his vehicle making information real-time.

Blynk app:-

Blynk app is a hardware-agnostic IoT platform with white label mobile apps, private cloud ,device management, data analytics and machine learning .On using the blynk app we tried to pop notification to every possible event that is occurring in the parking zone . Used a serial algorithm to display the slot number to the user who is going to park his vehicle .For example we display the empty slot number in a serial manner which gets filled , if the slot 1 is filled and when an another vehicle turns up we display slot 2 and further like these for all other vehicles , and if any vehicle leaves the slot number then we display the earlies slot number , not making the user to travel long if an initial spot is vacant .

PARKING A VEHICLE:

Once when the user enters the parking detect sensor he would receive a parking slot number on his mobile application which he is supposed to park his vehicle. Upon parking the vehicle in the respective slot and IR sensor successfully detecting the vehicle it would show a notification on the app the start time of the vehicle and the slot number in which the vehicle is parked and it would be similarly updated on the 16*2 display.

UN PARKING AVEHICLE:

Unparking your vehicle from the parking slot would pop a notification on the application app stating the start time and the end time the user has parked his vehicle in the parking slot and an small amount which the user needs to pay when he leaves the parking zone which is fixed for any duration .

This case shows that all the parking slots are empty and therefore, the system will allow a car to enter into the parking zone . The 16*2 LCD will display the number of vacant spot and filled spot and similarly it would be displayed on the application. This following case focuses on showing a slot number when the user is near to the parking detect sensor. It shows a parking slot number where the user should park his vehicle and upon parking it shows.

SMART PARKING SYSTEM

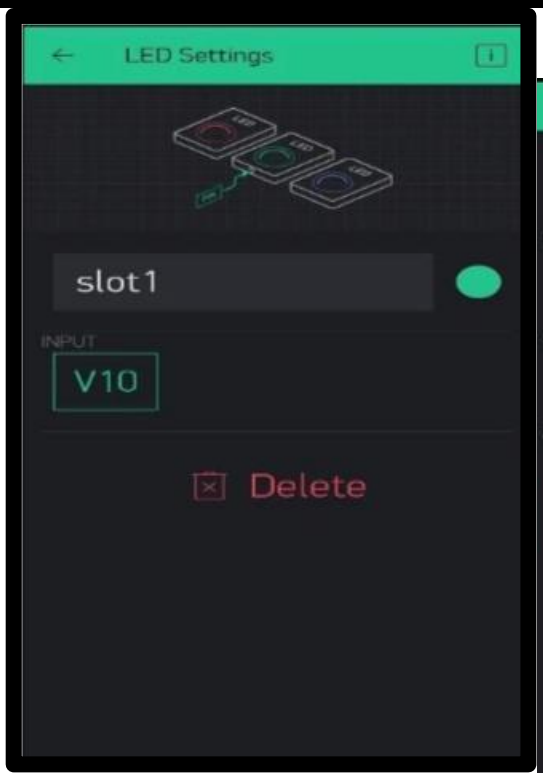
Program Code

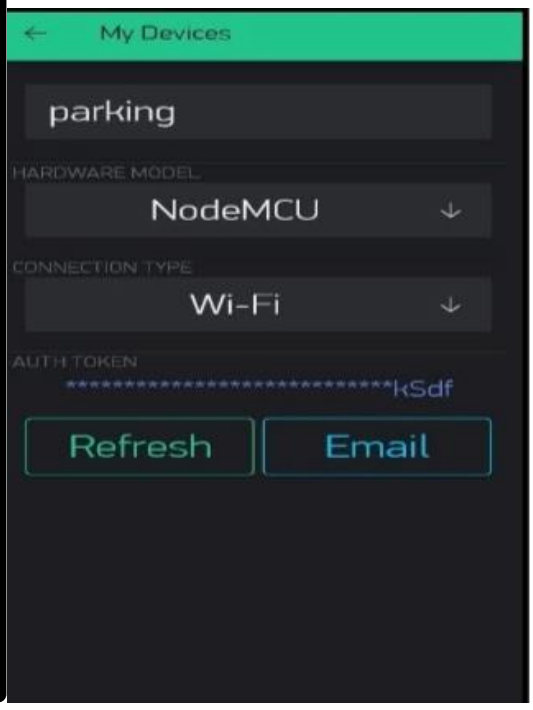
```
#include <Servo.h>
#include <Wire.h>
#include <LiquidCrystal_I2C.h>
#include <ESP8266WiFi.h>
#include <ESP8266HTTPClient.h>

Servo gateServo1;
Servo gateServo2;
LiquidCrystal_I2C lcd(0x27, 16, 2); // Change the address if your LCD is different

const int irSensor1 = D2; // IR sensor pins
const int irSensor2 = D3;
const int irSensor3 = D4;
const int irSensor4 = D5;
```

```
const int gatePin1 = D6;   // Servo motor control pins
const int gatePin2 = D7;

bool isOccupied1 = false;
bool isOccupied2 = false;

const char* ssid = "YourSSID";
const char* password = "YourPassword";
const char* serverURL = "http://yourserver.com"; // Change to your server

void setup() {
  pinMode(irSensor1, INPUT);
  pinMode(irSensor2, INPUT);
  pinMode(irSensor3, INPUT);
  pinMode(irSensor4, INPUT);
  gateServo1.attach(gatePin1);
  gateServo2.attach(gatePin2);
  lcd.init();
```

```
  if (httpCode == 200) {
    Serial.println("Status updated successfully");
  } else {
    Serial.println("Failed to update status");
  }

  http.end();
 }
}
```

Displaying The Real-time Parking Slot Availablity By Using Blynk App






Smart Parking
1ST
2ND
3RD


CarParking
Not_ Available
Available
Available