VISVESVARAYA TECHNOLOGICAL UNIVERSITY

Jnana Sangama, Belgaum-590018

A PROJECT REPORT **(15CSP85)** ON

"SMART PARKING SYSTEM"

Submitted in Partial fulfillment of the Requirements for the Degree of

Bachelor of Engineering in Computer Science & Engineering

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CERTIFICATE

Certified that the project work entitled **" SMART PARKING SYSTEM "** carried out by **Mr. RAJ MANI**, USN **1CR16CS124**, **Mr. VAGISH V BHAT** , USN **1CR16CS174** , bonafide students of CMR Institute of Technology, in partial fulfillment for the award of **Bachelor of Engineering** in Computer Science and Engineering of the Visveswaraiah Technological University, Belgaum during the year 2019-2020. It is certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in the Report deposited in the departmental library.

The project report has been approved as it satisfies the academic requirements in respect of Project work prescribed for the said Degree.

Ms Navaneetha M	**Dr. Prem Kumar Ramesh**	**Dr. Sanjay Jain**
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DECLARATION

We, the students of Computer Science and Engineering, CMR Institute of Technology, Bangalore declare that the work entitled " **SMART PARKING SYSTEM** " has been successfully completed under the guidance of Asst Prof. Ms. Navaneetha M, Computer Science and Engineering Department, CMR Institute of technology, Bangalore. This dissertation work is submitted in partial fulfillment of the requirements for the award of Degree of Bachelor of Engineering in Computer Science and Engineering during the academic year 2019-2020. Further the matter embodied in the project report has not been submitted previously by anybody for the award of any degree or diploma to any university.

Place: Bengaluru

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Team members:

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ABSTRACT

The project entitled SMART PARKING SYSTEM using Iot , the major motivation of this project is to reduce the traffic congestion in roads, multi-storeyed 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 and book a parking slot accordingly. The paper also describes a high-level view of the system architecture. Towards the end, the paper discusses the working of the system in form of a use case that proves the correctness of the proposed model.

ACKNOWLEDGEMENT

I take this opportunity to express my sincere gratitude and respect to **CMR Institute of Technology, Bengaluru** for providing me a platform to pursue my studies and carry out my final year project

I have a great pleasure in expressing my deep sense of gratitude to **Dr. Sanjay Jain,** Principal, CMRIT, Bangalore, for his constant encouragement.

I would like to thank **Dr.Prem Kumar Ramesh,** HOD, Department of Computer Science and Engineering, CMRIT, Bangalore, who has been a constant support and encouragement throughout the course of this project.

I consider it a privilege and honor to express my sincere gratitude to my guide **Ms. Navaneetha M, Assistant Professor,** Department of Computer Science and Engineering, for the valuable guidance throughout the tenure of this review.

I also extend my thanks to all the faculty of Computer Science and Engineering who directly or indirectly encouraged me.

Finally, I would like to thank my parents and friends for all their moral support they have given me during the completion of this work

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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.

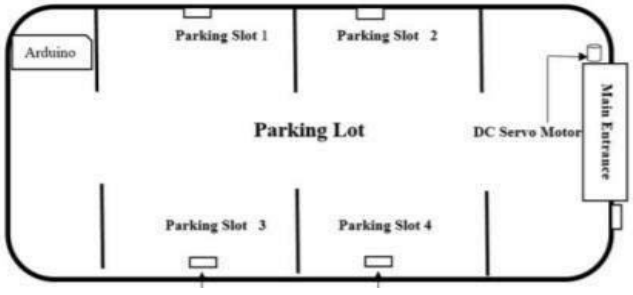


Fig 1.1 Shows the block diagram of smart parking system

1.2 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.

1.3 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.

1.4 Scope of the project

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.

1.5 Methodology

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 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. 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.

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.

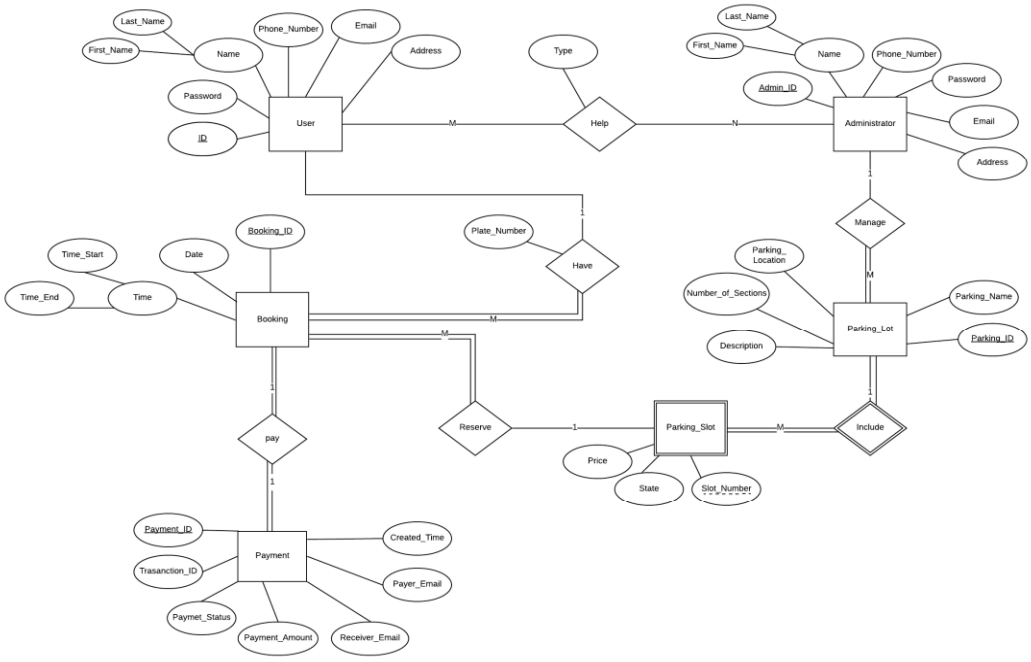


Fig 2.1 Entity Relationship Diagram of Smart Parking System

[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 develop an 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 consumption by 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 the following 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).

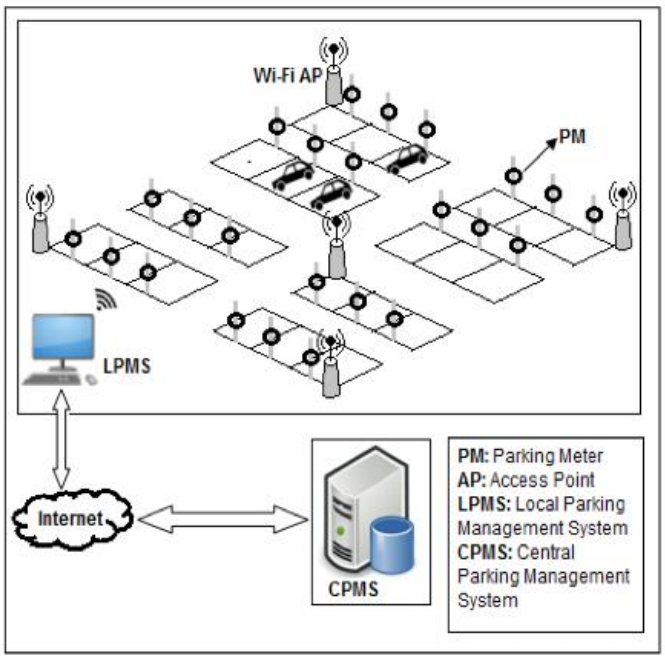


Fig 2.2 Network Architecture of proposed System

[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 the people 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 find the 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 distances and paying extra money. An application based approach consist of the applications which provides the parking slots for the particular locality for example .The application named ‘Parking Panda ’ provides the parking slots to the areas like stadium, sports leagues etc.

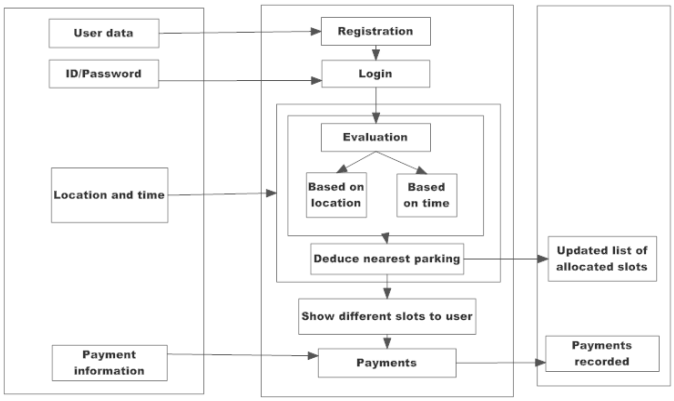


Fig 2.3 Block Diagram of parking system

[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 the demand in trading but one of the problems created by road traffic is "parking". To park all 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 displays the 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 available

at that time than drivers will start searching for another parking zone so that this process is 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 are also included like e- wallet, debit card, credit card from which the user can pay. Penalty will 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 to embedded web-server. It thereby displays the information on a LED screen with which the user can check for empty vehicle slots . Also image capturing devices are used for continuously 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 which is not feasible . Finding a parking slot in a congested city is very hard. In many cases people go to a parking station and they find it full and there is no space available for

parking. Then in search of parking space they have to again roam with their vehicle to find available parking.

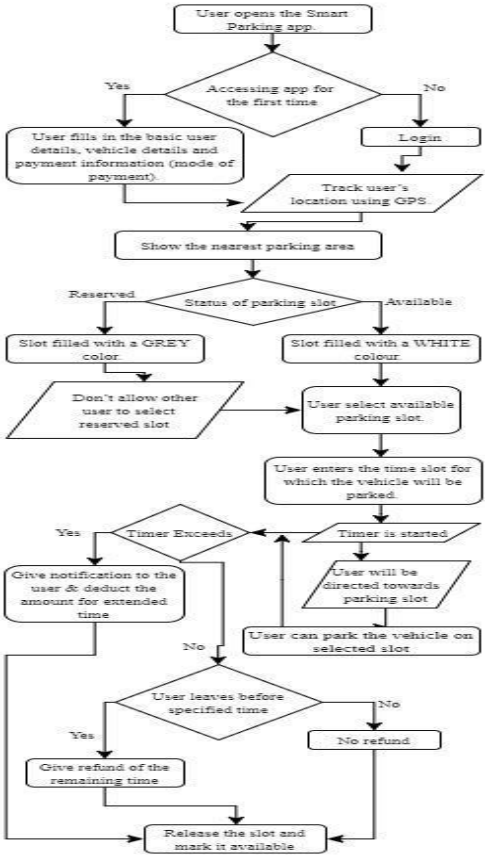


Fig 2.4 Flow chart of Smart Parking System

[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 is expensive, 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 extend the battery lifetime and increase the vehicle detection accuracy, a parking sensor system has been proposed. While power management technique has been implemented to optimize energy consumption, high occupancy monitoring accuracy is achieved using two-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 significant progress, smart parking payment is rarely studied in smart parking research . Yet, there are 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 parking has 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 a smart 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 benefits in terms of detection and payment reliability, and reduced expense by reducing the system complexity and installation, and extending batteries lifetime through the reduction of the system power consumption.

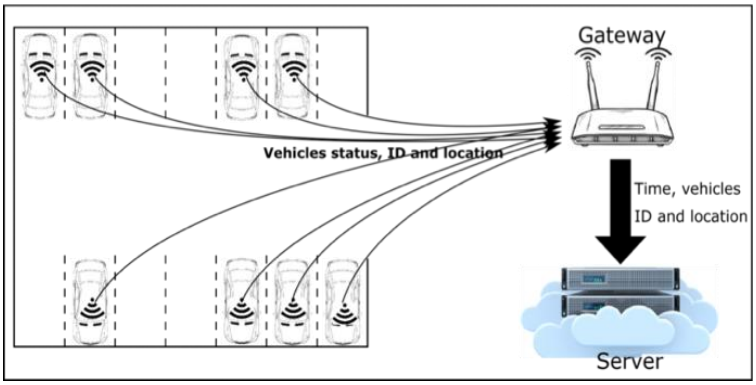


Fig. 2.5. Proposed system architecture; wireless occupancy sensor; wireless gateway; data storage and processing unit.

Table 2.1 Summary of the Approaches

Approaches	
It deals with saving financial cost by developing the system in the most efficient manner .	Keeps a count on number of vacant spots and prior booking.
Real time monitoring vehicle occupancy	Displays appropriate message
Android app for providing all parking	Specifying every minute

details to the user.	information to the user using android application .

CHAPTER 3

SYSTEM REQUIREMENTS SPECIFICATION

3.1 Functional Requirement

Functional Requirement defines a function of a software system and how the system must behave when presented with specific inputs/or conditions. These may include calculations, data manipulation and processing and other specific functionality. In these systems following are the functional requirements

- The application should not display in-appropriate message for valid conditions.
- The application must not stop working when kept running for even a long time.
- The application should process information for any kind of input case.
- The application should generate the output for a given input test case .

3.2 Non-Functional Requirement

Non-functional requirements are the requirements which are not directly concerned with the specific function delivered by the system. They specify the criteria that can be used to judge the operation of a system rather than specific behaviours.

Given below are the non-functional requirements:

- Product requirements
- Organizational requirements
- Basic operational requirements

3.3 Hardware Specifications

- ENODE MCU (ESP8266)
- JUMPER WIRES
- INFRARED SENSORS
- 16*2 LED DISPLAY
- DC MOTOR

3.4 Software Specification

- ARDUINO IDE

CHAPTER 4

SYSTEM ANALYSIS AND DESIGN

4.1 Node Mcu

The NodeMCU as shown in Fig 4.1has assimilated TCP/IP protocol that can give any microcontroller entrance to the Wi-Fi network that supports 2.4 GHz Wi-Fi (802.11 Wi-Fi standards).

NodeMCU is capable of either connecting to an existing wireless connection or hosting an application over http protocol. Each Node MCU module comes pre-programmed with an AT command set firmware which means one can simply link this up to your Raspberry Pi device and get about like Wi-Fi shield.

The reason why we use node mcu is that it is more cost-efficient with respect to Arduino uno , in Arduino we have to use ethernet shield which provides us secure ethernet connectivity whereas all these features are provided by node mcu and it also comes with a updated feature of wi-fi , where you can power or connect your system by Wi-Fi .

Fig. 4.1. Node MCU Module

4.2 16*2 LCD Display

An LCD is an electronic display module which uses liquid crystal to produce a visible image. The 16×2 LCD display is a very basic module commonly used in DIY's and circuits. The 16×2 translates o a display 16 characters per line in 2 such lines. In this LCD each character is displayed in a 5×7 pixel matrix. The 16*2 display 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 .

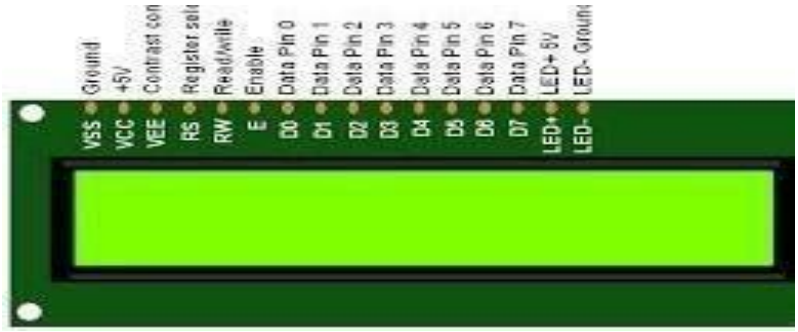


Fig 4.2 16*2 LCD DISPLAY

4.3 IR sensor

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 .

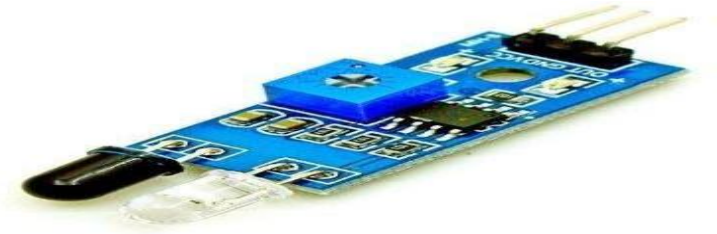


Fig 4.3 IR sensor

4.4 System Architecture

The below diagram shows the pin diagram of our model. It consists of one node mcu , one dc motor , one 16*2 LCD display and three IR sensors .The node mcu is the brain of our system which powers all the other devices .The 16*2 LCD display is powered by node mcu by connecting jumper wires from the display to node mcu . The DC 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 Node mcu.

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 .

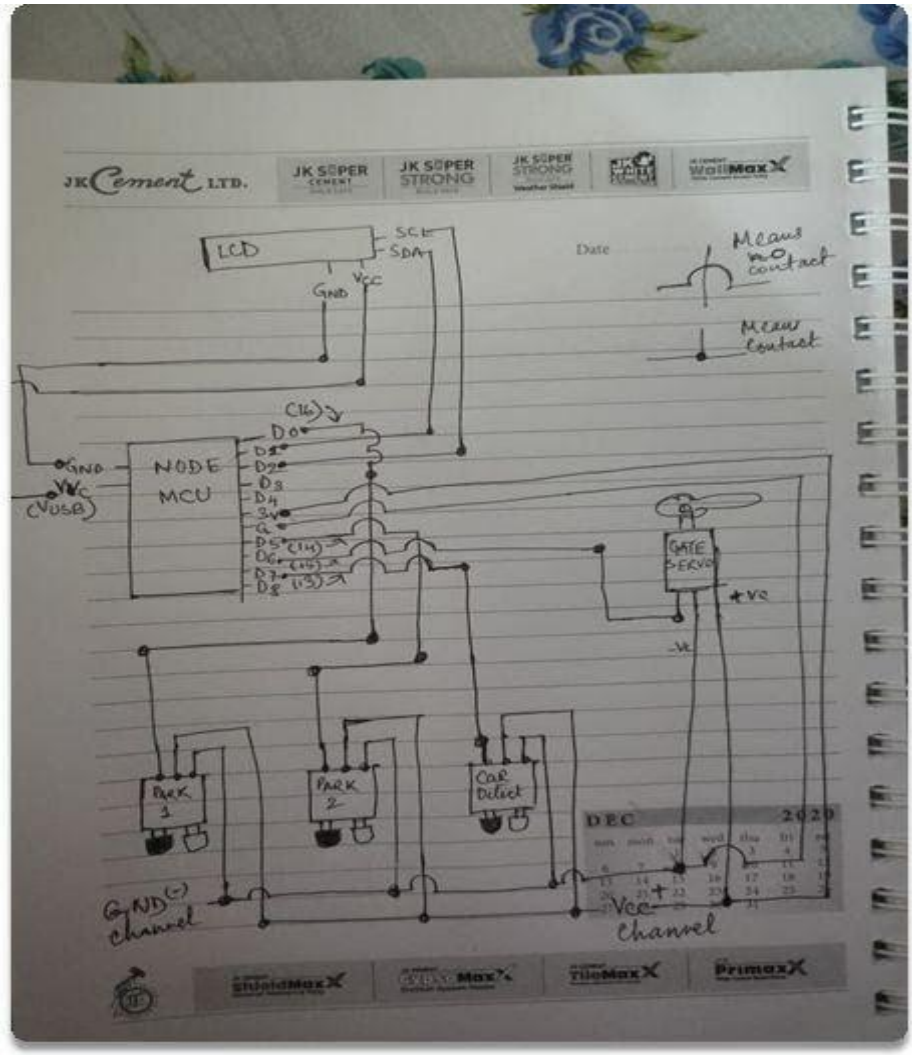


Fig 4.4 Circuit Diagram

CHAPTER 5

IMPLEMENTATION

5.1 Flowchart of the System

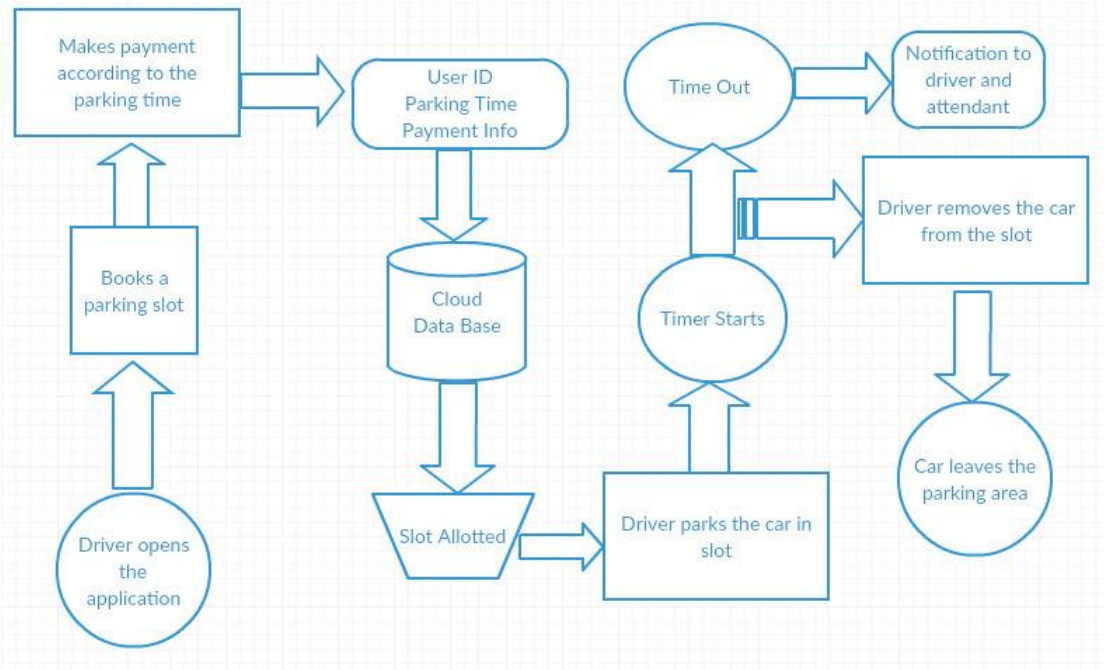


Fig 5.1 Flow Chart of the System

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 16*2 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 availability of parking area and user parking into the respective slot he/she would receive a message which states the start time of the parking and the slot in which he/she has parked.

Step 7: On successfully un-parking your vehicle from the parking slot the user will receive a message which states the start time and end time of his parking time and an amount which he needs to pay for the parking duration.

5.2 Design of the System

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

Fig 5.2 Experimental Setup

This model has the capacity of containing two 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 DC 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 two parking slots. Thus, we can park a maximum number of two cars through the system.

We have used two IR sensors which when vehicle parked will show appropriate message to the user and when all the parking slots the dc motor would not open gate for the vehicle to be parked. Displaying of appropriate message for any action which takes place in the parking zone is done effectively and efficiently .

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 .

CHAPTER 6

RESULTS AND DISCUSSION

6.1 Initial Setup

- The below diagram shows the initial case of the system when we turn on our project ,which indicates the number of vacant and filled spots on a 16*2 display LCD and similarly on the Blynk app.

Fig 6.1 Shows both parking slot empty

6.2 Parking a vehicle

- The below diagram shows the status of the parking zone when a single vehicle is parked in the parking zone. 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 .

Fig 6.2 When one parking spot is filled

6.3 Unparking a vehicle

- 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 .

Fig 6.3 Unparking Vehicle

6.4 No available parking slots

- In a situation when all the slots are filled and a new vehicle comes near to the vehicle detecting sensor ,the below message is popped on the user screen which displays that there are no parking slots available and the user can move his parking vehicle away from the parking zone .

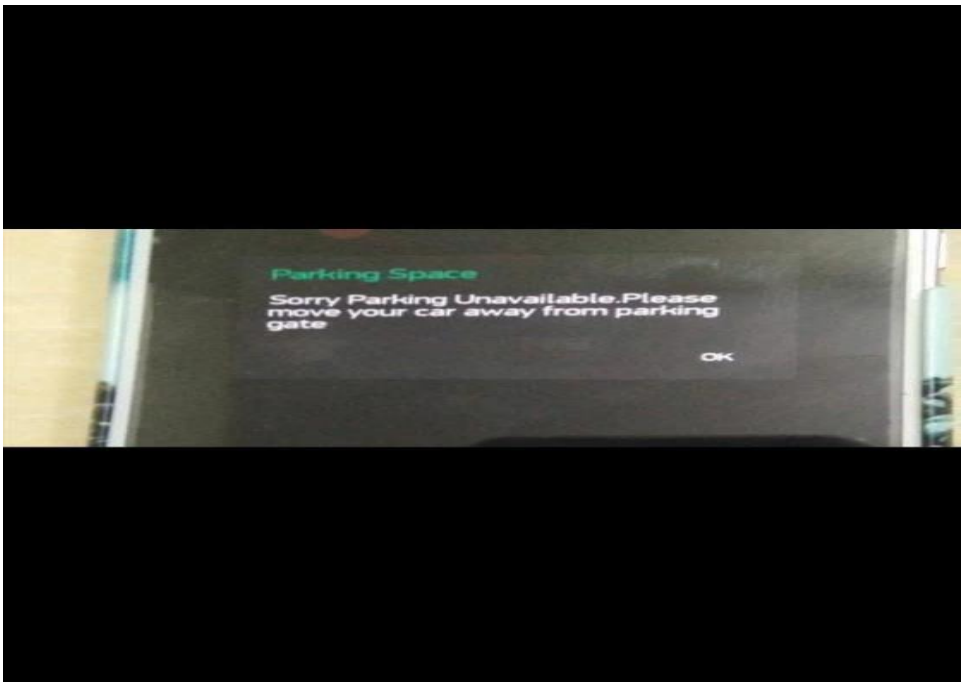


Fig 6.4 When there are no empty slots

CHAPTER 7

TESTING

Different cases have been explained and showed through the pictures in the following sections. All those two pictures correspond to each other while occurring at an event.

Case One

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.

Fig 7.1 Shows both parking slot empty on the model

Fig 7.2 App view of the parking system

Case Two

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 the start time of his parking.

Fig 7.3 Case of one parking slot filled on the model

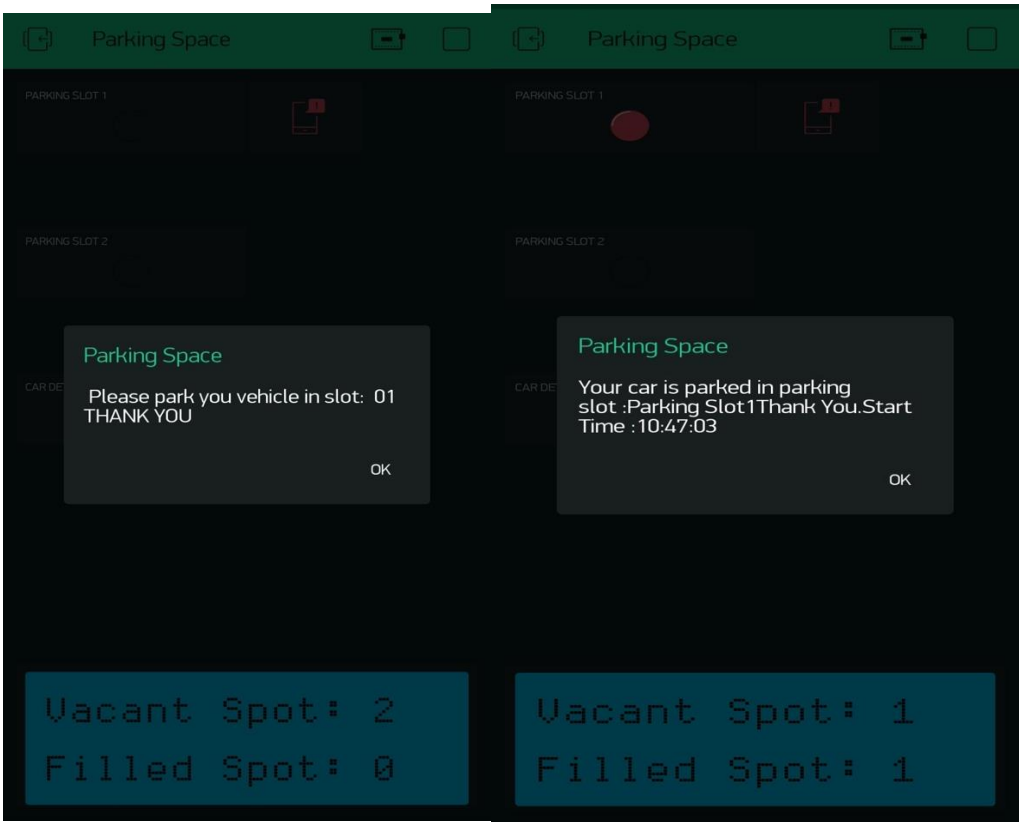
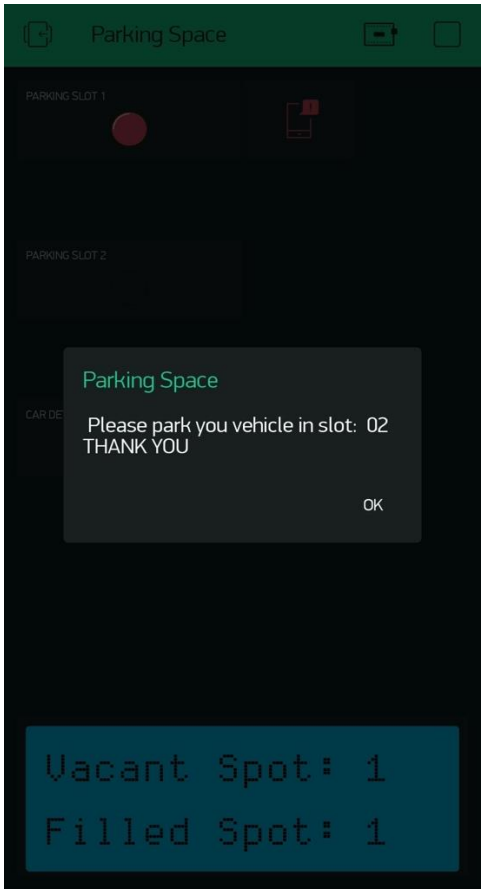
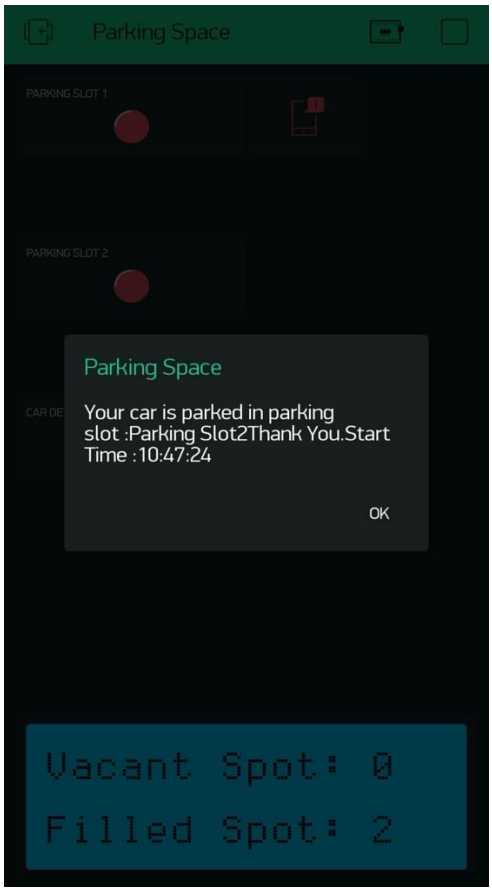


Fig 7.4 Shows the app view of vacant and filled spot

Case Three

This following case shows the app view and the model view when one slot is filled and an another vehicle turns up to the vehicle detect sensor . The DC motor then opens the gate for the user ,and at that point of time the user receives a message specifying in which slot he can park his vehicle . On successfully parking his vehicle in the slot he would receive a notification stating his start time of parking and the respective slot number in which he has parked his vehicle .





Case Four

This following case shows about unparking details where an user when unparks his vehicle from the parking slot he would be displayed with an appropriate message consisting of start time and end time of his parking. The user would be simultaneously allowed to pay a small amount which will be displayed on the application . On successfully unparking his vehicle the same would be updated in the count of 16*2 display

Fig 7.5 User unparking his vehicle from the slot

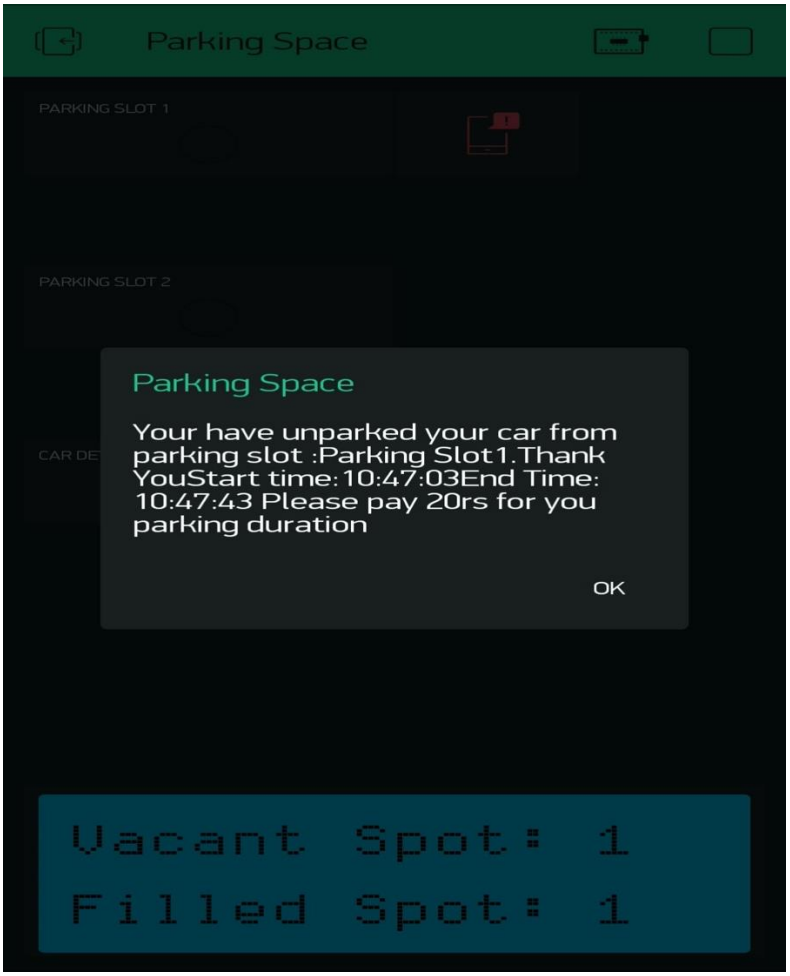


Fig 7.6 Application view of unparking .

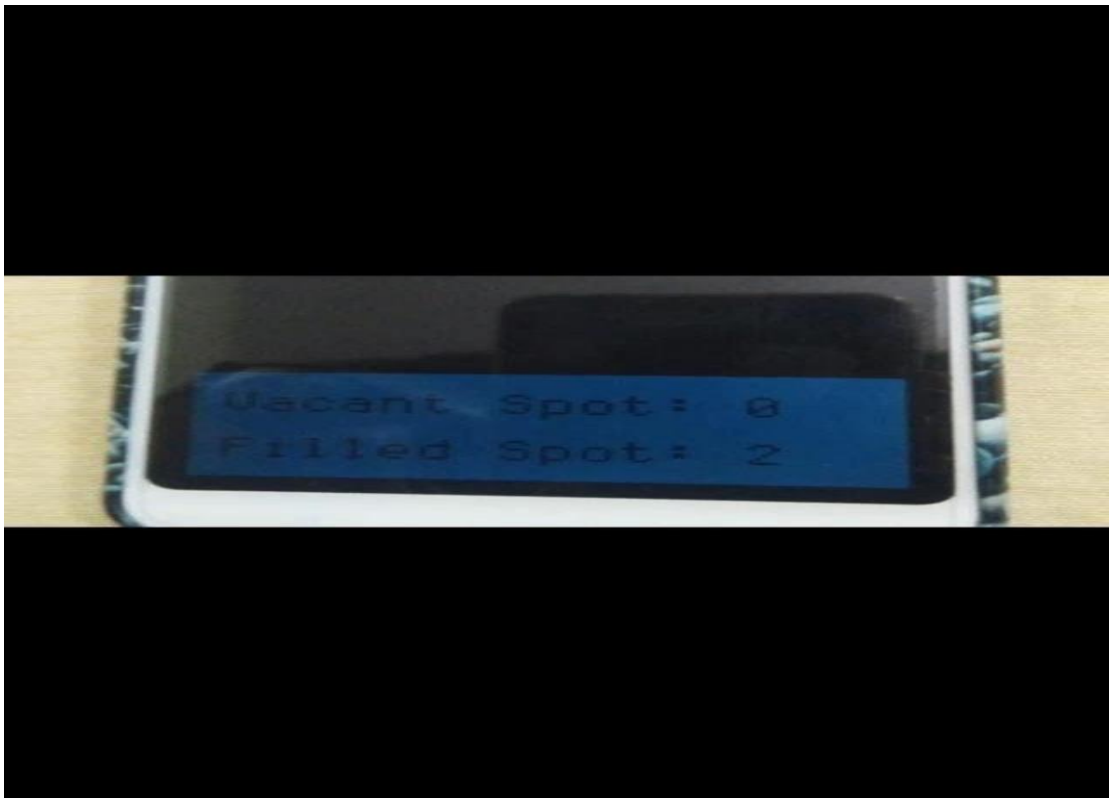


Fig 7.7 Updating the count of vacant and filled spot
and displaying it .

Case Five

In this case we would display a message stating that there are no more empty slots present in the parking zone .This message pop out when all the parking slots are filled and when a new vehicle turns up to the parking detect sensor requesting for an slot. Further the DC motor does not open the gates which makes it more sensible that there are no more parking slots available and the maintenance people should not upload any sign board indicating parking slots full . Saving human work in a efficient manner .

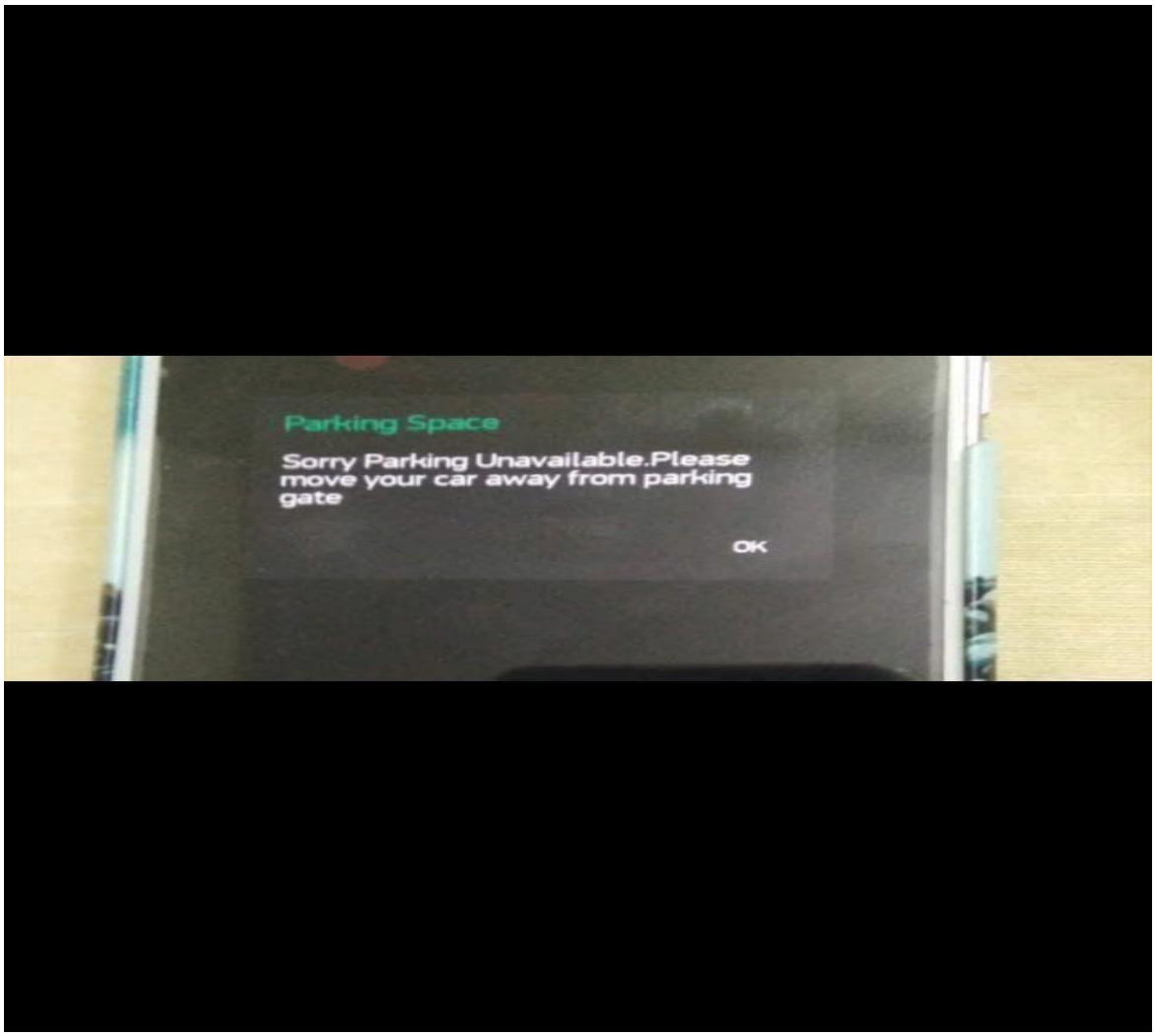


Fig 7.8 Message on app indicating no parking slots available

CHAPTER 8

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 could book a parking slot for them by the use of our mobile application.

The efforts made in this project are intended to improve the parking facilities of a city and thereby aiming to enhance the quality of life of its people.

8.1 Future work

- The future of smart parking systems is expected to be significantly influenced by the arrival of automated vehicles(AVs).
- Several cities around the world are already beginning to trial self -parking vehicles ,specialized AV parking lots 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 vehicle like its color, design and number which would further add security.

REFERENCES

[1] Abdul Ahad, Zishan Raza Khan, Syed Aqeel Ahmad,"Intelligent Parking System" Scientific Research Publishing, Vol.4,No.2, pp. 160-167, May 2016.

[2] Dr Y Raghavender Rao," Automatic Smart Parking System using Internet of Things (IOT)" International Journal of Engineering Technology Science and Research,Vol.4,No.5,pp.225-258,May 2017

[3] Suprit Atul Gandhi, Hasan Mohammad Shahid," Smart Parking System"

[4] Asian Journal of Convergence in Technology, Vol.4,No.1,May 2017Benson, J.P., T. O'Donovan, P. O'Sullivan, U. Roedig and C. Sreenan et al.,"Car park management using wireless sensor networks", Proceedings of the 31st Conference on Local Computer Networks, Tampa, FL., USA., pp: 588-595 November 2006.

[5] Geng Y. and Cassandras C. G, "A new smart parking system based on optimal resource allocation and reservations," in Proc. IEEE Conf. Intell. Transp. Syst. pp. 979–984, July 2011.

[6] M. M. Rashid, A. Musa, M. Ataur Rahman, and N. Farahana, A. Farhana, "Automatic Parking Management System and Parking Fee Collection Based on Number Plate Recognition.", International Journal of Machine Learning and Computing, Vol. 2, No. 2, April 2012,Published 2014.

[7] Arduino.cc. (2018). Arduino - ArduinoMega2560. , retrieved date: 21Oct.2018, online available at:https://www.arduino.cc/en/Guide/ArduinoMega2560