WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Efficient Parking Guidance System with Arduino and Nodemcu Esp8266 Using Blynk IoT Application

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ABSTRACT:

Utilizing and managing parking areas is a challenging task as space is often limited. Finding empty parking lots is hard and people always want to park their vehicles close to their preferred places. This becomes worse in highly populated areas during rush hour. People must roam around a lot to find a suitable parking area, which leads to the wastage of valuable time and fuel consumption. The main aim of our project is to reduce the traffic in the parking place so that we can save precious time and fuel. Here we use IR sensors to detect the vehicles in the parking lot. The signal from these sensors will be sent to Arduino UNO which connects the parking lot to the NodeMCU ESP8266 Wi-Fi chip. Finally, we must install the Blynk IoT application on mobile phones to easily find the empty parking lot to park their vehicle. In the Blynk IoT application, we have to select the hardware as ESP8266, and the connection type should be Wi-Fi. Therefore, the connection will be established, and people can park their vehicles at their preferred places by using the Blynk IoT application.

Keywords: **IR Sensors, Arduino UNO, NodeMCU ESP8266, Blynk IoT**

1. INTRODUCTION

As urbanization continues to rise, there has been a significant increase in individual car ownership. This has become more accessible to the average middle-class individual due to the thriving economy and affordable car options. While this is positive in terms of personal mobility, it has led to various challenges. The consequences include heavy traffic congestion, increased pollution levels, limited availability of roads, and insufficient parking spaces.

One of the major issues arising from this situation is the wasted time and fuel consumed by drivers searching for parking spaces. This not only affects the individual drivers but also contributes to overall traffic congestion, leading to additional time and fuel wastage for other motorists on the road. These challenges highlight the urgent need for effective parking management solutions and better infrastructure planning to address the growing demand for parking spaces in urban areas.

With the growing number of automobiles in use, traffic congestion and parking challenges have become increasingly prevalent. The conventional approach to managing this issue often involves employing more personnel to handle the increased traffic flow. However, even in areas such as malls, trade centers, and business parks, finding suitable parking spaces has become a significant problem. Many of us have personally experienced the disorder, confusion, and lengthy queues involved in searching for an available parking spot in such locations.

In this project, we are constructing an IoT-based Car Parking System utilizing Arduino UNO, NodeMCU ESP8266, and six IR sensors. The key to achieving efficient parking lies in the ability to connect, analyze, and automate the data collected from devices, which is enabled by the Internet of Things (IoT). By incorporating low-cost sensors, real-time data, and user-friendly applications, we create a system that allows users to monitor the availability of parking spaces.

The objective is to automate the process of searching for the most suitable parking floor, spot, or even lot. By leveraging IoT technology, we aim to reduce the time and effort spent on manual search by providing users with real-time information on available and unavailable parking spaces. This enhances the overall efficiency and convenience of parking for drivers.

2. LITERATURE SURVEY

[1] Wael Alsafery, Badraddin Alturki, Stephan Reiff-Marganiec, Kamal Jambi, "Smart Car Parking System Solution for the Internet of Things in Smart Cities" this study introduces a smart parking system aimed at improving user convenience and reducing overall costs associated with finding a suitable parking space. The key objective is to optimize the process of locating parking spots, thereby saving users valuable time and minimizing unnecessary movement to chosen parking areas.

A notable finding of this study is the proposal of a smart car parking system that effectively reduces data transmission through the network, resulting in energy savings at the perception layer. On the application layer side, the focus is on enhancing user experience by minimizing time spent searching for parking, alleviating traffic congestion, and reducing carbon emissions from vehicles during the hunt for available parking spaces.

[2] Tharun Bhupathi, Abhilash Chittala, Durga Prasad Alakunta, "INTELLI Parking System using Internet of Things". In recent years, the rise of smart cities has been fueled by the rapid development and expansion of the Internet of Things (IoT). This has led to increased focus on building reliable infrastructures in urban areas. One pressing issue faced by many cities is the growing number of vehicles on the streets coupled with a shortage of parking spaces. To address this problem, the demand for smart car parking systems has risen as they assist drivers in quickly locating suitable parking spots.

This paper introduces a smart parking system that utilizes infrared and ultrasonic sensors, with control provided by Arduino Mega 2560. The system incorporates a Radio Frequency Identification (RFID) reader to grant authorization for entry into the smart parking system. Additionally, a mobile application is integrated to allow users to access information on available parking spaces through Wi-Fi connectivity.

To validate the functionality of this smart parking system, a small-scale model is implemented, encompassing all the necessary components, including sensors and a Liquid Crystal Display (LCD). The results demonstrate the successful simulation of car parking activities using the mobile application and the integrated sensors.

[3] Adil H., Abderrahim M. And Larbi H., "Designing and Managing a Smart Parking System Using Wireless Sensor Networks" this smart parking system is designed to enhance the shopping experience for customers by optimizing their time through various features. It assists in locating nearby parking spots, offers real-time information on parking space availability, and provides convenient smart payment services.

The objective of this study was to develop an Auto Gate Smart Parking System utilizing the Internet of Things (IoT) concept. The development process followed the Input Process Output model, involving steps such as requirements analysis, design and testing, and evaluation.

The system incorporates an Auto Number Plate Recognizer (ANPR) implemented using Raspberry Pi. It utilizes an ultrasonic sensor, Raspberry Pi camera, database, and Arduino board to detect the vehicle's plate number. To conduct testing, vehicle plate numbers were registered in the database via Google Form, and the system was evaluated using the registered plate numbers.

[4] Denis Ashok, Akshat Tiwari, and Vipul Girje, "Smart Parking System using IoT Technology", this paper introduces the development of a user-friendly mobile application called Android based Car Parking Monitoring System (ACPMS), designed to assist users in finding available parking spaces. ACPMS offers functionalities that enable users to check for vacant parking spots and locate the nearest parking lots.

The system acquires parking location information through sensors deployed in the parking lot of a shopping complex. By utilizing the current user's position, ACPMS provides real-time updates on parking availability. The application is tested in a realistic environment, specifically for movement detection and location services, ensuring users receive timely notifications through the mobile application.

3. PROPOSED SYSTEM

The increasing number of vehicles being sold every day has exacerbated the parking problem, making it increasingly challenging to find available parking spaces in parking areas. Drivers invest significant time and effort in searching for parking spaces, often resorting to street parking, which exacerbates traffic congestion and spatial constraints. During peak hours and festive seasons, finding a safe parking area becomes particularly difficult, leaving drivers struggling to secure suitable parking spaces.

Our proposed system aims to alleviate traffic congestion in parking areas. To achieve this, we utilize IR sensors to detect vehicles in the parking lane. The captured information is then transmitted to an Arduino UNO microcontroller, which is connected to a NodeMCU ESP8266 Wi-Fi chip.

The NodeMCU ESP8266 is further linked to the Blynk IoT application through Wi-Fi connectivity. This integration allows drivers to conveniently access real-time information about parking space availability. By using the Blynk IoT application, drivers can easily identify which parking spaces are vacant and which ones are occupied, enabling them to make informed decisions about where to park their vehicles.

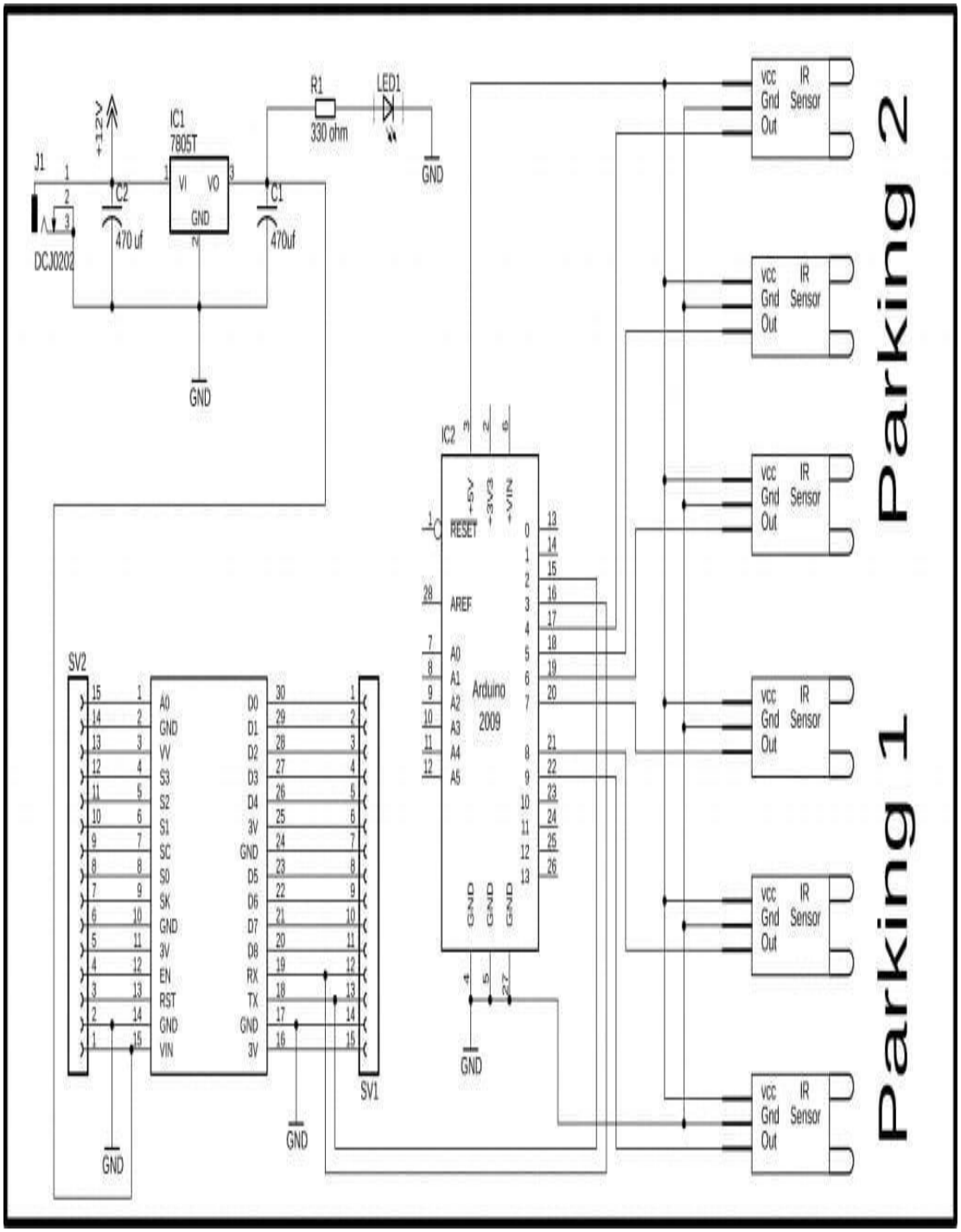

Fig. 1: System Architecture for Efficient Parking Guidance System

4. IMPLEMENTATION

Uploading code into the device:

Step 1: Connect the device and laptop through a USB cable to upload the code into the device.

Step 2: Click on the upload icon then it automatically compiled and uploaded into the device.

Connecting to Blynk IoT app:

Step 1: Install the Blynk IoT application on your mobile phone from Google Play Store.

Step 2: Click on add new device à QuickStart Device. Let's go. And then select hardware as ESP8266 and then click on continue.

Step 3: Click on device that you created and then click on "**+**" icon and select super chat. Now the graph is set for gas levelling. The device automatically comes online after it connects to the Wi-Fi credentials given in the code itself.

ALGORITHM

Step 1: Determine the number of parking spots that we must monitor.

Step 2: Install a sensor at each parking spot to detect whether a vehicle is present or not.

Step 3: Connect the sensors to the Arduino UNO.

Step 4: Write a code to program the Arduino UNO to read the sensor data.

Step 5: Connect the NodeMCU ESP8266 with Arduino UNO.

Step 6: Connect NodeMCU ESP8266 with a computer which has Arduino software installed.

5. RESULTS

5.1 Parking Layout:

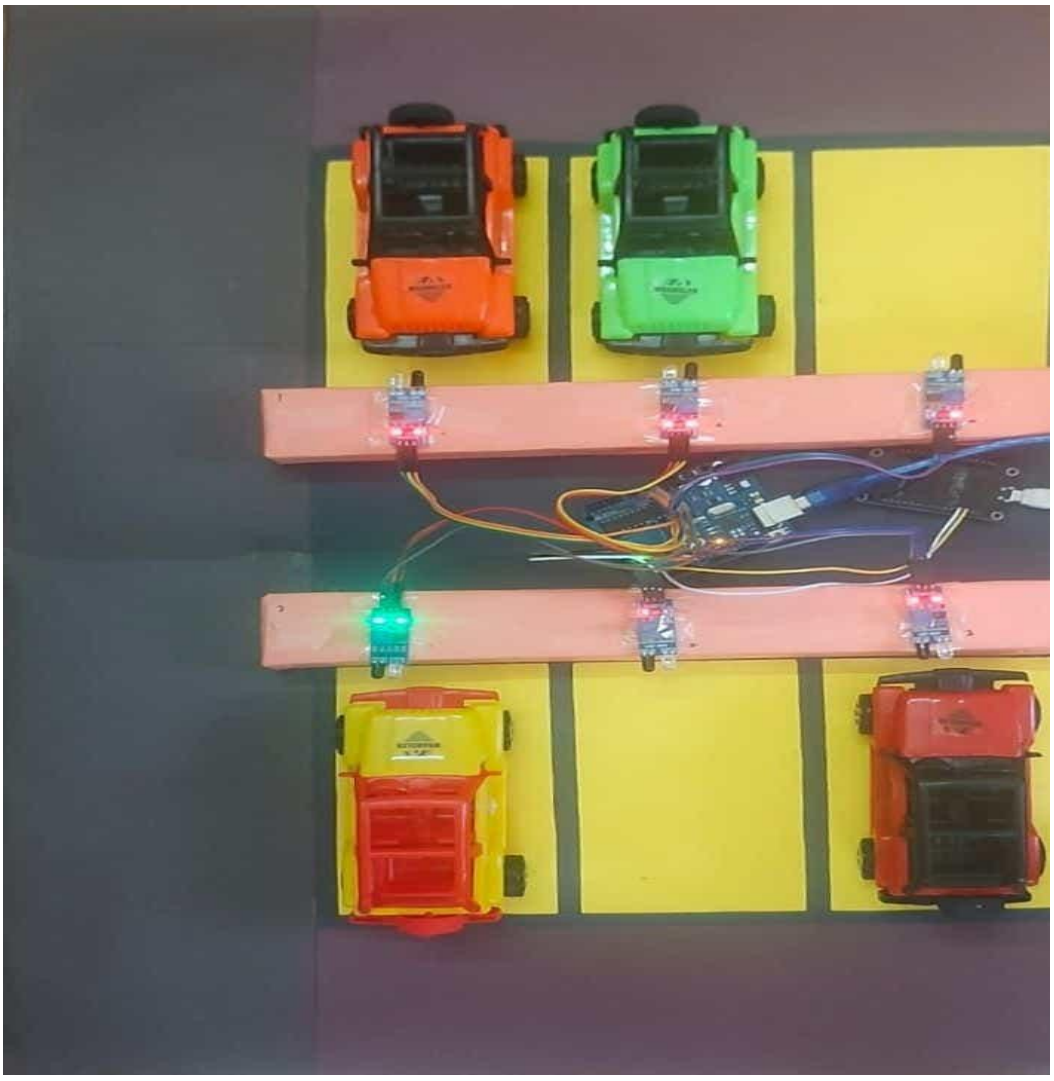

Fig. 5.1: Picture of parking layout

Explanation: As demonstrated in Fig 5.1, the whole parking space is divided into two separate layouts each containing three slots for parking. We can see that in parking1 two vehicles are parked in slot 1 and slot 2. In parking 2 also two vehicles are parked in slot 1 and slot 3.

5.2 Blynk app in user phone:

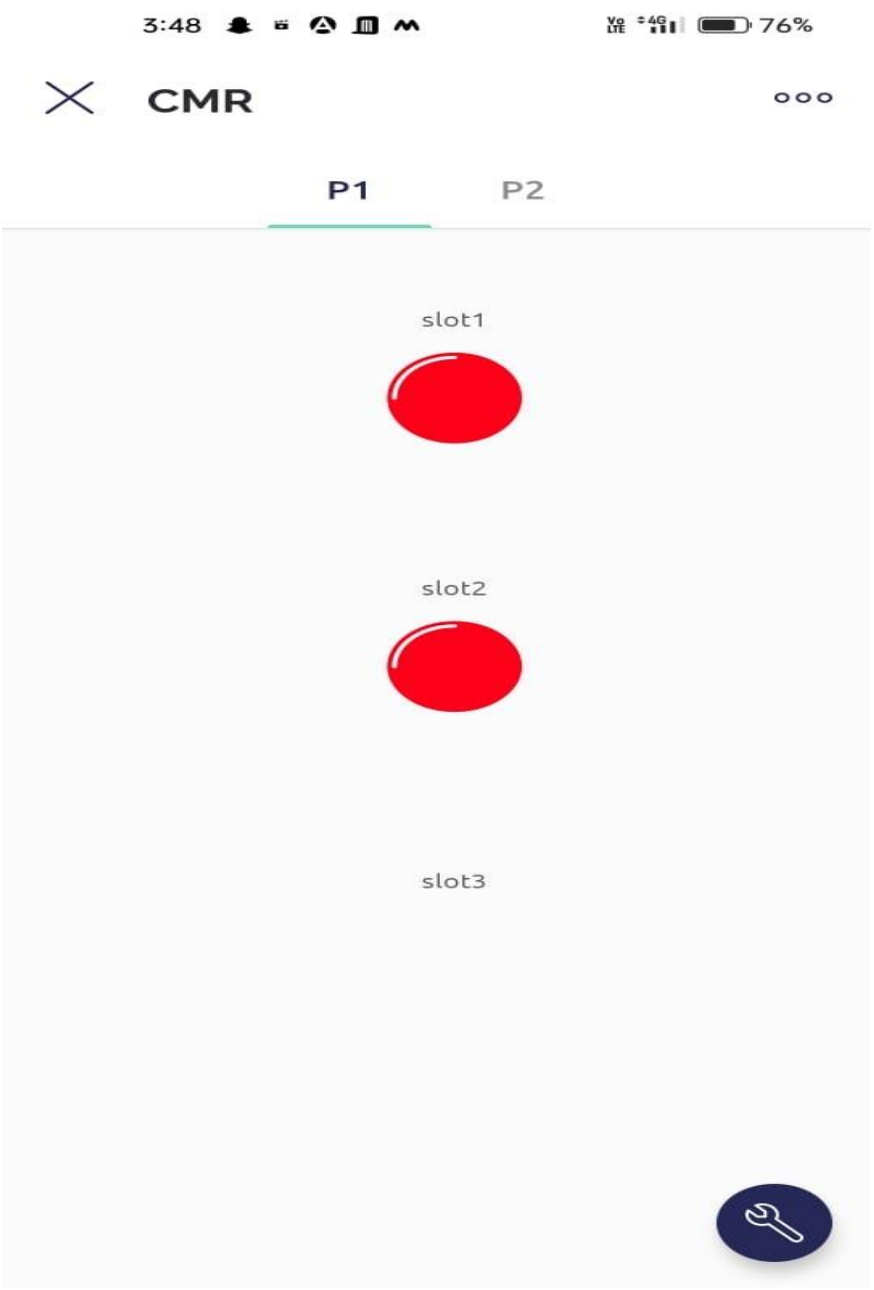

Fig. 5.2.1: User phone for parking area P1

Explanation: As shown in Fig 5.2.1, the app contains a separate tab for each parking layout named P1 in the parking space. P1 contains three led indicators which represent the three parking slots of that layout. Slot 1 and Slot 2 are occupied.

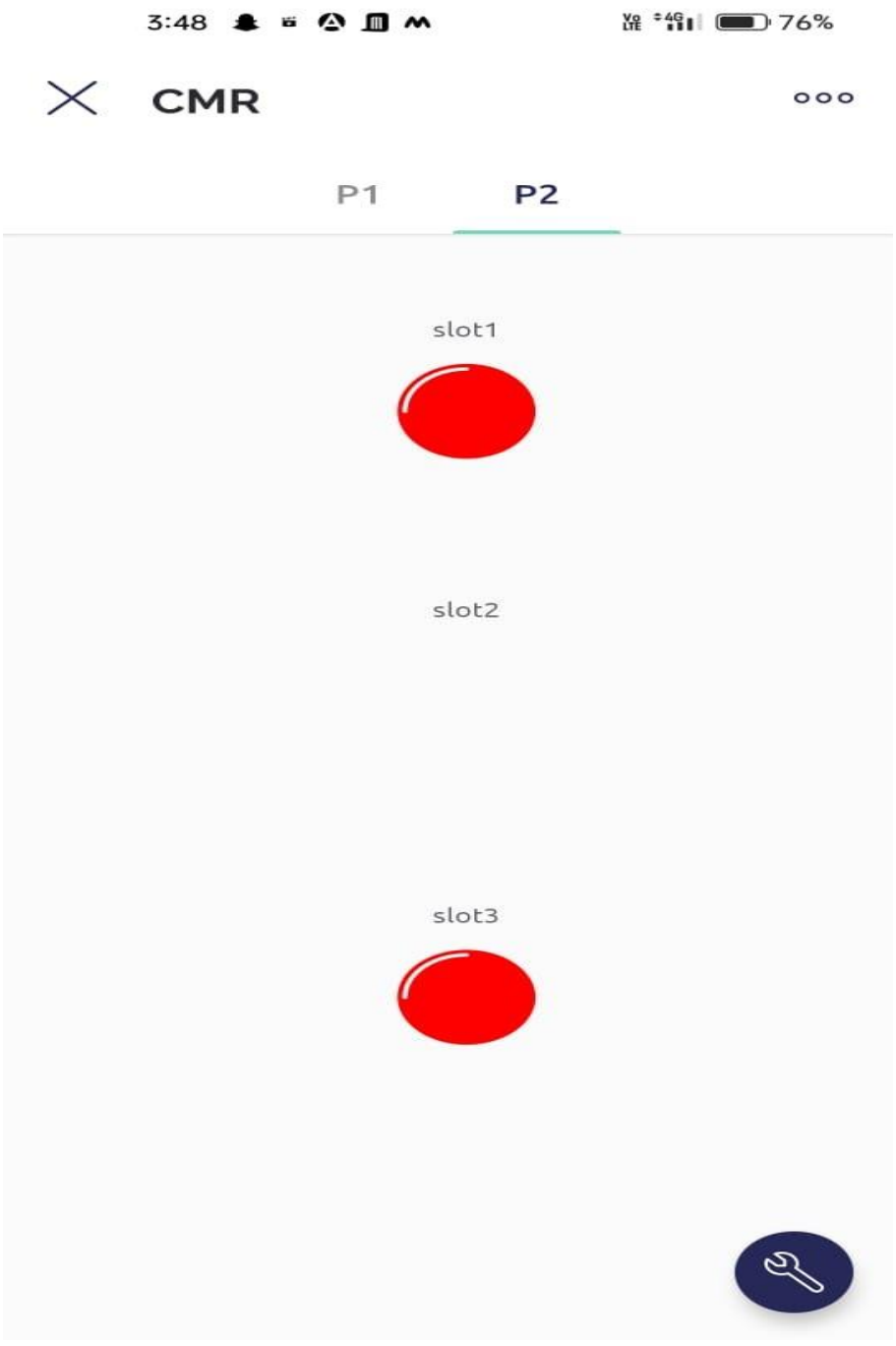

Fig. 5.2.2: User phone for parking area P2

Explanation: As shown in Fig 5.2.2, the app contains a separate tab for each parking layout named P2 in the parking space. P2 contains three led indicators which represent the three parking slots of that layout. Slot 1 and Slot 3 are occupied.

5.3 Blynk cloud website

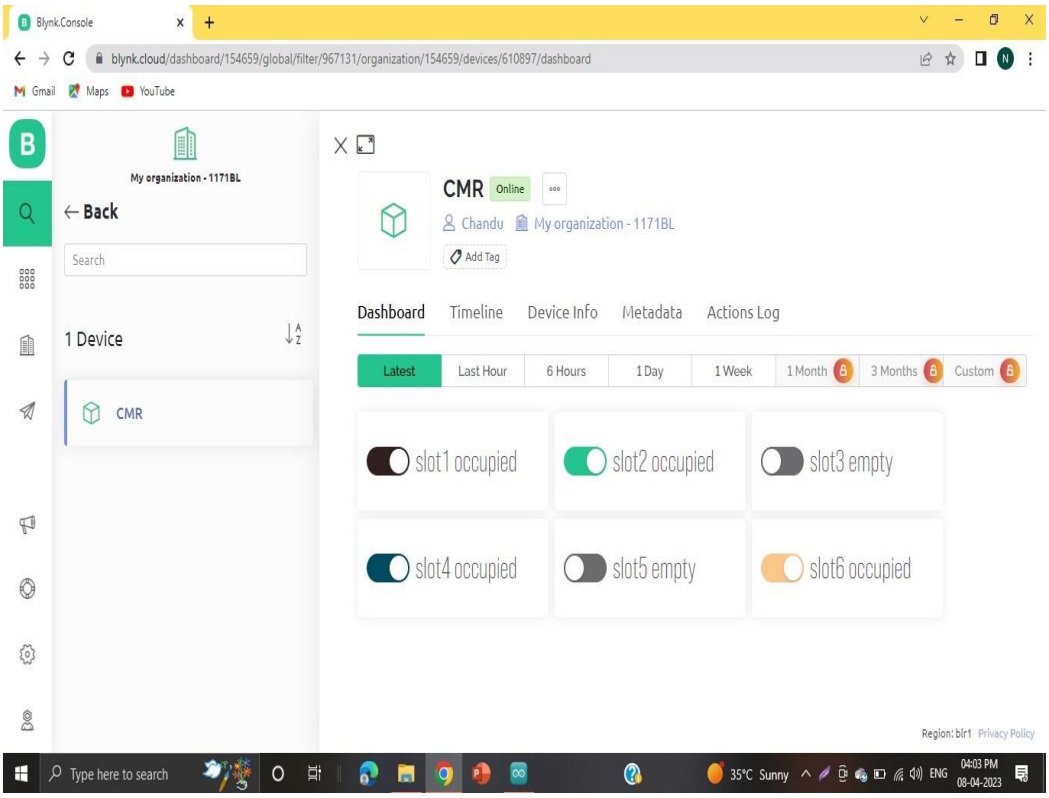

Fig. 5.3: Slot details in Blynk cloud website

Explanation: As shown in Fig 5.3, we can see which slot empty and which slot is occupied in the Blynk cloud website when the device is online in the dashboard.

5.4 Arduino code output

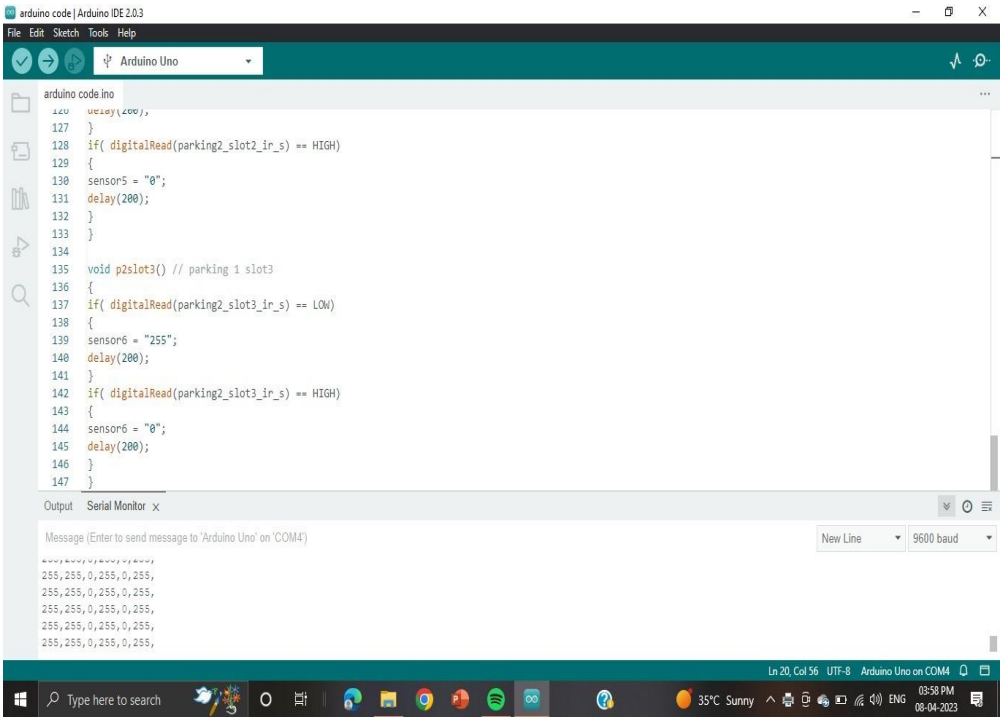

Fig. 5.4: Output of Arduino code

Explanation: As shown in Fig 5.4, we can see that in the serial monitor “255” represents the vehicle is present and “0” represents the vacant space in the parking slot. Each time the value gets updated as shown in the serial monitor.

6. CONCLUSION

After conducting a thorough study on smart parking projects, it has been determined that implementing such a system in our country would be highly advantageous. The key benefits of this system include significant time and fuel savings, as well as the ability to establish sustainable and environmentally friendly parking management practices. Additionally, the system boasts lower maintenance costs, thereby enabling property developers to achieve cost savings. Furthermore, the system enhances security in parking areas, reducing concerns related to theft or unauthorized access. Lastly, it effectively mitigates the challenges associated with parking facilities and helps alleviate traffic congestion, reducing the overall hassle for drivers.

By implementing this project, we not only address the parking challenges but also promote the growth of Automation Engineering in our country. This initiative contributes to technological advancements and encourages the widespread utilization of automation technologies. Through our efforts, we aim to contribute to the development and progress of our city by leveraging the potential of technology and automation.

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