A Project report on

SMART PARKING MANAGING SYSTEM USING IOT

Submitted in partial fulfillment of the requirements

for the award of the degree of

BACHELOR OF TECHNOLOGY

in

ELECTRONICS AND COMMUNICTION ENGINEERING

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

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This is to certify that the project report entitled SMART PARKING MANAGING SYSTEM USING IOT is the bonafide work carried out by **Uday kumar reddy B (204G1A04B6), Pavani B (204G1A0476), Sai Kumar S (204G1A0488), Sainath reddy A (204G1A0494)** in partial fulfilment of the requirements for the award of the degree of **Bachelor of Technology** in **Electronics and Communication Engineering** during the academic year 2023- 2024.

20/4/24

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DECLARATION

We, Mr. B. Uday Kumar Reddy (204G1A04B6), Ms. B. Pavani (204G1A0476), Mr. S. Sai Kumar (204G1A0488), Mr. A. Sainath Reddy (204G1A0494) students of SRINIVASA RAMANUJAN INSTITUTE OF TECHNOLOGY, Rotarypuram, here by declares that the dissertion entitled " SMART PARKING MANAGING SYSTEM USING IoT " embodies the report of our project work carried out by us during final year Bachelor of Technology under the guidance of D. Maruthi Kumar, Department of ECE, SRINIVASA RAMANUJAN INSTITUTE OF TECHNOLOGY, and this work has been submitted for the partial fulfillment of the requirements for the award of the Bachelor of Technology Degree. The results embodied in this project have not been submitted to any other University or Institute for the award of any Degree or Diploma.

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Project Associates

ABSTRACT

The project entitled SMART PARKING SYSTEM using Iot , the major motivation of this project is to reduce the traffic congestion in roads, multi storied buildings and malls due to unavailability of parking spaces .The project displays the nearest empty slot if present with respect to user location. Our project aims to make efficient use of parking spaces. We track vacant slots in the parking space and assign that to the user. Smart parking system as described above can lead to an error-free, reliable, secure and fast management system.

In recent times the concept of smart cities have gained great popularity. Thanks to the evolution of the Internet of things the idea of smart city now seems to be achievable. Consistent efforts are being made in the field of IoT in order to maximize the productivity and reliability of urban infrastructure. Problems such as, traffic congestion, limited car parking facilities and road safety are being addressed by IoT.

The proposed Smart Parking system consists of an on-site deployment of an IoT module that is used to monitor and signalize the state of availability of each single parking space. A mobile application is also provided that allows an end user to check the availability of parking space. The proposed work also describes a high level view of the system architecture. Towards the end, the proposed work discusses the working of the system in form of a use case that proves the correctness of the proposed model.

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LIST OF ABBREVIATIONS

ACRONYM	DESCRIPTION
IOT	Internet Of Things
GPIO	Global Purpose Input Output
CPU	Central Processing Unit
IDE	Integrated Development Environment
NODEMCU	Node Micro-Controller Unit
Wi-Fi	Wireless Fidelity
IR	Infrared Sensor
PIR	Passive Infrared Sensor
LCD	Liquid-Crystal Display
RTOS	Real-Time Operating System
SDK	Software Development Kit

CHAPTER 1

INTRODUCTION

The project entitled smart parking system is to manage all the parking facilities to an user. The recent growth in economy and due to the availability of low price cars in the market, an every average middle-class individual can afford a car, which is good thing, however the consequences of heavy traffic jams, pollution, less availability of roads and spot to drive the motor car. One of the important concerns, which is to be taken in accounting, is the problem of parking those vehicles. Though, if there is space for parking the vehicle but so much time is squandered in finding that exact parking slot resulting in more fuel intake and not also environment friendly. It will be a great deal if in some way we find out that the parking itself can provide the precise vacant position of a parking slot then it'll be helpful not limited to the drivers also for the environment. Initially when the user is about to enter the location the LCD displays the number of empty and filled spots and when the user is with its vehicle near to the parking detect sensor, he/she would be thrown with a notification on their mobile app of the parking slot number, where they should park there vehicle.

1.1 RELEVANCE OF THE PROJECT

The main important benefit of a smart parking system is its advanced technology. It follows the latest technologies and concepts to assure profitable outcomes. The design and implementation of smart parking is very easy to supervise and manage. This system can be easily handled by the staff members because of its well-organized structure.

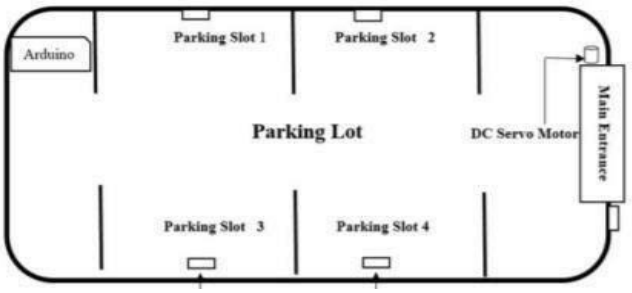

Fig.1.1: Block Diagram of Smart Parking System

1.1.1 PROBLEM STATEMENT

In recent research in metropolitan cities the parking management problem can be viewed from various angles such as high vehicle density on roads. This results in annoying issues for the drivers to park their vehicles as it is very difficult to find a parking slot.

The drivers usually waste time and effort in finding parking space and end up parking their vehicles finding a space on the street which further leads to space congestion. In worst case, people fail to find any parking space especially during peak hours and festive season.

1.1.2 OBJECTIVE

Smart Parking involves the use of low-cost sensors, real-time data and applications that allow users to monitor available and unavailable parking spots. The goal is to automate and decrease time spent manually searching for the optimal parking floor, spot and even lot. Some solutions will encompass a complete suite of services such as online payments, parking time notifications and even car searching functionalities for very large lots. A parking solution can greatly benefit both the user and the lot owner.

Optimized parking – Users find the best spot available, saving time, resources and effort. The parking lot fills up efficiently and space can be utilized properly by commercial and corporate entities.

Reduced traffic – Traffic flow increases as fewer cars are required to drive around in search of an open parking space.

Reduced pollution – Searching for parking burns around one million barrels of oil a day. An optimal parking solution will significantly decrease driving time, thus lowering the amount of daily vehicle emissions and ultimately reducing the global environmental footprint.

Increased Safety – Parking lot employees and security guards contain real-time lot data that can help prevent parking violations and suspicious activity. License plate recognition cameras can gather pertinent footage. Also, decreased spot-searching

traffic on the streets can reduce accidents caused by the distraction of searching for parking.

Decreased Management Costs – More automation and less manual activity saves on labor cost and resource exhaustion.

Enhanced User Experience – A smart parking solution will integrate the entire user experience into a unified action. Driver's payment, spot identification, location search and time notifications all seamlessly become part of the destination arrival process.

At present some countries have portals which users can gain information about parking areas via the internet. This system can give users the information about parking space, but it won't be able to give which parking slot is vacant and occupied. Hence, such a system cannot smartly handle the issue. Car lifts along with an automated robotic system, which automatically takes the car to a particular parking spot as soon as the car enters on a platform. This system cannot be installed by medium scale shopping malls, movie theatres as it can cost them a huge amount. At many public places, the system only shows the availability but it cannot show the exact slot and path to the slot available. Hence, there is the need to smartly find the path to the vacant spot.

In this project we are using NodeMCU, IR sensors, and servo motors. One IR sensor is used at entry and exit gate to detect the car while two IR sensors are used to detect the parking slot availability. Servo motors are used to open and close the gates according to the sensor value. NodeMCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware, which is based on the ESP-12 module. The term "NodeMCU" by default refers to the firmware rather than the dev kits. The firmware uses the Lua scripting language. The ESP8266 is a low-cost Wi-Fi enabled microchip with full TCP/IP stack and microcontroller capability. NodeMCU includes CPU core, faster Wi-Fi, more GPIOs, and supports Bluetooth 4.2, and low power Bluetooth. The ESP8266 is a low-cost WiFi enabled microchip with full TCP/IP stack and microcontroller capability. NodeMCU includes CPU core, faster Wi-Fi, more GPIOs, and supports Bluetooth 4.2, and low power Bluetooth. As soon as the IR sensors get the presence of a car in front of the entrance, it will send signal to the NodeMCU to check if there is an empty slot inside the parking lot. When NodeMCU acknowledges that there is an empty slot or more then it will send a signal to the dc servo motor which will open the main entrance. On the other hand if an NodeMCU encounters no empty slots at the time of a car trying

to make an entrance, the gate will just not open. In addition, there will be a website linked with the NodeMCU board to show the number of parking.

The idea behind our methodology is very simple, usually users spend most of their time in looking for an empty slot where they can park their vehicle which increases fuel consumption and time wastage. We came-up with a new method where we provide the user an empty slot number where he can park his vehicle without wasting his time for finding one. Similarly we try to display the start time and end time so that the user can know for what amount of time he has parked his vehicle.

1.2 INTRODUCTION TO IOT

IoT stands for Internet of Things, which means accessing and controlling daily usable equipments and devices using Internet.

IoT includes all topics such as introduction, features, advantage and disadvantage, ecosystem, decision framework, architecture and domains, biometric, security camera and door unlock system, devices, etc.

Fig.1.2: Internet Of Things

What is an Internet of Things (IoT)

Let's us look closely at our mobile device which contains GPS Tracking, Mobile Gyroscope, Adaptive brightness, Voice detection, Face detection etc. These components have their own individual features, but what about if these all communicate with each other to provide a better environment? For example, the phone brightness is adjusted based on my GPS location or my direction.

Connecting everyday things embedded with electronics, software, and sensors to internet enabling to collect and exchange data without human interaction called as the Internet of Things (IoT).

The term "Things" in the Internet of Things refers to anything and everything in day-to-day life which is accessed or connected through the internet.

IoT is an advanced automation and analytics system which deals with artificial intelligence, sensor, networking, electronic, cloud messaging etc. to deliver complete systems for the product or services. The system created by IoT has greater transparency, control, and performance.

As we have a platform such as a cloud that contains all the data through which we connect all the things around us. For example, a house, where we can connect our home appliances such as air conditioner, light, etc. through each other and all these things are managed at the same platform. Since we have a platform, we can connect our car, track its fuel meter, speed level, and also track the location of the car.

Active Engagement:

If there is a common platform where all these things can connect to each other would be great because based on my preference, I can set the room temperature. For example, if I love the room temperature to to be set at 25 or 26-degree Celsius when I reach back home from my office, then according to my car location, my AC would start before 10 minutes I arrive at home. This can be done through the Internet of Things (IoT).

How does Internet of Thing (IoT) Work?

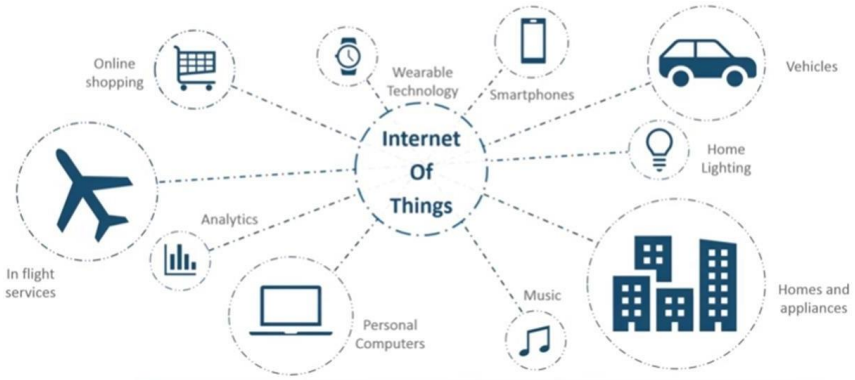

Fig 1.3: Working Of Internet of Things

The working of IoT is different for different IoT echo system (architecture). However, the key concept of there working are similar. The entire working process of IoT starts with the device themselves, such as smartphones, digital watches, electronic appliances, which securely communicate with the IoT platform. The platforms collect and analyze the data from all multiple devices and transfer the most valuable data with applications to devices.

Features of IOT

The most important features of IoT on which it works are connectivity, analyzing, integrating, active engagement, and many more. Some of them are listed below:

Connectivity: Connectivity refers to establish a proper connection between all the things of IOT to IOT platform it may be server or cloud. After connecting the IoT devices, it needs a high speed messaging between the devices and cloud to enable reliable, secure and bi-directional communication.

Analyzing: After connecting all the relevant things, it comes to real-time analyzing the data collected and use them to build effective business intelligence. If we have a good insight into data gathered from all these things, then we call our system has a smart system.

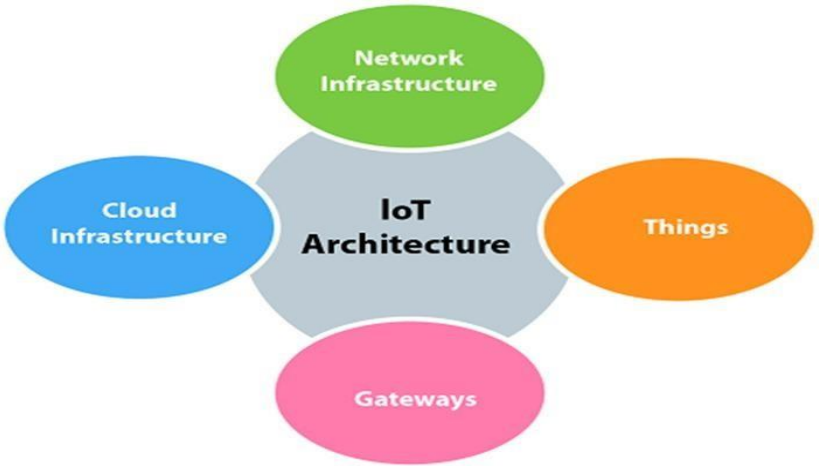

Fig.1.4: Architecture Of Internet Of Things

Integrating: IoT integrating the various models to improve the user experience as well.

Artificial Intelligence: IoT makes things smart and enhances life through the use of data. For example, if we have a coffee machine whose beans have going to end, then the coffee machine itself order the coffee beans of your choice from the retailer.

Sensing: The sensor devices used in IoT technologies detect and measure any change in the environment and report on their status. IoT technology brings passive networks to activate networks. Without sensors, there could not hold an effective or true IoT environment.

Active Engagement: IoT makes the connected technology, product, or services to active engagement between each other.

Endpoint Management: It is important to be the endpoint management of all the IoT system otherwise, it makes the complete failure of the system. For example, if a coffee machine itself order the coffee beans when it goes to end but what happens when it orders the beans from a retailer and we are not present at home for a few days, it leads to the failure of the IoT system. So, there must be a need for endpoint management

CHAPTER 2

LITERATURE SURVEY

[1] Developing a Smart Parking Management System Using the Internet of Things

Searching for parking wastes significant amounts of time and effort and leads to substantial financial costs. This is particularly the case for people who are always pressured to be on time. Smart cities employ all kinds of modern technologies to manage and enhance resources effectively. Urban parking facilities are one of the essential assets that must be managed. We developed a smart parking management system (SPMS) as a modern solution to manage parking and save users time, effort and cost. In the context of today's modern life, it has become necessary to improve search methods for available parking and minimize the congestion that occurs at the parking entrance. Searching or booking available parking online earlier is a better substitute than searching at a parking lot where there is a possibility of not being able to find parking. Our smart parking management system was developed to:

• Manage parking and solve problems efficiently using technology

• Apply technical solutions to improve the smart cities concept

The proposed system uses a variety of technologies that help manage parking. It provides essential services for users, including searching for parking, reservations and payment. It is extended to cover more advanced services such as receiving notifications, statistics and monitoring the parking state. The system is connected to sensors to detect occupancy and an automatic number plate recognition (ANPR) camera to control access. The remainder of the paper is organized as follows.

[2] An IoT-based E-Parking System for Smart Cities

The huge proliferation in the number of vehicles on the road along with mismanagement of the available parking space has created parking related problems as well as increased the traffic congestion in urban areas. Thus, it is required to developan automated smart parking management system that would not only help a driver to locate a suitable parking space for his/her vehicle, but also it would reduce fuel consumption as well as air pollution.

It has been found that a drivers search for a suitable parking facility takes almost 15 minutes which increases the fuel consumptionby the vehicle, traffic congestion and air pollution. A significant amount of research works exist in the area of design and development of smart parking system. Various features of smart parking system are listed below.

- Inquiry on availability of parking space and reservation of parking lot
- Real-time parking navigation and route guidance
- Vehicle occupancy detection and management of parking lots.

Most of the smart parking systems (SPS) proposed in literature over the past few years provides solution to the design of parking availability information system, parking reservation system, occupancy detection and management of parking lot, real-time navigation within the parking facility etc. However, very few works have paid attention to the real time detection of improper parking and automatic collection of parking charges. Thus, this paper presents an internet-of thing (IoT) based E-parking system that employs an integrated component called parking meter (PM) to address thefollowing issues.

- Real-time detection of improper parking
- Estimation of each vehicles duration of parking lot usage
- Automatic collection of parking charges

The E-parking system proposed in this paper also provides city-wide smart parking management solution via providing parking facility availability information and parking lot reservation system and it is named as parking meter (PM) based E-parking (PM-EP).

[3] Smart Parking based System for smarter cities

India is getting motorized i.e. the rate of private vehicles is more as compared to public transports. As the rate of people owning their vehicles increases, the need of parking slots to park vehicles also increases. But currently the scenario is that there are not sufficient parking slots available or there is also possibility that people are not now aware about the legal parking slots available in their locality. This situation leads to the unnecessary crowding of vehicles on the road and also results in inconveniency of people walking on the road.

To overcome above problems, We are proposing the solution in the form of a multilingual android application which will be helpful for thepeople to find their parking slots digitally. By digitally we mean that this particular system will assign the parking slot based on the current location of the user and the parking slot which the user wants according to his/her ease. Ease in terms of finding the exact slot. The payments can be done digitally or through vending machines. The end user can register and login with his/her account which will help the system to findthe location and displaying the nearest parking area and nearest parking slot, whether it is available or not. If not then it will direct user to the next nearest slot and so on.

The existing system comprises of both traditional and application-based approach for parking. If we talk about the traditional approach it utilizes manual method of parking i.e. user has to find the spot for parking by traveling to far distancesand paying extra money. An application-based approach consists of the applications which provides the parking slots for the particular locality for example. The applicationnamed ‘Parking Panda ’ provides the parking slots to the areas like stadium, sports leagues etc.

[4] SMART PARKING SYSTEM TO REDUCE TRAFFIC CONGESTION

Transportation is the key-success for any of the country. Now a day, many people have options to use their own vehicle for travelling. This will surely increase thedemand in trading but one of the problems created by road traffic is "parking". To parkall these vehicles in the major metro cities is quite tedious and difficult task and it became problematic to park vehicles. Lot of research and development is being done all over the world to implement better and smarter parking management mechanisms. The current smart parking systems or Wireless Sensors Network Parking requires the combination of wireless sensor networks module, Embedded web-server, Central Web-Server. Sensor networks make use of Infrared (IR) Sensor nodes to check the parking slot state and send this information to embedded web-server. It thereby displaysthe information on a LED screen with which the user can check for empty vehicle slots.These systems not guide the users to reach to the parking lot. If the slot is not availableat that time than drivers will start searching for another parking zone so that this processis time consuming and will increase the traffic congestion.

This paper proposes a Reservation-based Smart Parking System for avoiding the traffic problems that provides the pre- booking of slots through the use of the mobile application. This application is expected to provide an efficient and cost- effective solution to the vehicle parking problems. Application must be installed in the user's mobile. Unlike the existing system, our idea is to use client-server architecture where client request for the reservation of slots and server responds with the slots which are available at that time. Our system is that the user has an option to go for the parking area according to his/her convenience. The advantage of this will greatly reduce the time taken by the vehicle to search for a parking area. Advanced payment modules arealso included like e- wallet, debit card, credit card from which the user can pay. Penaltywill be added on late exit as well as an over use of the slot after user specified entry and exit time. The refund will be given on cancelation of parking slot and early exit. The supervisor is required to monitor the area.

Many of the vehicles parking facilities are unable to cope with the influx of vehicles on roads and parking area. The current smart parking systems or Wireless Sensors Network Parking requires the combination of wireless sensor networks module, Embedded web-server, Central Web-Server. Sensor networks make use of Infrared (IR) Sensor nodes to check the parking slot state and send this information toembedded web-server. It thereby displays the information on a LED screen with whichthe user can check for empty vehicle slots. Also image capturing devices are used forcontinuously clicking pictures of parking area to ensure empty slots which results in high power consumption and also high maintenance cost is required. There are some systems in the market like the smart parking services which are based on the wireless sensor networks which uses wireless sensors to effectively find the available parking space. But to use this system, additional hardware needs to be installed in the car whichis not feasible.

[5] An IoT-Based Intelligent System for Real-Time Parking Monitoring and Automatic Billing

Today, the parking industry is being transformed by new technologies that are allowing cities to reduce rates of congestion significantly. Sensor networks that sense vehicle occupancy are providing the basic intelligence behind smart parking systems. Thanks to the Smart Parking technology, it is now possible to know in real-time the location of free parking spaces and to help drivers to get to their ultimate destination. A variety type of vehicle detectors has been used in parking information acquisition. These vehicle detectors mainly include the inductive loop, acoustic sensor, infrared sensor, or

ultrasonic sensor. System using video camera sensor technologies have been proposed to collect the information in vehicle parking field. However, a video camera sensor is vulnerable to bad weather and night time operation. Furthermore, it isexpensive, and can generate a large amount of data that can be difficult to transmit in a wireless network. The magneto-resistive based detection systems combined with a wireless area network are the most popular technique due to their high accuracy.

Yet, this type of sensor is facing different issues, i.e. it can be bedeviled by electromagnetic interference, which affects the accuracy, the reading from sensor needs to be collected constantly which will result in wearing out the battery. To extendthe battery lifetime and increase the vehicle detection accuracy, a parking sensor systemhas been proposed. While power management technique has been implemented to optimize energy consumption, high occupancy monitoring accuracy is achieved usingtwo-fold sensing approach. It is a sequence of darkness and Signal Strength Indicator (RSSI) measurement-based techniques. The wireless sensors are still intrusive, they are embedded in the pavement, or taped to the surface of each individual parking lot. Existing sensors, such as ground based parking sensors costs up to $200 per parking lot. As consequence, smart-parking technology using wireless sensors for outdoor parking is costly due to the large number of sensors units required to cover the entire parking lot. Although, parking occupancy monitoring systems have made a significantprogress, smart parking payment is rarely studied in smart parking research. Yet, thereare companies working on the patents of parking systems for payments. A first approach consists in using a camera or an RFID transceiver for vehicle detection and identification. A limitation of this solution lies in that the system is complex and its implementation is expensive when a detection device is installed on each parking lot. Furthermore, when only RFID transceiver is used for vehicle detection and identification, the system can be bedeviled by electromagnetic interference, which affects the accuracy. Moreover, this system is designed to detect a vehicle when entering a parking and seek payment, whereas information on vacant parking lots is not provided. A technique for monitoring vehicle parking using one camera to record the entrance of a vehicle and a second camera to record the vehicle leaving the parkinghas been proposed. Moreover, in a system and method for obtaining and displaying information on vacant parking space is described.

When a user occupies a parking space designated with an individual ID, he enters this ID into a parking meter or via asmart phone mobile app., and pays the parking fees. The database processes the received data and changes the status of the parking space with its ID from unpaid to paid. These data are used as information on the occupation of a parking space. In this paper, we propose a smart sensor system allowing outdoor parking monitoring and payment without requiring any user/driver interaction. It will be deployed without having to install new components on each parking lot. The proposed sensor has benefitsin terms of detection and payment reliability, and reduced expense by reducing the system complexity and installation, and extending batteries lifetime through thereduction of the system power consumption.

CHAPTER 3
EXISTING SYSTEM

An Existing System utilizes RFID tags and manual labor combined technology with human assistance to optimize parking management. Here's how it could work:

RFID Tags: Each vehicle is equipped with an RFID tag, which contains unique identification information.

RFID Readers/Gateways: At the entrance and exit points of the parking IOT, RFID readers or gateways are installed. These devices can read the tags on vehicles as they enter and exit the parking area**.**

Database Management System: A database is used to store information about the RFID tags, including vehicle details, entry and exit times, and parking space availability.

Automated Entry/Exit: When a vehicle with an RFID tag approaches the entrance, the RFID reader scans the tag and checks the database for available parking spaces. If there is space available, the gate opens automatically, allowing the vehicle to enter. Similarly, when the vehicle exits, the RFID reader records the exit time and updates the database accordingly.

Manual Labor: While the RFID system handles the automated entry and exit process, manual labor can still be utilized for various tasks:

Guiding Vehicles: Person can assist in directing vehicles to available parking spaces, especially in crowded or complex parking space.

Customer Assistance: Employee can provide assistance to customers who may have questions or issues with the parking system.

Maintenance: Manual labor can be employed for routine maintenance task to ensure smooth operation of the parking facility.

Monitoring and Management: Managers can use a central monitoring system to oversee the entire parking operation, including real-time occupancy status, revenue tracking, and employee performance.

CHAPTER 4
PROPOSED SYSTEM
SMART PARKING MANGING SYSTEM USING IOT

The system comprises an ESP8266 Wi-Fi module as the primary controller, enabling internet connectivity for remote monitoring and control. This module communicates with the Arduino Nano, which serves as the interface between the hardware components and sensors of the system. The Arduino Nano collects data from various sensors and processes it to manage parking space availability and access control.

Each parking space is equipped with a PIR (Passive Infrared) sensor, which detects the presence of vehicles by sensing the infrared radiation they emit. When a vehicle enters or exits a parking space, the corresponding PIR sensor sends a signal to the Arduino Nano, which updates the parking status in real-time. This allows the system to accurately determine the availability of parking spaces and manage them efficiently.

In addition to the PIR sensors, IR (Infrared) sensors are placed at the entry and exit points of the parking lot. These sensors detect vehicles entering and leaving the parking area, triggering the Arduino Nano to update the available parking spaces and manage access control. The Arduino Nano ensures that entry is only permitted when parking spaces are available, preventing overcrowding and facilitating smooth traffic flow within the parking facility.

The system integrates with the Blynk app, a smartphone application that enables users to remotely monitor and control the parking system. Through the Blynk app, users can receive real-time updates on parking availability, reserve parking spaces, and receive alerts and notifications regarding the status of the system. This enhances user experience and allows for convenient management of parking spaces, especially in busy or congested areas.

Overall, the proposed smart parking system leverages ESP8266, Arduino Nano, PIR sensors, IR sensors, and the Blynk app to create an efficient and user-friendly solution for managing parking spaces. By combining hardware components with internet connectivity and mobile application support, the system offers real-time monitoring, remote access control, and enhanced convenience for both operators and users alike.

4.1 HARDWARE REQUIREMENTS

4.1.1 ESP8266:

The ESP8266 is a system on a chip (SOC) Wi-Fi microchip for Internet of Things (IoT) applications produced by Espressif Systems. Given its low cost, small size and adaptability with embedded devices, the ESP8266 is now used extensively across IoT devices.

The ESP8266 module enables microcontrollers to connect to 2.4 GHz Wi-Fi, using IEEE 802.11 bgn. It can be used with ESP-AT firmware to provide Wi-Fi connectivity to external host MCUs, or it can be used as a self-sufficient MCU by running an RTOS -based SDK. The module has a full TCP/IP stack and provides the ability for data processing, reads and controls of GPIOs

ESP8266 Functions

ESP8266 has many applications when it comes to the IoT. Here are just some of the functions:

- **Networking:** The module's Wi-Fi antenna enables embedded devices to connect to routers and transmit data
- **Data Processing:** Includes processing basic inputs from analog and digital sensors for far more complex calculations with an RTOS or Non-OS SDK
- **P2P Connectivity:** Create direct communication between ESPs and other devices using IoT P2P connectivity.
- **Web Server:** Access pages written in HTML or development languages.

Fig.4.1: ESP8266

4.1.2 LCD DISPLAY

LCDs were a big leap in terms of the technology they replaced, which include light-emitting diode (LED) and gas-plasma displays. LCDs allowed displays to be much thinner than cathode ray tube (CRT) technology. LCDs consume much less power than LED and gas-display displays because they work on the principle of blocking light rather than emitting it. Where an LED emits light, the liquid crystals in an LCD produces an image using a backlight.The LCD is used to display the number of vacant and spilled spot. It also gets updated on the display LCD when a vehicle parks or unparks the vehicle .

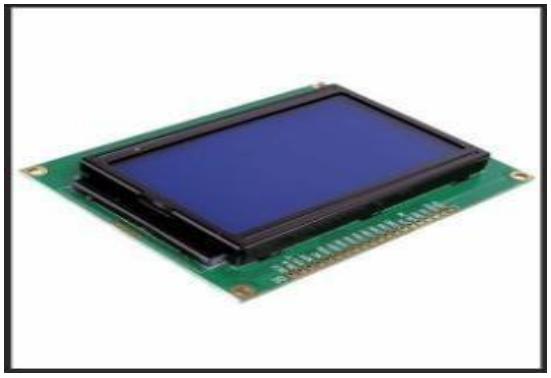

Fig.4.2: LCD DISPLAY

4.1.3 IR SENSORS

An infrared (IR) sensor is an electronic device that measures and detects infrared radiation in its surrounding environment. Infrared radiation was accidentally discovered by an astronomer named William Herchel in 1800. While measuring the temperature of each color of light (separated by a prism), he noticed that the temperature just beyond the red light was highest. IR is invisible to the human eye, as its wavelength is longer than that of visible light (though it is still on the same electromagnetic spectrum). Anything that emits heat (everything that has a temperature above around five degrees Kelvin) gives off infrared radiation.

We are using three IR detect sensor in our project, one IR detect sensor is used to sense the vehicle near the parking sensor and other two IR detect sensor is used to send data to the node mcu which is the brain of our system whether a vehicle is parked in that slot or is unparked.

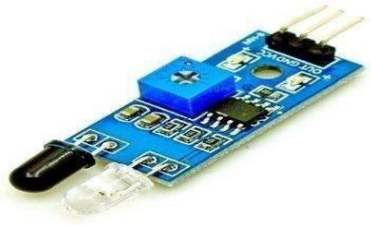

Fig.4.3: IR sensor

4.1.3 SERVO MOTOR

A servomotor (or servo motor) is a simple electric motor, controlled with the help of servomechanism. If the motor as a controlled device, associated with servomechanism is DC motor, then it is commonly known as a DC servo motor. If AC operates the controlled motor, it is known as a AC Servo Motor.

A servo consists of a Motor (DC or AC), a potentiometer, gear assembly, and a controlling circuit. First of all, we use gear assembly to reduce RPM and to increase torque of the motor. Say at initial position of servo motor shaft, the position of the potentiometer knob is such that there is no electrical signal generated at the output port of the potentiometer. Now an electrical signal is given to another input terminal of the error detector amplifier. Now the difference between these two signals, one comes from the potentiometer and another comes from other sources, will be processed in a feedback mechanism and output will be provided in terms of error signal. This error signal acts as the input for motor and motor starts rotating. Now motor shaft is connected with the potentiometer and as the motor rotates so the potentiometer and it will generate a signal. So as the potentiometer's angular position changes, its output feedback signal changes. After sometime the position of potentiometer reaches at a position that the output of potentiometer is same as external signal provided.

Fig.4.4: Servo Motor

4.2 SYSTEM ARCHITECTURE

The below diagram shows the pin diagram of our model. It consists of one node mcu, one servo motor, one LCD display and IR sensors. The node mcu is the brain of our system which powers all the other devices. The LCD display is powered by node mcu by connecting jumper wires from the display to node mcu . The Servo motor is also powered by node mcu with connecting its pins to node mcu. The IR sensor consists of three pins, where two pins refer to the power supply and ground and the other pins refer to the pin which is going to be connected in the controller.

On successfully connecting all the components in the given figure now we have to connect the blynk app. While using the blynk app we have to specify the widgets used in our android app and the pin number to which they are connected to node mcu in the actual model so that the mobile app will react exactly to the inputs provided in the model.

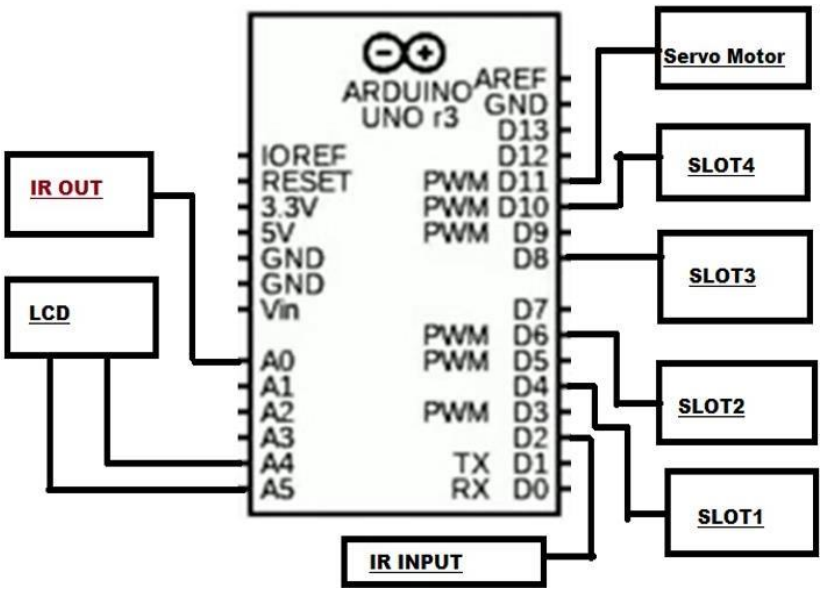

Fig.4.5: Circuit Diagram

4.3 IMPLEMENTATION

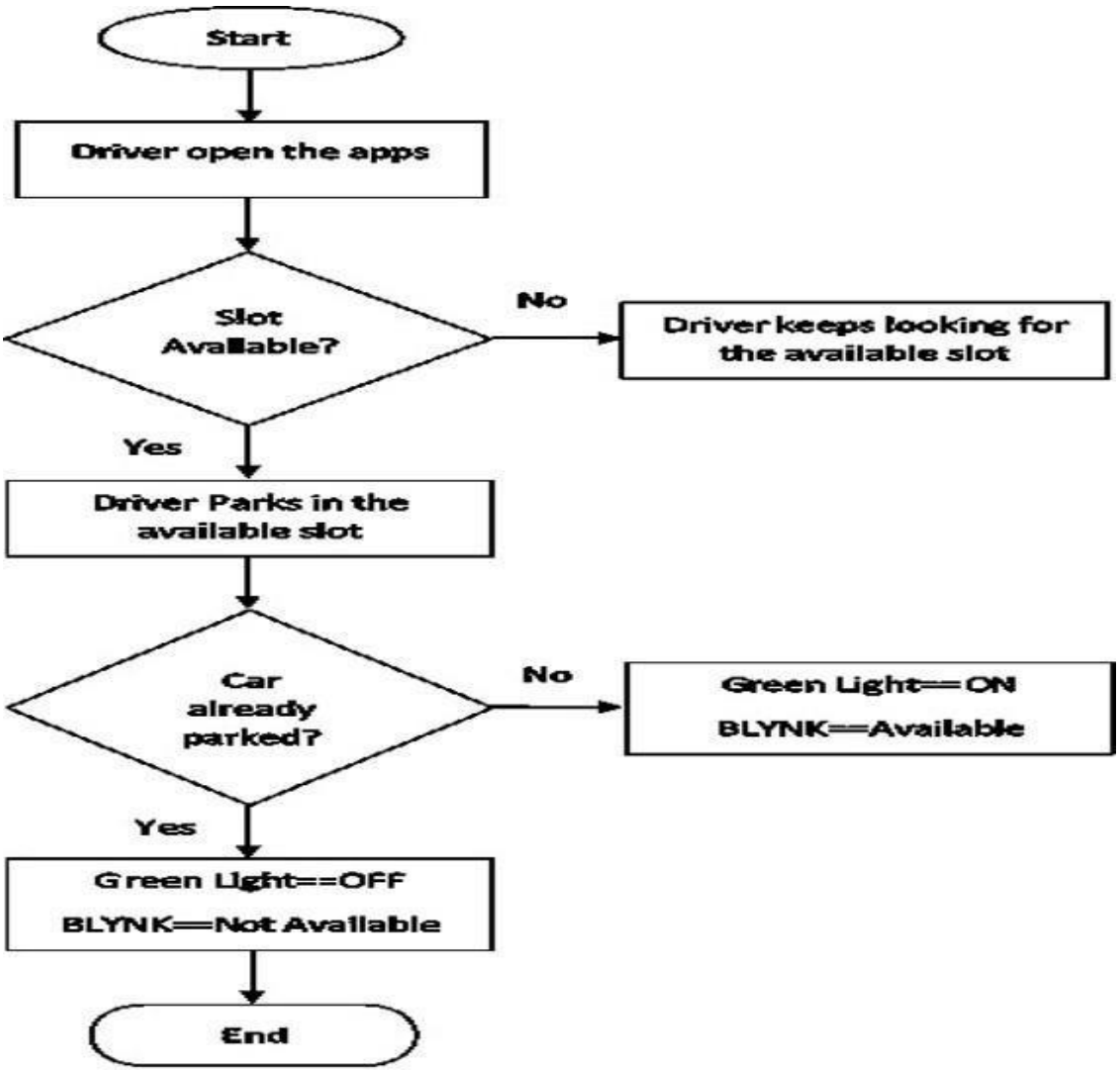

Fig.4.6: Flow Chart of the Proposed System

Below are the steps that a driver needs to follow in order to park its car using our parking system.

Step 1: Install the smart parking application on your mobile device.

Step 2: On the display the number of vacant and filled spots are displayed so that the user can see the status of parking zone.

Step 3: Once the user logs into the app he would see the parking architecture with the cars filled at which position and positions which are empty.

Step 4: When the user is near to the parking IR detect sensor, he would receive a notification on his app on which slot he can park his vehicle if there is a empty slot.

Step 5: If there is no empty slot the user will be displayed with an appropriate message on the mobile application.

Step 6: On successfully un-parking your vehicle from the parking slot the user will receive a message.

4.4 DESIGN OF THE SYSTEM

The picture shows the miniature model of the Automated Car Parking System.

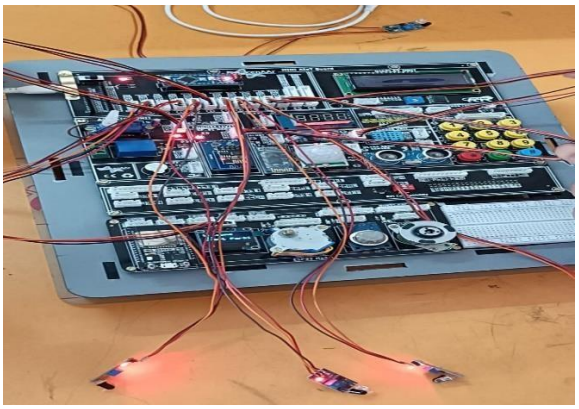

Fig.4.7: Experimental Setup

This model has the capacity of containing four cars. There are two sensors at the entrance to detect the presence of a car before going inside or outside of the parking lot. The other two sensors are plotted inside the parking lot to detect the car individually for each parking slot. A Servo motor has been used at the entrance to open and close the gate according to the signals sent by the sensors through Arduino.

The projection on the screen corresponds to the system model parking slots. This is a real time display regarding the status of the parking lot. As this is a web-based representation, anyone will be able to get the status of the parking lot by visiting the website on the URL through their cell phones, laptops, desktops and other internet supporting devices. The model of the parking lot has four parking slots. Thus, we can park a maximum number of four cars through the system. We have used IR sensors which when vehicle parked will show appropriate message to the user and when all the parking slots are filled then the dc motor would not open gate for the vehicle to be parked.

4.5 SOFTWARE REQUIREMENTS

4.5.1 ARDUINO IDE

The ARDUINO Integrated Development Environment (IDE) is a cross platform application (for windows, MAC, OS, Linux) that is written in functions from C and C++. It is used to write and upload programs to ARDUINO compatible boards, but also, with the help of third-party cores, other vendor development boards. The source code for the IDE is released under the GNU General Public License, version 2. The ARDUINO IDE supports the languages C and C++ using special rules of code structuring. The ARDUINO IDE supplies a software library from the wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main () into an executable cyclic executive program with the GNU tool chain, also included with the IDE distribution. The ARDUINO IDE employs the program AVRDUDE to convert the executable code into a text file in hexadecimal encoding that is loaded into the ARDUINO board by a loader program in the board's firmware. By default, AVRDUDE is used as the uploading tool to flash the user code onto official ARDUINO boards.

With the rising popularity of ARDUINO as a software platform, other vendors started to implement custom open-source compilers and tools (cores) that can build and upload sketches to other microcontrollers that are not supported by ARDUINO's official line of microcontrollers.

The Arduino Integrated Development Environment (IDE) stands as a cornerstone in the realm of microcontroller programming, offering a comprehensive and user-friendly platform for developing software for Arduino-compatible devices. Its significance lies in its ability to simplify the process of writing, compiling, and uploading code to Arduino microcontroller boards, making it accessible to users across a spectrum of skill levels and backgrounds. At its core, the Arduino IDE provides a versatile code editor equipped with essential features tailored for Arduino programming. Within this editor, users can craft Arduino sketches – programs written in the Arduino programming language, which is a variant of C/C++ optimized for Arduino hardware. One of the hallmark features of the Arduino IDE is its syntax highlighting functionality, enhancing code readability by color-coding different elements such as keywords, variables, and comments.

This aids in code comprehensionand debugging, facilitating a smoother programming experience for users. The Arduino IDE further streamlines the development workflow by providing a repository of built-in examples covering a wide array of functionalities andapplications. These examples serve as invaluable learning resources for users, offeringpractical demonstrations of how to interface with various sensors, actuators, and communication modules using Arduino boards. Moreover, the Arduino IDE seamlesslyintegrates with Arduino hardware, allowing users to compile and upload their sketchesdirectly to Arduino boards with ease. The IDE offers support for a diverse range of Arduino-compatible boards, including the popular Arduino Uno, Arduino Nano, Arduino Mega, and many others. This broad compatibility ensures that users can leverage the Arduino IDE across different projects and hardware platforms, fostering versatility and flexibility in their development endeavors.

Beyond its fundamental coding capabilities, the Arduino IDE encompassesa robust ecosystem of plugins, libraries, and extensions that extend its functionality and cater to diverse project requirements. Users can augment the IDE with additional libraries to access pre-written code for specific tasks, simplifying complex operations and accelerating development cycles. Moreover, the Arduino IDE fosters community collaboration and knowledge sharing through its active online forums, where users can seek guidance, share insights, and collaborate on projects with fellow enthusiasts. This vibrant community-driven ethos underpins the ethos of Arduino, democratizing access to technology and empowering individuals to innovate and create.

In conclusion, the Arduino IDE stands as a cornerstone of the Arduino ecosystem, empowering users to unleash their creativity and bring their ideas to life through programming and electronics. Its intuitive interface, robust features, and extensive ecosystem make it an indispensable tool for hobbyists, students, educators, and professionals alike, fostering a culture of exploration, experimentation, and innovation in the world of microcontroller development. Whether embarking on a simple project or tackling a complex endeavor, the Arduino IDE serves as a trusted companion, guiding users on their journey towards realizing their technological aspirations.

4.5.2 INSTALLATION OF IDE

Download the most recent variant from this page: http://arduino.cc/en/Main/Software.

Next, continue with the establishment and please permit the driver establishment process.

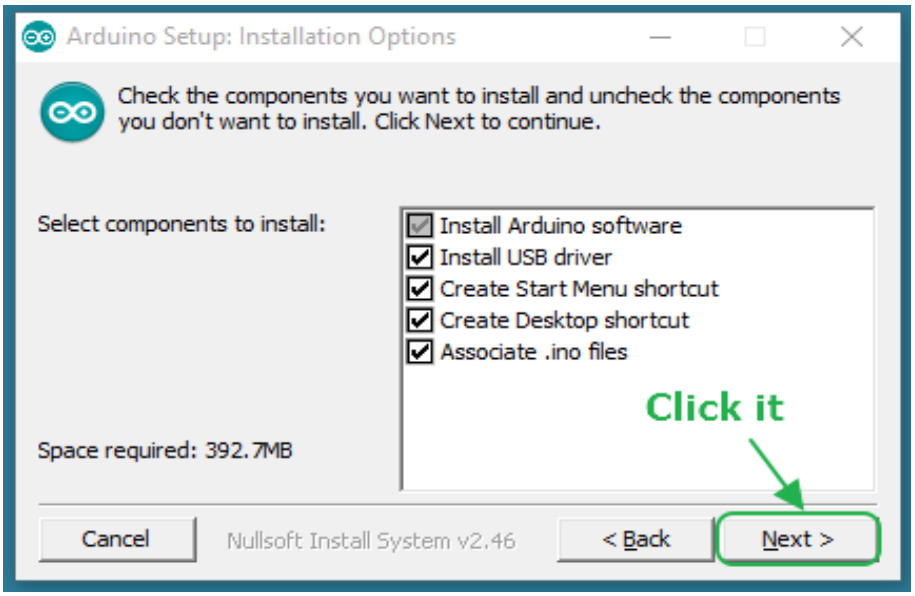

Fig.4.8: ARDUINO Setup-Installation Option

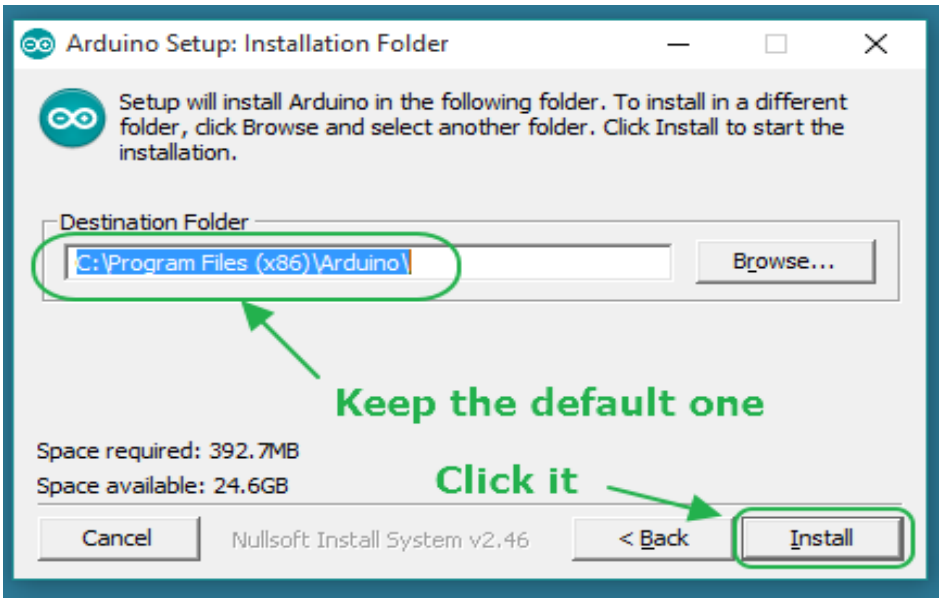

Fig.4.9: ARDUINO Setup Installation Folder

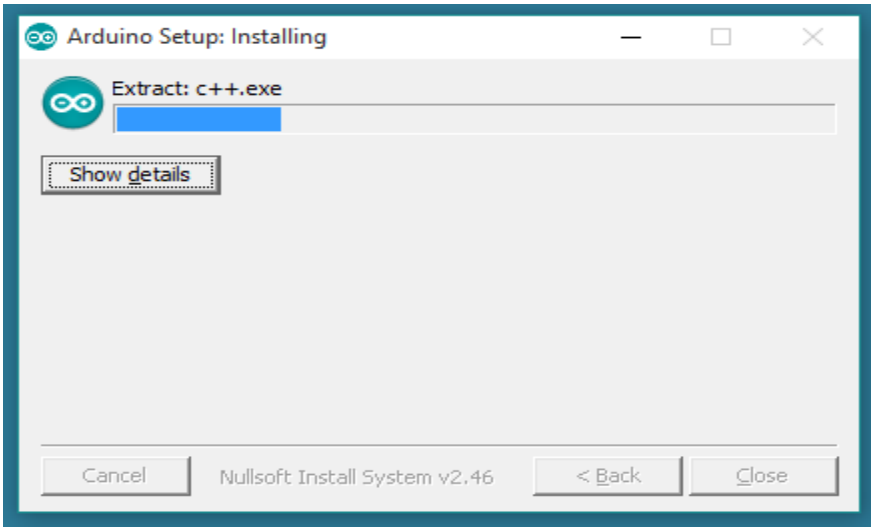

Fig.4.10: ARDUINO Setup Installating

The procedure will separate and introduce all the expected documents to execute legitimately the Arduino Software (IDE).

SELECT YOUR BOARD

1. You'll need to select the entry in the Tools > Open the Boards Manager. Go to Tools > Board > Boards Manager…
2. Search for Arduino nano and press install button.

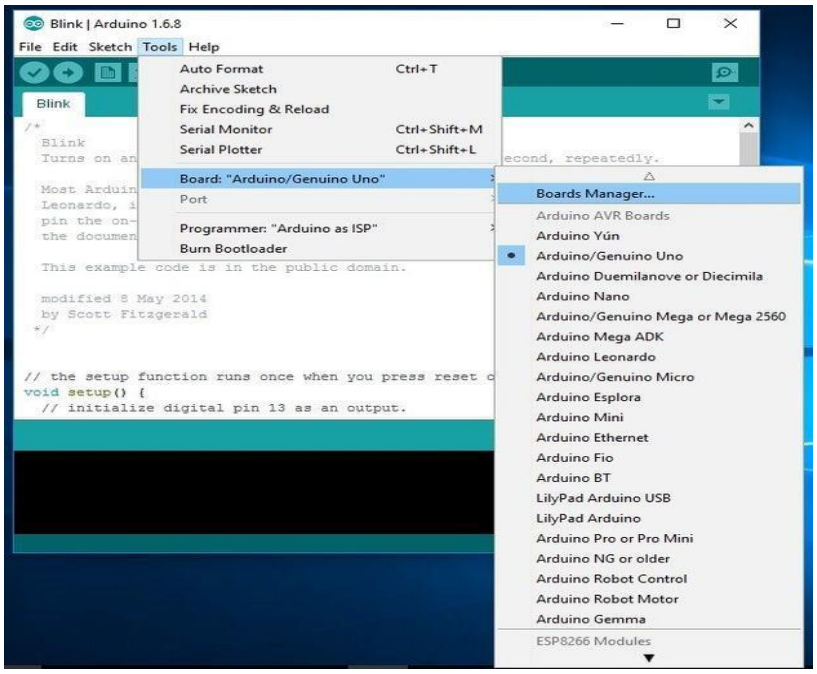

Fig.4.11:Selection of Board

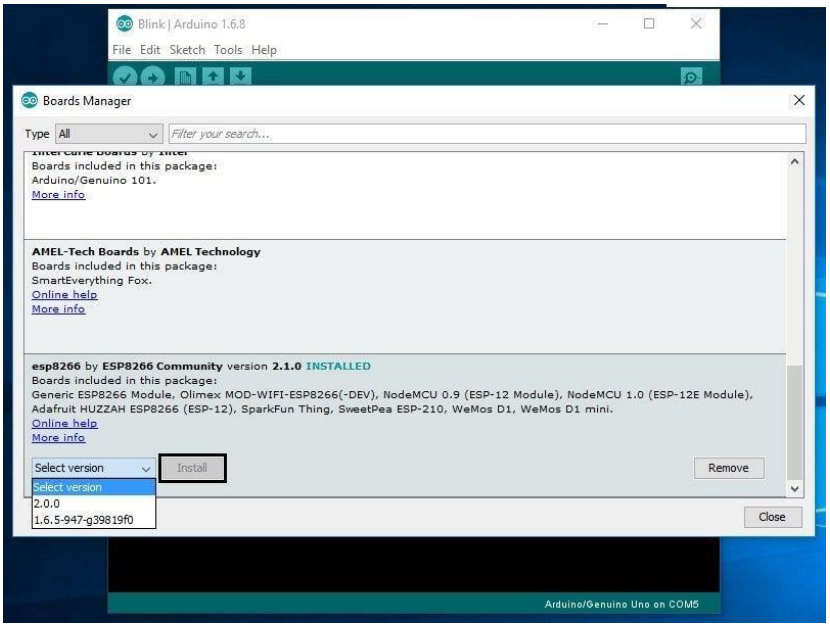

Fig.4.12:ESP8266 Board Package

The Boards Manager window opens, scroll the window page to bottom till you see the module with the name ESP8266. Once we get it, select that module and select version and click on the Install button. When it is installed it shows Installed in the module as shown in the figure and then close the window.

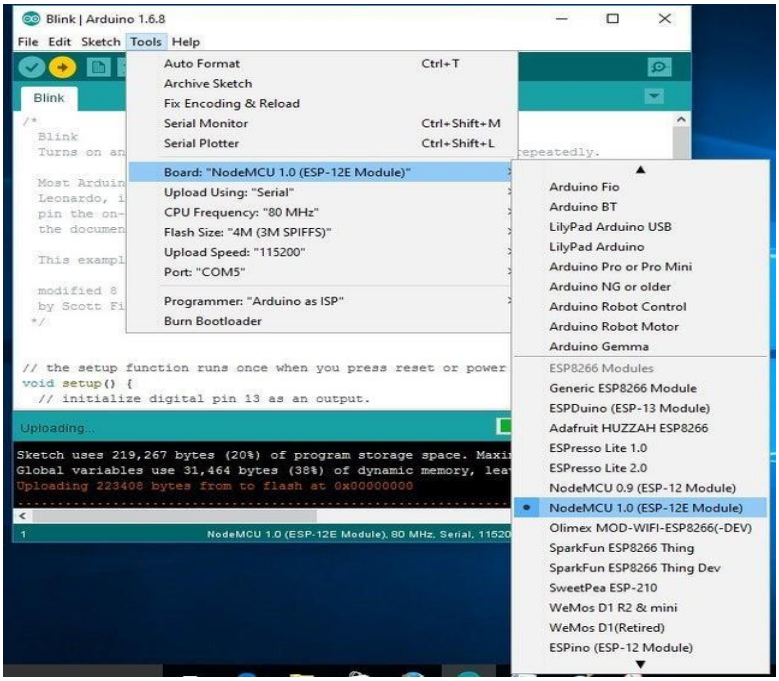

Fig.4.13: Selecting ESP8266 Arduino Board

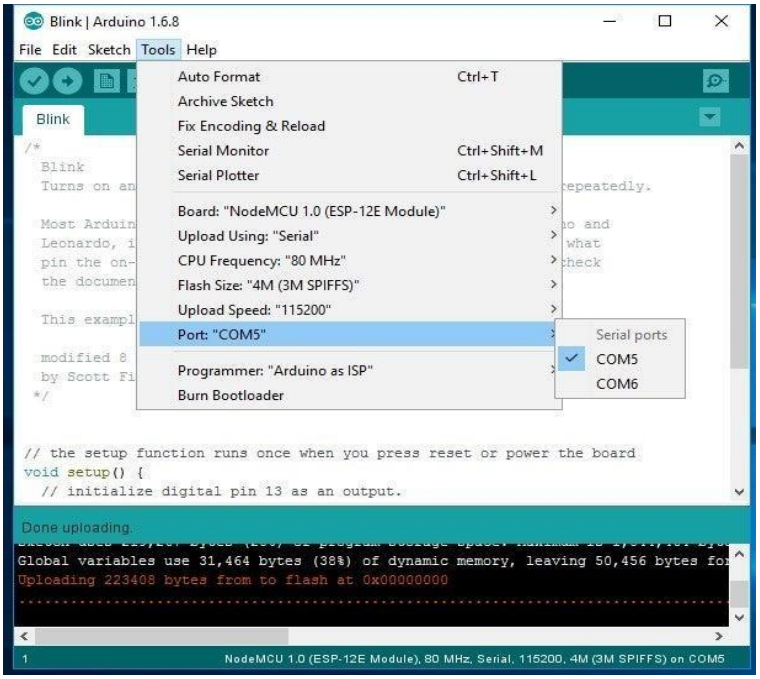

Fig.4.14: Selecting COM Port

The Blink example will open on a new window, click on tools to select the port: "COM" based on which esp8266 module is connected to your respected COM port of the computer.

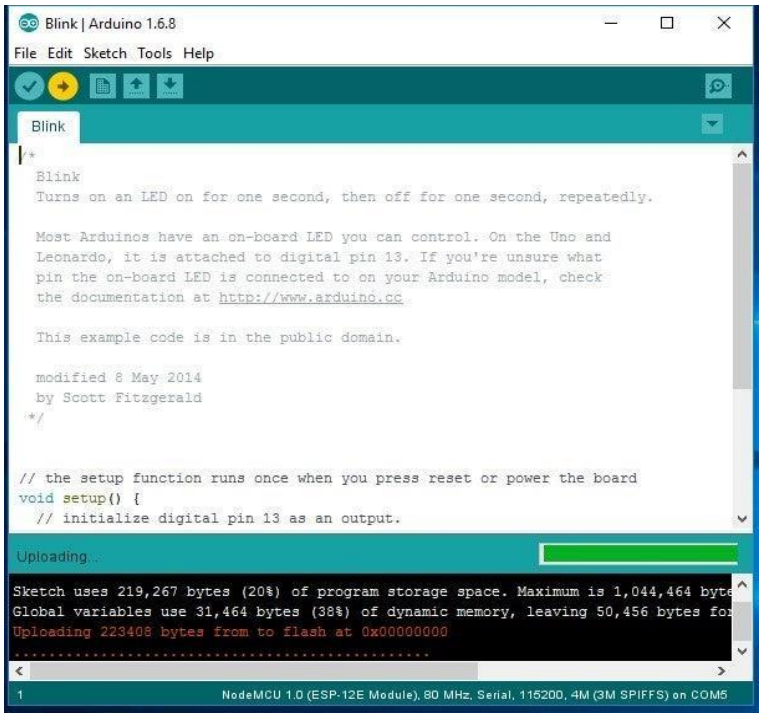

Fig.4.15: Uploading the Program to ESP8266 Module

4.5.3 BLYNK IOT

Blynk is a versatile platform for building IoT (Internet of Things) applications, offering a comprehensive suite of tools and services to connect hardware devices to the internet and control them remotely. Here's an overview of Blynk IoT:

Easy Prototyping: Blynk simplifies the process of prototyping IoT projects by providing a user-friendly drag-and-drop interface to create custom mobile apps for controlling hardware devices. Users can quickly design interactive interfaces without writing any code, making it accessible to beginners and experienced developers alike.

Cloud Connectivity: Blynk provides cloud connectivity services that allow hardware devices to communicate with mobile apps over the internet. This enables remote monitoring and control of IoT devices from anywhere with an internet connection, providing flexibility and convenience for users.

Supported Hardware Platforms: Blynk supports a wide range of hardware platforms, including popular microcontrollers like Arduino, Raspberry Pi, ESP8266, ESP32, and more. This compatibility allows users to choose the hardware that best suits their project requirements and seamlessly integrate it with the Blynk platform.

Widgets and Widgets: Blynk offers a variety of widgets that can be added to the mobile app interface to interact with hardware devices. These widgets include buttons, sliders, gauges, graphs, and more, providing users with flexible control options for their IoT projects.

APIs and Integrations: Blynk provides APIs and integrations that enable seamless integration with third-party services and platforms. This allows users to extend the functionality of their IoT applications by integrating with services like IFTTT, Zapier, Google Sheets, and more.

Security and Privacy: Blynk prioritizes security and privacy, implementing robust encryption and authentication mechanisms to ensure the integrity and confidentiality of data transmitted between devices and the Blynk cloud servers. Users can also configure access control settings to restrict access to their IoT devices.

Overall, Blynk IoT offers a powerful and user-friendly platform for building IoT applications, allowing users to quickly prototype, deploy, and manage their projects with ease. Whether you're a hobbyist, maker, or professional developer, Blynk provides the tools and services you need to bring your IoT ideas to life.

INSTALLING BLYNK IOT APP ON MOBILE DEVICE (ANDROID/IOS):

STEP 1: Download Blynk App: Go to the Google Play Store (for Android) or the App Store (for iOS) on your mobile device.

STEP 2: Search for Blynk: In the search bar, type "Blynk" and locate the Blynk IoT appfrom the search results.

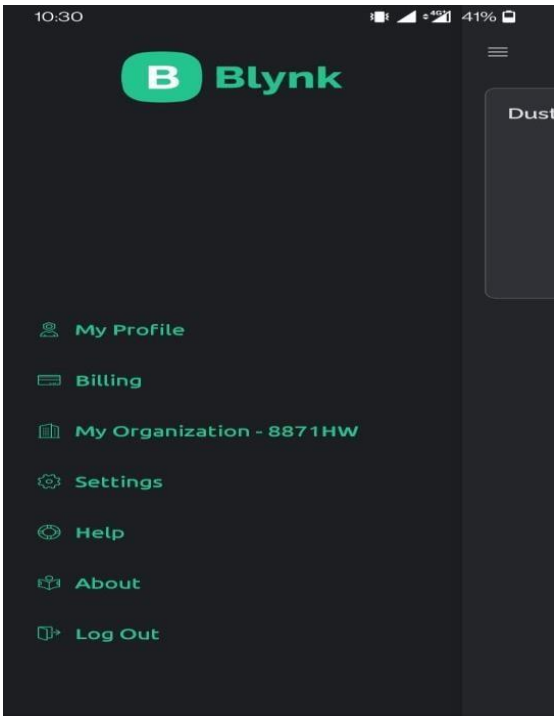

Fig.4.16: Blynk IOT App on Mobile Device

STEP 3: Install Blynk: Tap on the Blynk app icon and then tap the "Install" or"Download" button to install the app on your mobile device.

STEP 4: Open Blynk: Once the installation is complete, open the Blynk app from yourdevice's home screen or app drawer.

INSTALLING BLYNK IOT APP ON WINDOWS LAPTOP:

1. Download Blynk Software: Open your web browser on your windows laptop and go to the Blynk website (https://blynk.io/).
2. Download Blynk for Windows: Navigate to the "Downloads" section of the website and locate the Blynk software for Windows.

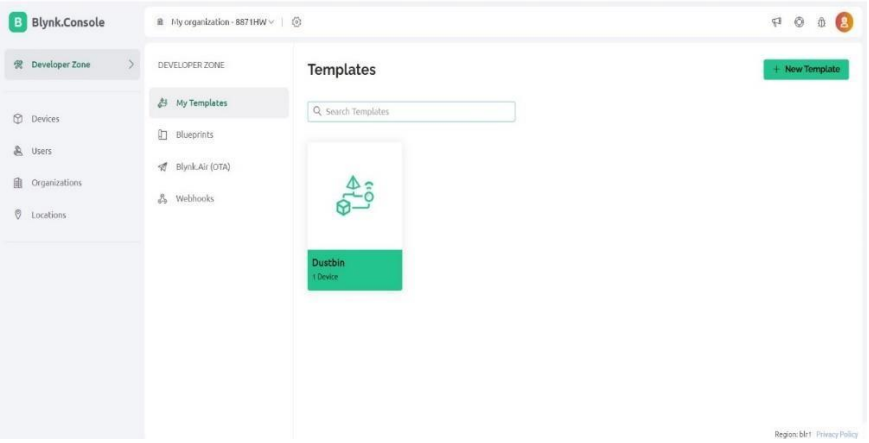

Fig.4.17: Blynk IOT App on Windows Laptop

3. Download and Install: Click on the download link to download the Blynk installer for Windows. Once the download is complete, run the installer to begin the installation process.
4. Follow Installation Instructions: Follow the on-screen instructions provided by the installer to complete the installation of the Blynk software on your windows laptop.

SETTING UP BLYNK ACCOUNT:

1. Create Blynk Account: Open the Blynk app on your mobile device or the Blynk software on your windows laptop.
2. Sign Up: If you don't have a Blynk account, sign up for a new account by providing your email address and creating a password.
3. Verify Email: Check your email inbox for a verification email from Blynk. Click on the verification link in the email to verify your account.
4. Log In: Once your account is verified, log in to the Blynk app or software using your email address and password.

CONNECTING DEVICES:

1. Add New Project: In the Blynk app or software, create a new project by clicking on the "+" icon or the "Create New Project" button.

2. Select Hardware: Choose the hardware platform you're using (e.g., Arduino, ESP8266, Raspberry Pi) and the connection type (Wi-Fi, Bluetooth, USB).

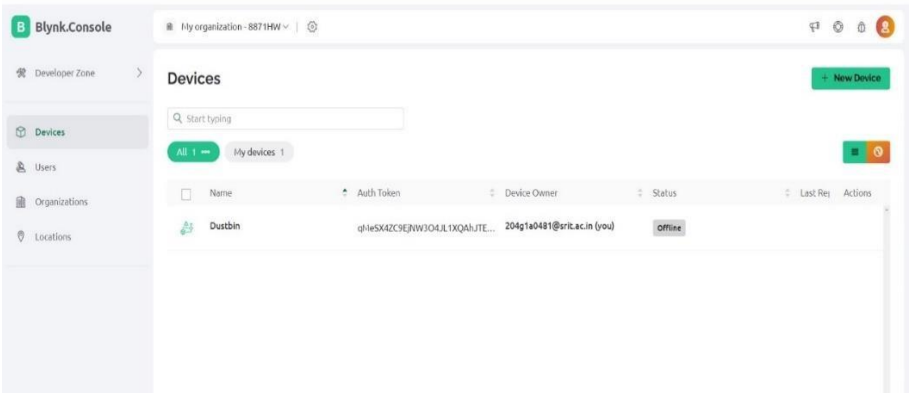

Fig.4.18: Blynk IOT: Connecting Devices

3. Get Auth Token: Blynk will generate an authentication token for your project. Note down this token as it will be used to connect your hardware device to the Blynk cloud server.
4. Configure Hardware: Follow the instructions provided by Blynk to configure your hardware device and connect it to the Blynk cloud server using the authentication token.

USING BLYNK APP/SOFTWARE:

1. Create UI: Design the user interface (UI) for your project by adding widgets like buttons, sliders, gauges, and graphs to control and monitor your hardware devices
2. Customize Controls: Customize the appearance and behavior of each widget according to your preferences and project requirements.
3. Test and Deploy: Test your project within the Blynk app or software to ensure everything is working correctly. Once satisfied, deploy your project to start using it in real-time.

That's a general overview of the process to install and set up the Blynk IoT app on both mobile devices and Windows laptops, as well as how to connect and use Blynk with hardware devices. This system monitors the garbage bins and informs about the level of garbagecollected in the garbage bins via a Blynk IOT platform with the help of Wi-Fi-module.

The web page gives a view of the garbage bins to show the level of garbage collected. Thus, this system helps to keep the city clean by informing about the garbage levels of the bins by providing percentage of the waste in the bins via IOT platform.

CHAPTER 5
RESULTS AND APPLICATIONS

5.1 RESULTS

The deployment of the proposed smart parking system incorporating ESP8266, Arduino IDE, Blynk app, and IR sensors is anticipated to yield several advantageous outcomes. First and foremost, the system promises to enhance the efficient utilization of parking spaces by providing real-time updates on availability. This feature not only minimizes the time spent searching for parking but also reduces congestion within the parking lot, thereby improving overall traffic flow. Additionally, with access control mechanisms in place, the system ensures that entry is permitted only when parking spots are vacant, thereby mitigating overcrowding and potential traffic jams. The integration with the Blynk app offers users convenient access to parking information, allowing them to check availability remotely and even reserve spots in advance, leadingto an enhanced user experience. Moreover, the system enables parking operators to remotely monitor and manage the facility, facilitating proactive interventions and timely maintenance. Ultimately, by leveraging IoT technologies and mobile applications, the smart parking system provides a modern, efficient, and user-centric solution to parking management challenges, promising benefits in terms of efficiency,convenience, and cost-effectiveness for both operators and users alike.

So, we got the below results of this project named “SMART PARKING MANAGING SYSTEM USING IOT”.

Parking a vehicle

1. Opening the gate when vehicle is detected using IR Sensor at Entrance of Parking area.

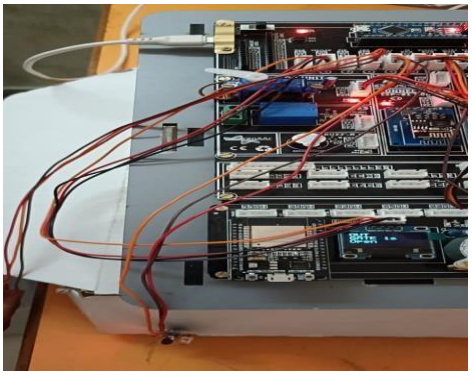

Fig.5.1: Gate is opened

2. After entering the vehicle, it is parked in selected slot then the filled slot is displayed in both LCD and blynk app.

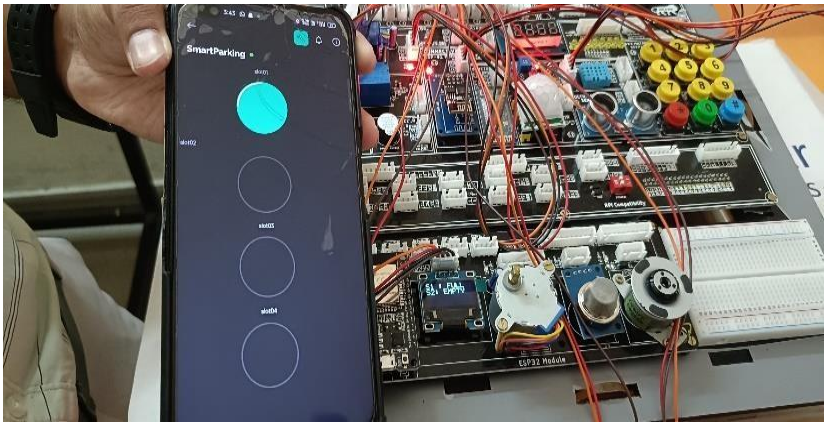

Fig. 5.2: Showing Slot- 1 is Filled in Both LCD and Blynk app

3. In a situation when all the slots are filled and a new vehicle comes near to the vehicle detecting sensor, then it displays that all slots are filled and gate is closed i.e it do not allow vehicles to parking area.

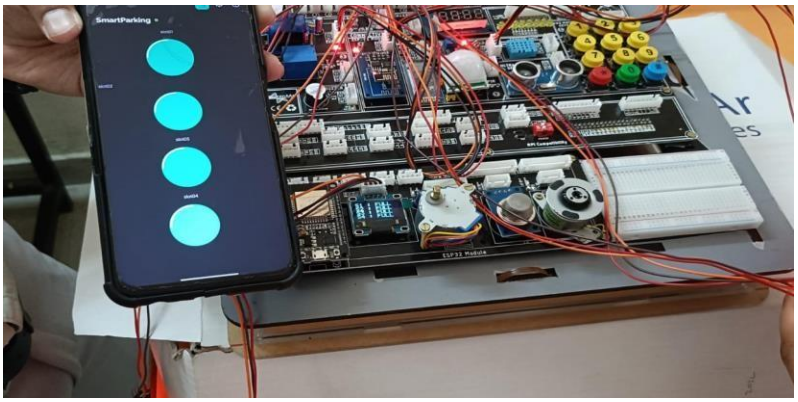

Fig.5.3: Displaying all the Slots are filled

4.Unparking your vehicle from the parking slot would pop a notification on the application app stating that Gate is open to leave and after leaving the parking zone it displays that gate is closed.

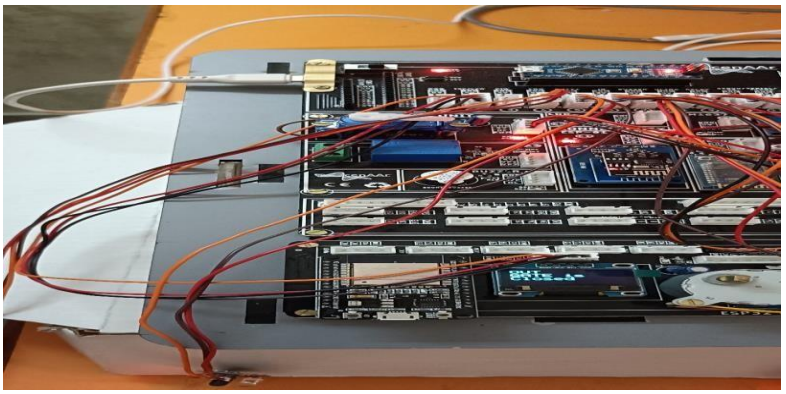

Fig.5.4: Displaying Gate is Closed

5.2 APPLICATIONS:

Smart parking systems offer a range of applications across various industries and environments, providing innovative solutions to parking management challenges. Some key applications include:

URBAN AREAS: In densely populated urban areas, smart parking systems help alleviate parking congestion and streamline traffic flow. By providing real-time information about parking availability, these systems enable drivers to quickly locate vacant spots, reducing traffic congestion and emissions caused by circling vehicles.

COMMERCIAL CENTERS: Shopping malls, office complexes, and retail centers can benefit from smart parking systems by offering customers a more convenient parking experience. Real-time availability updates allow visitors to plan their trips more efficiently, enhancing customer satisfaction and loyalty.

TRANSPORT HUBS: Airports, train stations, and bus terminals often face challenges in managing parking for travelers. Smart parking systems can optimize space utilization, improve traffic flow, and provide travelers with real-time information on available parking options, reducing stress and enhancing the overall travel experience.

HEALTHCARE FACILITIES: Hospitals and medical centers can benefit from smart parking systems to manage parking for patients, visitors, and staff more effectively. Real-time updates on parking availability help reduce wait times, improve access to healthcare services, and enhance the overall patient experience.

EVENT VENUES: Stadiums, concert halls, and conference centers experience fluctuations in parking demand during events. Smart parking systems can dynamically adjust parking availability based on demand, ensuring efficient use of parking space and minimizing traffic congestion during peak periods.

CONCLUSION & FUTURE WORK

CONCLUSION

The concept of Smart Cities has always been a dream for humanity. Since the past couple of years ago large advancements have been made in making smart cities a reality. The growth of Internet of Things and Cloud technologies have given rise to new possibilities in terms of smart cities. Smart parking facilities and traffic management systems have always been at the core of constructing smart cities. In this project, we address the issue of parking and present an IoT based Cloud integrated smart parking system. The system that we propose provides real time information regarding availability of parking slots in a parking area. Users from remote locations can able toknow about the parking slots in different areas. The efforts made in this project are intended to improve the parking facilities of a cityand thereby aiming to enhance the quality of life of its people.

FUTURE WORK

The future of smart parking systems is expected to be significantly influencedby the arrival of automated vehicles (AVs). Several cities around the world are already beginning to trial self -parkingvehicles, specialized AV parking slots and robotics parking valets. This project can be enhanced for tracking vehicle speed on the roads. Developing a smart parking solution within a city solves pollution problem. Addition of Machine learning to store various other information of the vehiclelike its color, design and number which would further add security.

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APPENDIX

```
#define BLYNK_PRINT Serial

#define BLYNK_TEMPLATE_ID "TMPL3-a9JRmeu"
#define BLYNK_TEMPLATE_NAME "SmartParking"
#define BLYNK_AUTH_TOKEN "WNjD5tfFgrtg9EfACMYJ9qFt3m4_MSgH"

#include <Servo.h>
#include <GyverOLED.h>



#include <ESP8266_Lib.h>
#include <BlynkSimpleShieldEsp8266.h>

// Your WiFi credentials.
// Set password to "" for open networks.
char ssid[] = "Realmee";
char pass[] = "20202020";

const int ir_pin = 2;
const int ir1 = 4;
const int ir2 = 6;
const int ir3 = 8;
const int ir4 = 12;
const int ir_out =  A0;
Servo servo;
GyverOLED<SSD1306_128x64, OLED_NO_BUFFER> oled;

// Hardware Serial on Mega, Leonardo, Micro...
#define EspSerial Serial

// or Software Serial on Uno, Nano...
//#include <SoftwareSerial.h>
```

```
//SoftwareSerial EspSerial(2, 3); // RX, TX

// Your ESP8266 baud rate:
#define ESP8266_BAUD 115200
ESP8266 wifi(&EspSerial);
void setup() {
  // put your setup code here, to run once:
  Serial.begin(115200);
  pinMode(ir_pin, INPUT);
  pinMode(ir1, INPUT);
  pinMode(ir2, INPUT);
  pinMode(ir3, INPUT);
  pinMode(ir4, INPUT);
  pinMode(ir_out, INPUT);
  servo.attach(11);
  oled.init();
  oled.clear();
  oled.setCursor(0, 0);
  oled.setScale(2);
  oled.println("Welcome ");
  oled.setCursor(5, 2);
  oled.println("To");
  oled.setCursor(0, 4);
  oled.println("Smart Parking");
  Blynk.begin(BLYNK_AUTH_TOKEN, wifi, ssid, pass);
  delay(5000);
}

void loop() {
  // put your main code hre, to run repeatedly:
  Blynk.run();
  oled.clear();
  int irin = digitalRead(ir_pin);
  int slot1 = digitalRead(ir1);
```

```
 int slot2 = digitalRead(ir2);
 int slot3 = digitalRead(ir3);
 int slot4 = digitalRead(ir4);
 int out = digitalRead(ir_out);
 Serial.println("IN :" + String(irin));
 Serial.println("Slot 1 :" + String(slot1));
 Serial.println("Slot 2 :" + String(slot2));
 Serial.println("Slot 3 :" + String(slot3));
 Serial.println("Slot 4 :" + String(slot4));
 Serial.println("OUT :" + String(out));

 if(irin == 0){
  oled.setCursor(0, 0);
  oled.setScale(2);
  oled.println("Gate is Open");
  servo.write(180);
  delay(1000);
  servo.write(0);
  oled.clear();
  oled.setCursor(0, 0);
  oled.setScale(2);
  oled.println("Gate is closed");
  while(digitalRead(ir_pin) == 0);
 }

 if(out == 0){
  oled.setCursor(0, 0);
  oled.setScale(2);
  oled.setCursor(0, 0);
  oled.println("OUT");
  oled.println("GATE is");
  oled.println("Open");
  servo.write(180);
  delay(1000);
```

```
  servo.write(0);
  oled.clear();
  oled.setCursor(0, 0);
  oled.println("OUT");
  oled.println("GATE is");
  oled.println("Closed");
  //oled.println("Gate is closed");
  while(digitalRead(ir_out) == 0);
 }

 if(slot1 == 0){
  oled.setCursor(0, 0);
  oled.setScale(2);
  oled.println("S1 : FULL");
  Blynk.virtualWrite(V0, 1);
 }else{
  oled.setCursor(0, 0);
  oled.setScale(2);
  oled.println("S1: EMPTY");
  Blynk.virtualWrite(V0, 0);
 }
 if(slot2 == 0){
  oled.setCursor(0, 2);
  oled.setScale(2);
  oled.println("S2 : FULL");
  Blynk.virtualWrite(V1, 1);
 }else{
  oled.setCursor(0, 2);
  oled.setScale(2);
  oled.println("S2: EMPTY");
  Blynk.virtualWrite(V1, 0);
 }
 if(slot3 == 0){
  oled.setCursor(0, 4);
```

```
    oled.setScale(2);
    oled.println("S3 : FULL");
    Blynk.virtualWrite(V2, 1);
   }else{
    oled.setCursor(0, 4);
    oled.setScale(2);
    oled.println("S3: EMPTY");
    Blynk.virtualWrite(V2, 0);
   }
   if(slot4 == 0){
    oled.setCursor(0, 6);
    oled.setScale(2);
    oled.println("S4 : FULL");
    Blynk.virtualWrite(V3, 1);
   }else{
    oled.setCursor(0, 6);
    oled.setScale(2);
    oled.println("S4: EMPTY");
    Blynk.virtualWrite(V3, 0);
   }
   delay(1000);
}
```

1st INTERNATIONAL CONFERENCE ON DATA ANALYTICS AND INTELLIGENCE COMPUTING-2024 (ICDAIC'24)

CERTIFICATE OF PARTICIPATION

This is to certify that Prof./Dr./Mr./Ms. **B. UDAY KUMAR REDDY** of **SRINIVASA RAMANUJAN INSTITUTE OF TECHNOLOGY** has presented a paper titled **SMART PARKING MANAGING SYSTEM USING IOT** in 1st International Conference on Data Analytics and Intelligence Computing organized by the Department of Artificial Intelligence and Data Science, Velammal Institute of Technology, Chennai, TamilNadu, India on April 06, 2024.

COORDINATORS
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