

# Live location based vehicle parking system

*Submitted in partial fulfilment of the requirements*

*of the degree of*

## BACHELOR OF ENGINEERING in INFORMATION TECHNOLOGY (A.Y. 2019-2020)

by

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Estd. in 2001

**Choice Based Credit Grading System with Holistic Student Development  
(CBCGS-H 2019)**

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This is to certify that Mr. Saurav Rathod, Ms. Stuti Shrimal, Mr. Kanishk Sonee , are bonafide students of Information Technology Department, **Thakur College of Engineering and Technology (An Autonomous College affiliated to University of Mumbai)**. They have satisfactorily completed the requirements of BE project as prescribed by University of Mumbai, while working on “Live Location based vehicle parking system”.

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Date:

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## **ABSTRACT**

In recent times the concept of smart cities have gained great popularity. Thanks to the evolution of 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. Car parking is a major issue in modern congested cities of today. There simply are too many vehicles on the road and not enough parking space. This has led to the need for efficient parking management systems. Smart parking enables better and real time monitoring and managing of available parking space resulting in significant revenue generation, better urban environment and reduces fuel consumption. Present days getting a parking space in urban areas is very difficult in peak hours due to lack of parking spaces. Due to this driver stuck in traffic or looking for parking spaces around the location makes traffic congestion. This causes waste of money and time. So if we have parking space information, we can plan for advance booking based on requirement, for that we developed a prototype of cars parking management system using Internet of things. Our system proposes an IoT based Smart city car Parking System on Streets which enables the user to park his vehicles in a systematic way and it reduces congestion in parking area.

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# CHAPTER 1

## Overview



## **1.1 Introduction**

Internet and its applications have become an integral part of today's human lifestyle. It has become an essential tool in every aspect. Due to the tremendous demand and necessity, researchers went beyond connecting just computers into the web. These researches led to the birth of a sensational gizmo, Internet of Things (IoT). Communication over the internet has grown from user-user interaction to device – device interactions these days. These concepts were proposed years back but still, it's in the initial stage of commercial deployment.

Since most of the process is done through the internet we must have an active high-speed internet connection. The technology can be simply explained as a connection between humans-computers-things. Sensors are deployed everywhere and these sensors convert raw physical data into digital signals and transmit them to its control centre. By this way, we can monitor environmental changes remotely from any part of the world via the internet. This systems architecture would be based on the context of operations and processes in real-time scenarios.

The Smart Parking Lot system works in a similar manner, with the use of a number of Infrared Sensors connected with a Node MCU (ESP8266) for transmission of collected data to the cloud and then to the user interface, which in our case is a website linked to cloud, using java script. The occupancy status of the parking slot is displayed on the GUI using HTML and CSS. The proposed system eliminates congestions usually faced at parking lots.

## **1.2 Background**

The conventional as well as current parking systems as seen in various public places like malls, theatres, stadiums etc. has various drawbacks. The main issue in these systems is finding or locating a parking spot that is vacant. To find a parking spot, one has to drive all around the parking lot which can range from a few 100 sq. metres to a multi-tiered parking lot. This approach of finding a vacant parking space is extremely time consuming and inefficient.

Conventional parking could soon be a thing of the past. There are just too many advantages to an automatic parking system! The population is growing, and cities are running out of space. This is where the automatic parking system comes in. It doesn't only save space, but also time and money.

Let's start with the disadvantages about conventional parking: The search for a parking space. Sometimes you have to drive around for ages. That's why good parking guidance system and digital signage are very helpful.

### **1.3 Importance of the project**

The various benefits and importance of attesting smart parking systems in large cities such as Mumbai are as follows:-

1. Since the entire parking system is automated, this will cut down the need of employees to manage the area, thus cutting down the costs as well as eliminating the need of manpower.
2. Users can remotely get an overview of the parking space before actually being physically present at the area
3. Users can drive directly to the parking spot that is vacant thus eliminating congestion for the other drivers.

### **1.4 Perspective of Customers and Stakeholders**

In huge metropolitan cities, the population being large enough to cause congestion at any place, parking spaces to those cities get adversely affected by the large number of vehicles that are present in that city. The main issue in these systems is finding or locating a parking spot that is vacant. The primary reason behind this proposed system is:-

1. The conventional as well as current parking systems as seen in various public places like malls, theatres, stadiums etc. has various drawbacks. To find a parking spot, one has to drive all around the parking lot which can range from a few 100 sq. metres to a multi-tiered parking lot. This approach of finding a vacant parking space is extremely time consuming and inefficient.
2. Conventional parking could soon be a thing of the past. There are just too many

advantages to an automatic parking system! The population is growing, and cities are running out of space. This is where the automatic parking system comes in. It doesn't only save space, but also time and money.

These two primary reasons that make the project a very important asset in terms of managing the congestion caused due to short spanned and impromptu decisions made the car drivers.

This project isn't only helpful in clearing situations that may cause extreme delays in day to day life but it also is the most efficient way to do it.

1. This project is extremely cost effective as it only costs 590rs that is equivalent to 7.71843 USD which is very frugal.
2. There are more Infrared sensors that can be connected in order to increase the usability as per requirements.
3. It does not require any human intervention to get the right output as it can be stated as a plug and play device.
4. The internet consumption is in kilobytes and is numeric while the IR sensors transmit the information through node MCU to Arduino uno.

## **1.5 Objectives and Scope of the project**

The objective of this project is to provide:

1. User-friendly GUI to display the vacant parking spots.
2. Eliminating traffic conditions or mega-block at parking lots in some cases.
3. A smart parking system designed at a very low cost than the already existing systems.
4. Easy access to parking systems all around the city.

The scope of the project is :-

1. At the entry of the parking lot, a Smart Ticket can be generated to be given to the driver which would record for how much time the car was parked.
2. A secure payment gateway present at the exit of the parking lot can be introduced to help with the parking fee.
3. Moreover, a driver can get a recommendation for the nearest vacant parking space based on his or her location when the user logs in on the platform.

## **1.6 Summary**

In this study, a smart parking system is illustrated as well as implemented for mega-cities. The components used are comparatively less expensive than the ones already in use. The implementation that is proposed should be installed in key places of the city which are suffering from congestion. This will not only make the area less congested, but also make it easy for the users to find parking spaces.

# CHAPTER 2

## Literature Survey

## **2.1 Introduction**

A writing literature review surveys overview insightful articles, books, papers, gathering procedures and different assets which are pertinent to a specific issue, zone of research, or hypothesis and gives a setting to an exposition by recognizing past research. Research recounts a story and the current writing causes us to recognize where we are in the story as of now. It is up to that composition a paper to proceed with that story with new research and new points of view yet they should initially be comfortable with the story before they can push ahead.

### **Technical Paper 1- “Smart Car Parking Using Arduino Microcontroller.”**

**BY-Mr. Vedant Chikhale, Mr. Raviraj Gharat, Ms. Shamika Gogate, Mr. Roshan Amireddy**

Smart car parking project aims at providing a confusion free and easy parking. This project helps the drivers of the cars to park their vehicles with minimum wastage of time with accurate information of the availability of the space to park over Android app. The operator also can collect parking fees efficiently and the drivers can book and pay for their parking space over Android app. It includes an Arduino Uno and Arduino Mega as the microcontroller unit to which the servo motors, LCD, object counter using IC 555 and IC 4026, ultrasonic sensors (HC-05) and IR sensors SR21-IC are interfaced. The LCD displays the availability of the space, the counter keeps the check of the number of cars entering and exiting the parking space, the servo motor helps as gate for the entry and exit of the cars. The ultrasonic sensors detect the availability of the parking space.

## **Technical Paper 2-“ Automatic Car Parking System using IR Sensors”**

**BY- B. Ramya Sri, A. Monika, G. Gowry Naga Sravanthi, D.Drona Akshay Kumar, CH. Papa Rao**

In this paper we have designed for vehicle parking and the main aim of this paper is to atomize the vehicle park for allowing the vehicles into the park. It can provide the exact location of the free space where the vehicles have to be parked. Here we use the microcontroller AT89C52 and the IR Sensors to identify the vehicles entering in to the park. LCD is provided to display the information about the total no of vehicles can be parked and the place free for parking by using Embedded C language. This can provide the exact location of the free space where the vehicles have to be parked. Whenever a car comes in front of the gate, the IR signal gets disturbed and the microcontroller will open the gate by rotating the stepper motor. The gate will be closed only after the car leaves the second IR pair since the microcontroller should know whether the car left the gate or not. Now the microcontroller decrements the value of the count and displays it on LCD. In this way, the microcontroller decrements the count whenever the car leaves the park and displays it on LCD. If the count reaches '0', i.e. if the park is completely filled, the microcontroller will display "NO SPACE FOR PARKING" on LCD.

## **Technical Paper 3-“ Smart Parking System using IoT”**

**BY- ElakyaR,Juhi Seth, Pola Ashritha, R Namith**

Efficient and smart way to automate the management of the parking system that allocates an efficient parking space using internet of things technology. The IoT provides a wireless access to the system and the user can keep a track of the availability of the parking area. With increase in the population of the vehicles in metropolitan cities, road congestion is the major problem that is being faced. The aim of this paper is to resolve this issue. The user usually wastes his time and efforts in search of the availability of the free space in a specified parking area. The parking information is sent to the user via notification. Thus, the waiting time for the user in search of parking space is minimised. RFID technology is being used to avoid car theft.

#### **Technical Paper 4- “Radio Frequency Identification (RFID) Based Car Parking System”**

**BY-** Muhammad Syamil Mazlan , Isredza Rahmi A Hamid, Hazalila Kamaludin

Radio Frequency Identification (RFID) technology is widely used in various applications such as attendance system, tracking system, monitoring system or parking system. Currently, the existing parking system used manual entrance through security guard to access the premise. Therefore, the company need to hire security guard to monitor the premise. In addition, the security guards need to monitor all movement of vehicle or person that enter or leave the premise. As a result, unauthorized vehicle or person can easily access the building. To address this problem, we proposed a parking system using RFID technology that can monitor vehicle's movement that enter or leave the specific area or place by scanning the RFID tag. The potential benefit is it can improve security for both security guards and users. Besides that, this parking system can facilitate access control for users and improve traffic flow during peaks period. There are five modules in the proposed parking systems which are user registration, vehicle registration, RFID tag, staff and report generation.



## 2.2 Literature survey table

Refer ence numb er	Year of publi cation	Name of author	Topic	Publication	Proposed solution	Research gaps
ISSN: 2454- 4116,	2017	Mr. Vedant Chikhale, Mr. Raviraj Gharat, Ms. Shamika Gogate, Mr. Roshan Amireddy	Smart Car Parking Using Arduino Microco ntroller	International Journal of New Technology and Research (IJNTR)	Smart Car Parking system is easier, efficient and less time consuming as it uses an Android app to book the nearest parking slot and also helps in tracking the number of cars entered in the parking area and the amount of payment collected which reduces human efforts. The system provides high performance in	The system requires high maintenance as each sensor must work properly to provide efficiency in working. High power dissipation is recorded through each sensor.

					tracking the car entering and exiting from the parking area and also its presence in a parking slot	
	2017	B. Ramya Sri, A. Monika, G. Gowry Naga Sravanthi, D.Drona Akshay Kumar, CH. Papa Rao	Automatic Car Parking System using IR Sensors	IJESC	The basic idea of IR Sensor is to send infrared light through IR-LEDs, which is then reflected by any object in front of the sensor. Here it is used to detect the vehicle that comes in front of the gate, the IR signal gets disturbed and the micro controller will open the gate by rotating the stepper motor.	infrared sensors detect any object which comes in its line of sight so there is a possibility that it will detect any obstacle due to which the parking space can be displayed as booked.
ISSN: 2249	2019	ElakyaR, Juhi Seth, Pola	Smart Parking	International Journal of	The system provides a real	This research paper does not

– 8958		Ashritha, R Namith	System using IoT	Engineering and Advanced Technology (IJEAT)	time process and information of the parking slots. This paper enhances the performance of saving users time to locate an appropriate parking space. It helps to resolve the growing problem of traffic congestion.	tell us how to book the parking space remotely
ISSN: 2549- 9610	2018	Muhammad Syamil Mazlan , Isredza Rahmi A Hamid, Hazalila Kamaludin	Radio Frequenc y Identific ation (RFID) Based Car Parking System	INTERNATI ONAL JOURNAL ON INFORMATI CS VISUALIZA TION	This system only allow authorized person to enter the factory area. Improve traffic flow during peak period. Facilitate the security guard to guarding the entrance.	System cannot update username information. System can only monitor the while the vehicle entering the premise. Any change of data must key in by the admin. Staff or workers

					Allow admin to monitor staff and workers record by referring to the database.	cannot update their details by themselves.
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## 2.3 Problem Definition

### Current Situation:

In the modern society, there is an ever-increasing number of vehicles. This is leading to problems such as large urban parking lots becoming inefficient, increasing difficulty to find open spaces in busy parking lots, as well as the increasing need to devote larger areas of land for additional parking spaces. One may ask, why are these problems significant?

### Problem Statement:

The three main problems that the increasing number of vehicles and the decreasing efficiency of modern busy parking lots are:

#### 1. Valuable time wasted from inconvenient and inefficient parking lots

On average, 3.5 - 12 minutes spent waiting for a spot in urban parking lots.

#### 2. More fuel consumed while idling or driving around parking lots, leading to more CO2 emissions

- Average distance travelled looking for a spot = 1.2km.
- Average CO2 produced per car per day = .14 kg CO2.
- 14kg for 1000 cars per day and 5110kg per year just for 1000 cars.

#### 3. Potential accidents caused by abundance of moving vehicles in disorganized parking lots

- 413 accidents occurred in public parking lots in Canada last year

- There were 788 parked car collisions, 5 being fatal
- 2/3 of traffic accidents in parking lots involve only 1 moving vehicle
- Parking Structure Issue
- 1/3 of these accidents involved 2 moving vehicles
- Parking System Issue

**Phase 1 (planning):**

Perform literature survey and find all the research gaps.

**Phase 2 (analysis):**

Prepare a report or synopsis to set a path that is to be followed after understanding the requirements and making the synopsis the development is to be started.

**Phase 3 (design):**

In development, the first step is to plan on how the project is to be done, the second step is to set the Ultrasonic sensors and node MCU and make the connections using wires.

**Phase 4 (code, implementation):**

After all the phases are completed properly, the actual development is to be started. We have created a code and is applied with the help of WiFi.

**Phase 5 (testing, deployment):**

The code has been rechecked and the needed connections has been made after testing and approval, apply the proposed system.

## **2.4 Feasibility study**

### **Technical feasibility :**

This assessment focuses on the technical aspects of the project that will determine the feasibility of this proposed system. The hardware side of the project uses the extremely popular nodemcu board and the ultrasonic sensor ; both of which are readily available in the market. On the software side, the technologies used for cloud storage is Firebase. Firebase is Google's solution for cloud computing and it is a reliable open source platform.

### **Economic feasibility:**

The proposed system's cost can vary according to the size of the parking lot. A single circuit consists of two primary components: the nodemcu board which costs around Rs.250-300 and the ultrasonic sensor which costs around Rs.50-75. Thus the final circuit will cost approximately in the range of Rs.300-375 for each parking spot, which is a cheap one time installation costs. As far as the software side is concerned, all the platforms used are free of cost.

## **2.5 Methodology**

### **2.5.1 Scrum**

Scrum is a framework for project management that emphasizes teamwork, accountability and iterative progress toward a well-defined goal. The framework begins with a simple premise: Start with what can be seen or known. After that, track the progress and tweak as necessary. The three pillars of Scrum are transparency, inspection and adaptation.

The framework, which is often part of Agile software development, is named for a rugby formation. Everyone plays a role. When it comes to product development, Scrum roles include product owner, Scrum master and Scrum development team.

Product owner: This team member serves as the liaison between the development team and its customers. The product owner is responsible for ensuring expectations for the completed product have been communicated and agreed upon.

Scrum master: This team member serves as a facilitator. The Scrum master is responsible for ensuring that Scrum best practices are carried out and the project is able to move forward.

Scrum development team: This is a group that works together for creating and testing incremental releases of the final product.

### **The Scrum process**

The Scrum process encourages practitioners to work with what they have and continually evaluate what is working and what is not working. Communication, which is an important part of the process, is carried out through meetings, called Events. Scrum Events include:

**Daily Scrum** . The Daily Scrum is a short stand-up meeting that happens at the same place and time each day. At each meeting, the team reviews work that was completed the previous day and plans what work will be done in the next 24 hours. This is the time for team members to speak up about any problems that might prevent project completion.

**Sprint Planning Meeting.** A Sprint refers to the time frame in which work must be completed, and it's often 30 days. Everyone participates in setting the goals, and at the end, at least one increment -- a usable piece of software -- should be produced.

**Sprint Review.** This is the time to show off the increment.

**Sprint Retrospective.** A Sprint Retrospective is a meeting that's held after a Sprint ends. During this meeting, everyone reflects on the Sprint process. A team-building exercise may also be offered. An important goal of a Sprint Retrospective is continuous improvement.

## Scrum artifacts

An artifact is something of historical interest that deserves to be looked at again. In Scrum product development, artifacts are used to see what's been done and what is still in the queue. Scrum artifacts, which include product backlog, Sprint backlog, product increment and burn-down, are useful to look at in Sprint Planning Meetings.

**Product backlog.** This refers to what remains on the "to be done" list. During a product backlog grooming session, the development team works with the business owner to prioritize work that has been backlogged. The product backlog may be fine-tuned during a process called backlog refinement.

**Sprint backlog.** This is a list of tasks that must be completed before selected product backlog items can be delivered. These are divided in to time-based user stories.

**Product increment.** This refers to what's been accomplished during a Sprint -- all the product backlog items -- as well as what's been created during all previous Sprints. The product increment reflects how much progress has been made.

**Burn-down.** The burn-down is a visual representation of the amount of work that still needs to be completed. A burn-down chart has a Y axis (work) and an X axis (time). Ideally, the chart illustrates a downward trend, as the amount of work still left to do over time burns down to zero.

### 2.5.2 Customer interaction details

Congestion on roads for securing a parking spot is a familiar sight. All of us have been in that situation where an appropriate parking spot just doesn't appear. And when it does, we have to wait for the other vehicles to locomote. Even listening to sound melodies doesn't do any good during this time. After all, how can one spend more than 15 minutes in parking a car?

A report by USA Today claims that drivers spend over 17 hours in a year to search for a parking spot. The report takes into account streets, garages and parking lots. Cheers! You just consumed



two working days of your year in parking your car. But, we don't blame you because there is no way one can avoid congestion. Is there?

### **Smart Parking System as an intelligent solution to the parking problems**

Smart Parking has been a buzz phrase lately, which is largely due to its ability to render Intelligent Parking assistance system. In simple words, smart parking is a strategy that consolidates human innovation and its alliance with the technologies available.

Smart Car Parking System is very similar to transportation intelligence that is guided by GPS. Let us take an example of you planning to go for a lavish dinner tonight. For that, you open your laptop, review the luxury restaurants and finally book one of them.

Since you don't want to spend your time finding a car parking slot, you refer a smart parking website for the same. You add filters to your search about on- and off-road parking spots. In return, the IoT based Intelligent Car Parking website provides you with details of the available car parking slots near your preferred destinations.

What you leave behind is congestion, frustration and pollution. What you welcome is the seamless integration of human innovation and technology.

### **Smart Parking Solutions and the Improved user experience**

The seamless combination of technology and human innovation paves the way for an effective parking solution that can save not only your money but also your time. With real-time updates Smart Parking Website is a perfect disruptor for the parking process.

### **Smart parking solutions reduces the traffic**

Considering the fact that several intelligent apps provide the facility to book a parking lot online, there are fewer cars roaming around for spaces on the streets. People who have booked their lots reach the destination at specific timings, which avoids overcrowding.

### **Smart Parking System reduces the pollution**

Air pollution is one of the biggest issues that the world needs to address to sustain life in the forthcoming days. Smart parking is one of those methods that reduce the congestion on roads and consequently decreases fuel combustion.

### **Smart Parking Solutions pave the way for innovative pricing**

Smart parking is a dynamic approach to carry out the parking process. This dynamism is prominently observed in the pricing that the operators specify for the parking lots. That said, the pricing depends upon the occupancy and the number of customers. If the number of people is more, you'll have to pay more and vice versa.

### **Smart parking Solutions safeguard the vehicles**

Everyone wants the vehicle to be safeguarded, and smart parking lots provide just that. With enhanced security systems in place and equipment like cameras and sensors regularly monitoring the parking spaces, these parking lots are ideal destinations for leaving the vehicles even for more extended periods.

# CHAPTER 3

## Analysis and planning

### **3.1 Introduction :**

The implementation of the proposed system is done in following steps:

#### **Planning:**

This step involves finalizing the software platforms to be used and the hardware components that will be required in the circuits.

#### **Designing:**

In this step , the database design and the circuit connection will be finalised. Here the main architecture of the entire proposed system will also be determined.

#### **Building:**

Here , the source code for the node MCU board as will be used to carry out basic tasks like reading data that is coming from the ultrasonic sensor and connecting to the Wi-Fi network.

#### **Testing:**

After making all the connections and flashing the main source code into the node MCU , the testing phase can start where the entire system will be handling different test cases. Based on the test results , required changes will be done in the connections or the source code. The process of testing will repeat until expected results are achieved

#### **Deployment:**

After successful test results the system can be deployed by connecting the front end site to the cloud database. The circuit will be installed at the parking spot and the users will be able to view the status of the parking lot in real time.

## 3.2 Project Administration (Resources, Tools used):

### Hardware components:

#### 1] RFID TAG:

RFID tags are a type of tracking system that uses smart barcodes in order to identify items. RFID is short for “radio frequency identification,” and as such, RFID tags utilize radio frequency technology. These radio waves transmit data from the tag to a reader, which then transmits the information to an RFID computer program. An RFID tag may also be called an RFID chip.

In the proposed system, the RFID tag is used to store the user data and it helps in providing entry only to the authorized users into the parking lot.



Fig 3.1 RFID tag

#### 2] RFID READER:

A RFID Reader is a device that uses radio-frequency waves to wirelessly transfer data between itself and a RFID tag/label in order to identify, categorize and track assets.

In the proposed system, the RFID reader is used to read the RFID tag. The reader accesses the information regarding the authority of the allotted parking space, and thus helps in maintaining security of the parking space by restricting permission only to the authorized users. The RFID module is connected to the Arduino Uno, which facilitates the motion of the Servo motor.



Fig 3.2 RFID reader

### 3] ARDUINO:

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.

In the proposed system, Arduino UNO is connected to the RFID reader, which collects the user information at the time of entrance in the parking lot, and simultaneously triggers the Servo motor, which either permits or denies the user's request.



Fig 3.3: Arduino Uno

#### 4] SERVO MOTOR:

A servo motor is an electrical device which can push or rotate an object with great precision. If you want to rotate an object at some specific angles or distance, then you use servo motor. It is just made up of simple motor which runs through servo mechanism.

In the proposed system, the Servo motor is responsible for handling the barricade at the entrance of the parking space. It is connected to the RFID reader.



Fig 3.4 Servo Motor

#### 5] NODE MCU:

Node MCU is an open source firmware developed for ESP8266 Wi-Fi chip. By exploring functionality with ESP8266 chip, Node MCU firmware comes with ESP8266 Development board/kit i.e. Node MCU Development board.

Since Node MCU is an open source platform, their hardware design is open for edit/modify/build. Node MCU Dev Kit/board consists of ESP8266 Wi-Fi enabled chip. The ESP8266 is a low-cost Wi-Fi chip developed by Espressif Systems with TCP/IP protocol.

In the proposed system, the NodeMCU is used to transmit the data collected by the infrared sensor to the Firebase for data collection, presentation and analysis.



Fig 3.5: NodeMCU (ESP8266)

## 6] INFRARED SENSOR:

An infrared sensor is an electronic instrument that is used to sense certain characteristics of its surroundings. It does this by either emitting or detecting infrared radiation. Infrared sensors are also capable of measuring the heat being emitted by an object and detecting motion.

In the proposed system, the purpose of the infrared sensor is to sense the presence of the car when parked in the parking space, and simultaneously send the data to the firebase using the Node MCU.



Fig 3.6: Infrared sensor

## Software platforms:

### 1] FIREBASE:

Firebase provides a real-time database and backend as a service. The service provides application developers an API that allows application data to be synchronized across clients and stored on Firebase's cloud. The company provides client libraries that enable integration with Android, iOS, JavaScript, Java, Objective-C, Swift and Node.js applications. The database is also accessible through a REST API and bindings for several JavaScript frameworks such as AngularJS, React, Ember.js and Backbone.js. The REST API uses the Server-Sent Events protocol, which is an API for creating HTTP connections for receiving push notifications from a server.



In the proposed system, Firebase is used to store the parking data collected by the infrared sensors and simultaneously send the data to a HTML based webpage, which is the user interface for the users, thus displaying the parking availability information.

Firebase is also used to calculate the parking index of the area by using the collected data, which provides for further analysis to gain competitive leverage by using business intelligence tools.

## 2] ARDUINO IDE:

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and based on Processing and other open-source software. This software can be used with any Arduino or Node MCU board.

Arduino IDE is used to provide instructions to the motherboard (Arduino Uno).

### 3.3 Scheduling (Gantt Chart):

A Gantt chart, or Harmon gram, is a type of bar chart that illustrates a project schedule. This chart lists the tasks to be performed on the vertical axis, and time intervals on the horizontal axis. The width of the horizontal bars in the graph shows the duration of each activity. Gantt charts illustrate the start and finish dates of the terminal elements and summary elements of a project. Terminal elements and summary elements constitute the work breakdown structure of the project.

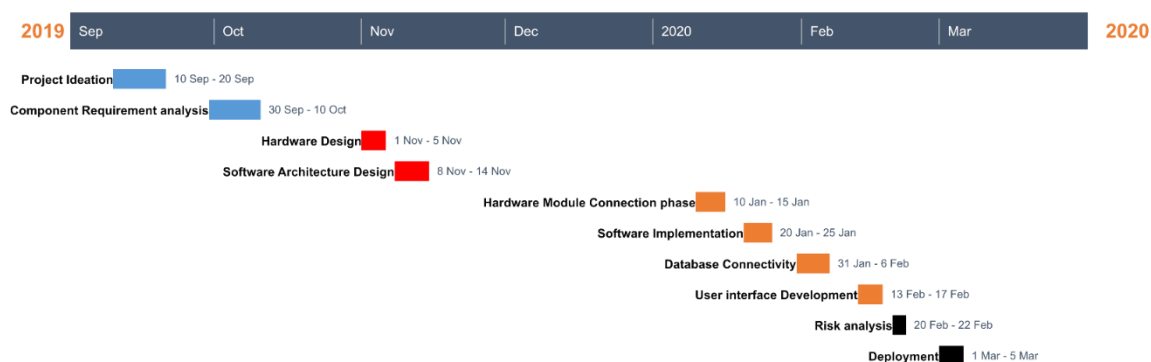


Fig 3.7 Gnatt Chart

### **3.4 Summary**

Thus, by using the scrum methodology for the proposed system, a successful deployment process was followed. Timely scrum meetings were held, and exposed terminals and risks were analyzed. The proposed system was made cost effective by calculating the project overhead costs beforehand and by using components that were cheaper than the components used in the already existing systems.

# CHAPTER 4

## Design and Implementation

#### 4.1 Data Flow diagram (DFD):

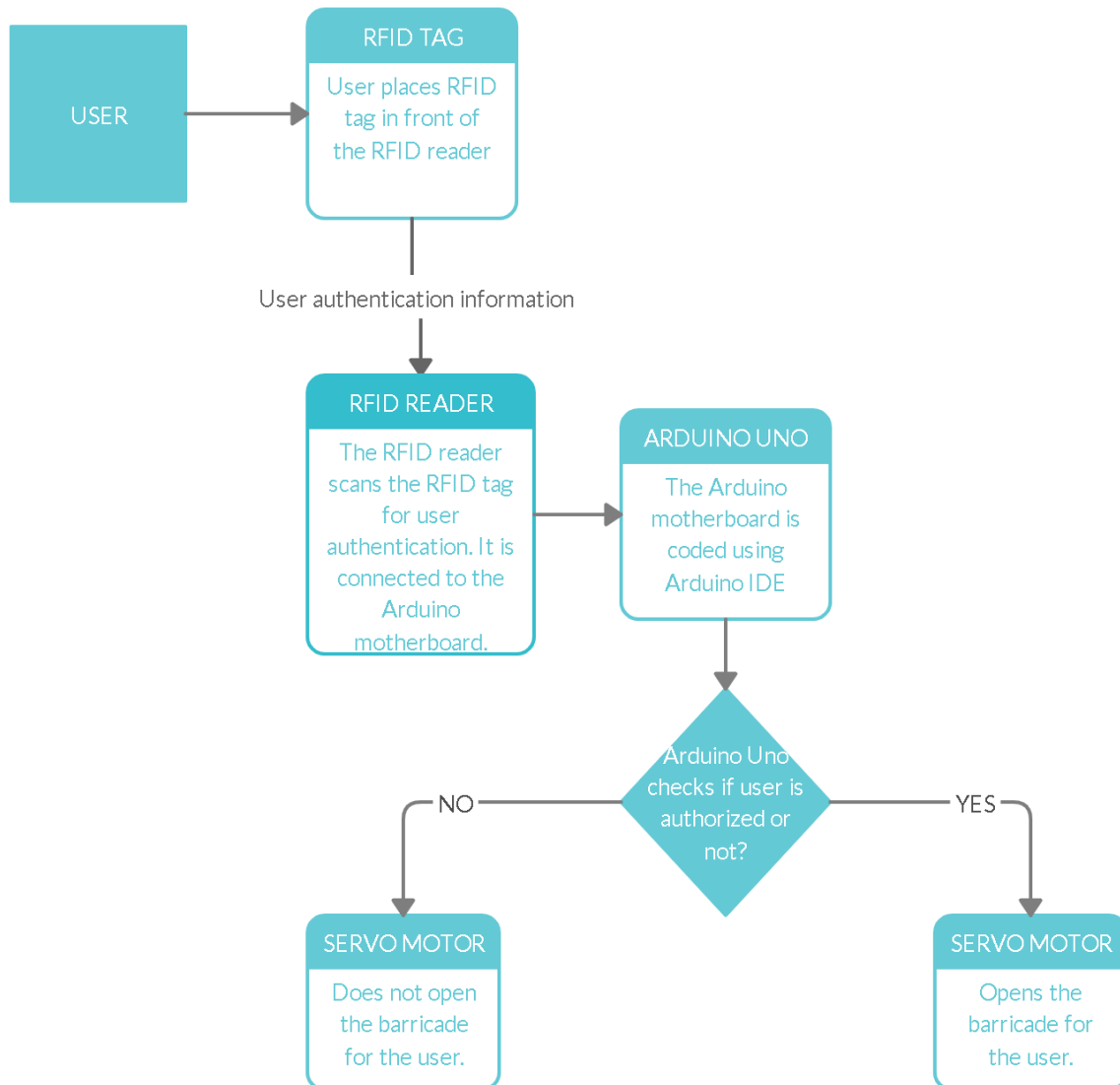


Fig 4.1 Parking entrance

## 4.2 Block Diagram

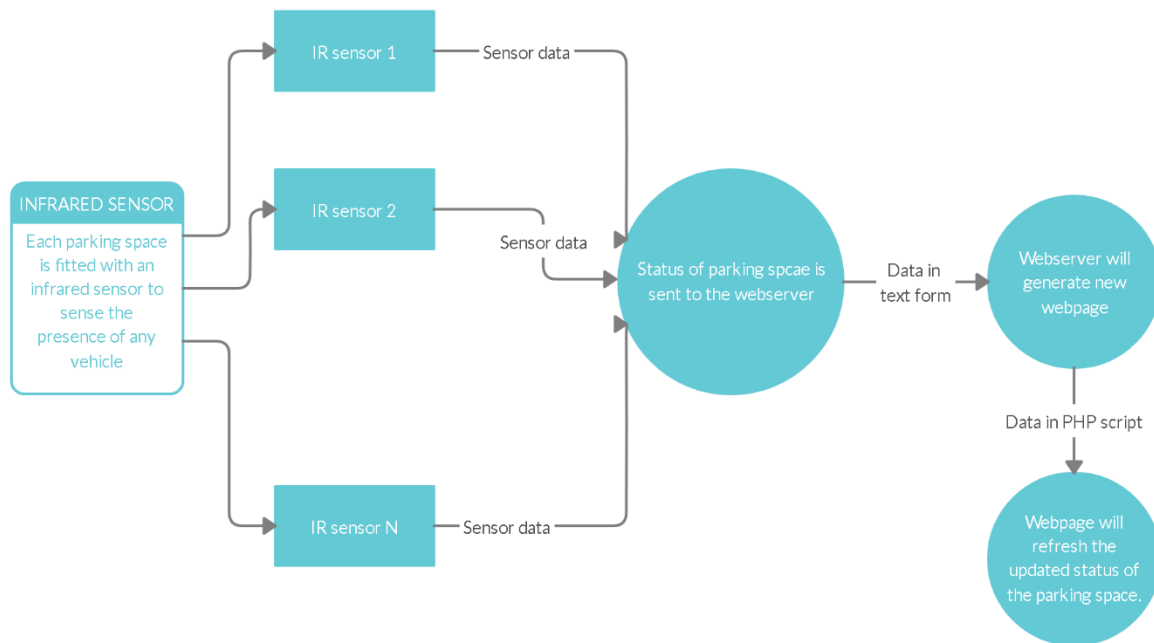


Fig 4.2: Block Diagram

### 4.3 Circuit diagram:

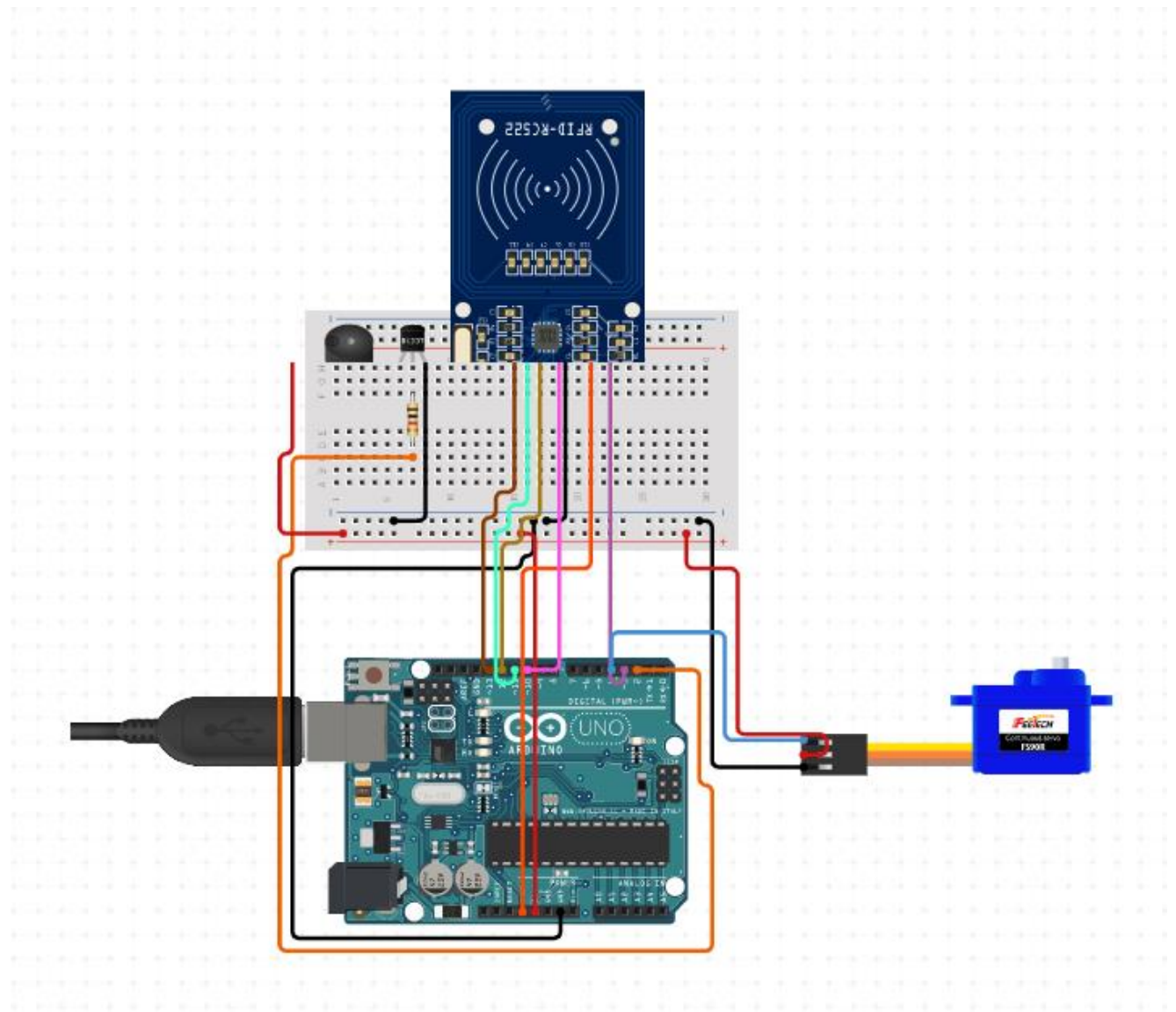


Fig 4.3: Circuit Diagram for RFID module

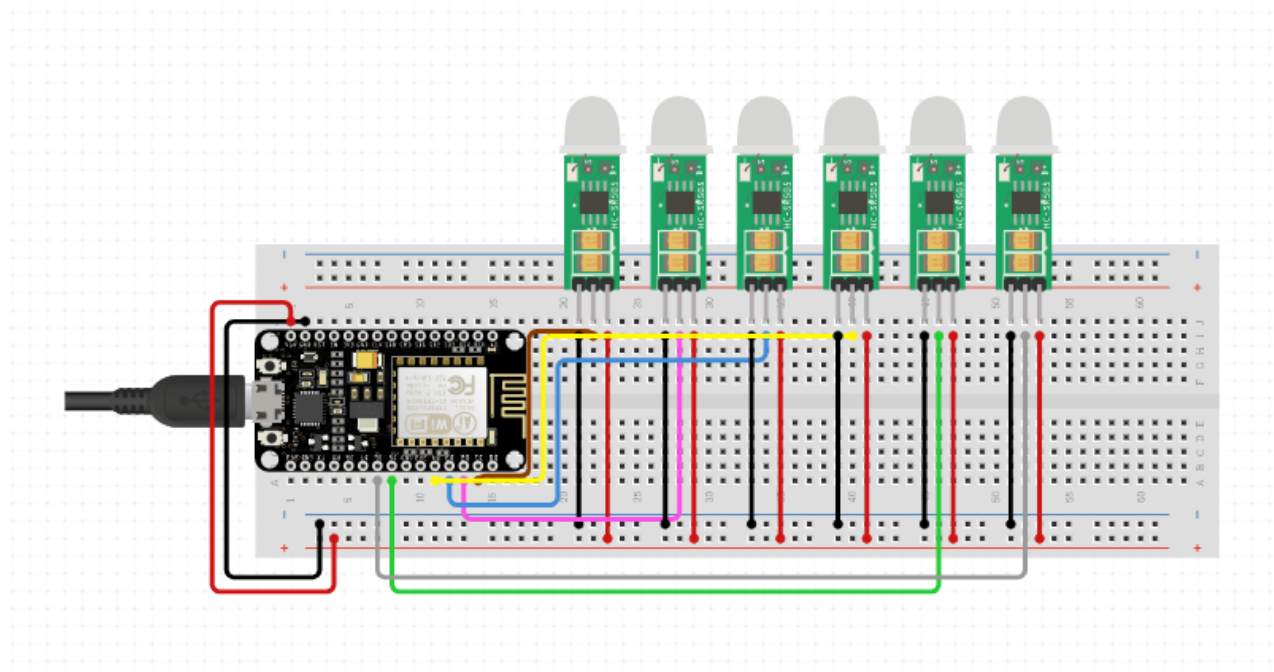


Fig 4.4 Circuit Diagram for IR sensor module

#### Hardware connection:

- **RFID reader-**

1. RFID SDA to Arduino Uno 10
2. RFID SCK to Arduino Uno 13
3. RFID MOSI to Arduino Uno 11
4. RFID GND to Bus GND
5. RFID 3.3v to Arduino Uno 3.3v
6. RFID RST to Arduino Uno 3

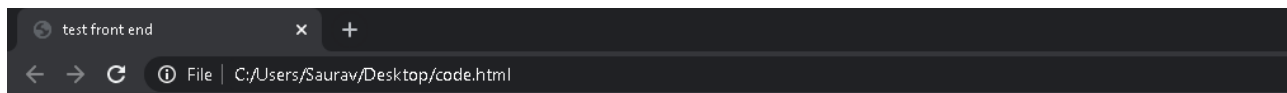
- **Servo Motor-**

1. Servo Vin to Bus POS
2. Servo 0 to Bus GND
3. Servo Sig to Arduino Uno 4

- **Buzzer-**

1. Buzzer POS to Bus POS
2. Buzzer Neg to TSBC337C

## 4.5 GUI Design:



**inorbit malad column 1 column 2**

<b>row 1</b>	slot 1	slot 2
<b>row 2</b>	slot 3	slot 4
<b>row 3</b>	slot 5	slot 6

Fig. 4.5 GUI Design



# CHAPTER 5

## Results & Discussion

## 5.1 Actual Results:

### Outputs:

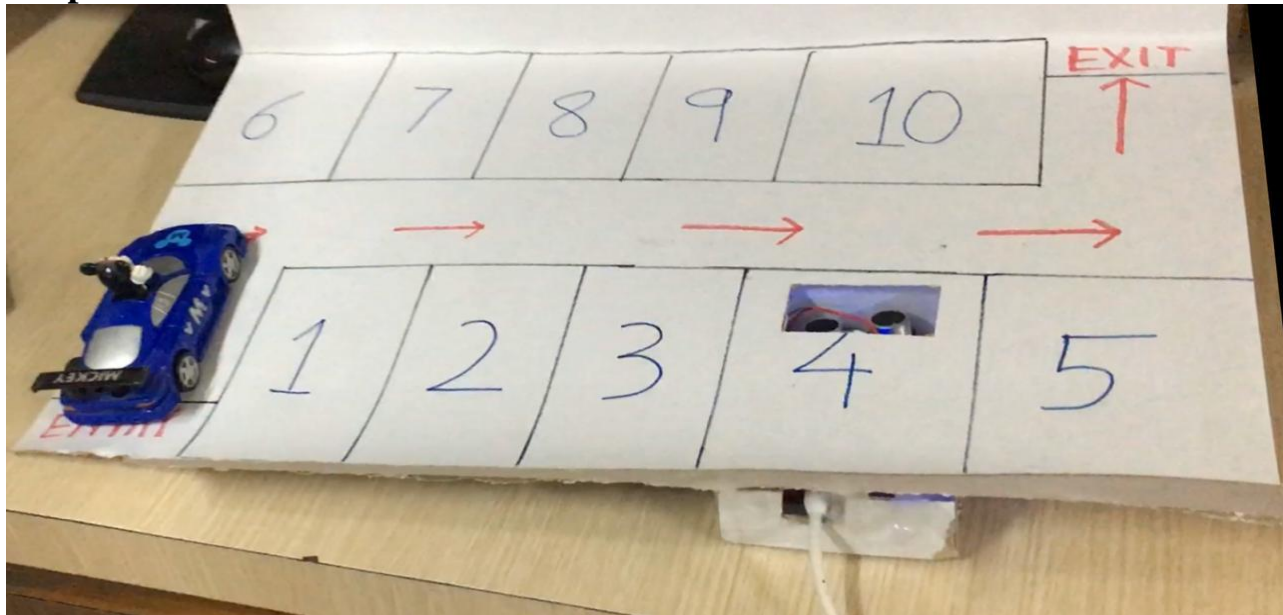


Fig 5.1.1 Car enters the parking space

ad	column 1	column 2	column 3	column 4	column 5
slot 6	slot 7	slot 8	slot 9	slot 10	
slot 1	slot 2	slot 3	slot 4	slot 5	

Fig 5.1.2 Free parking slot

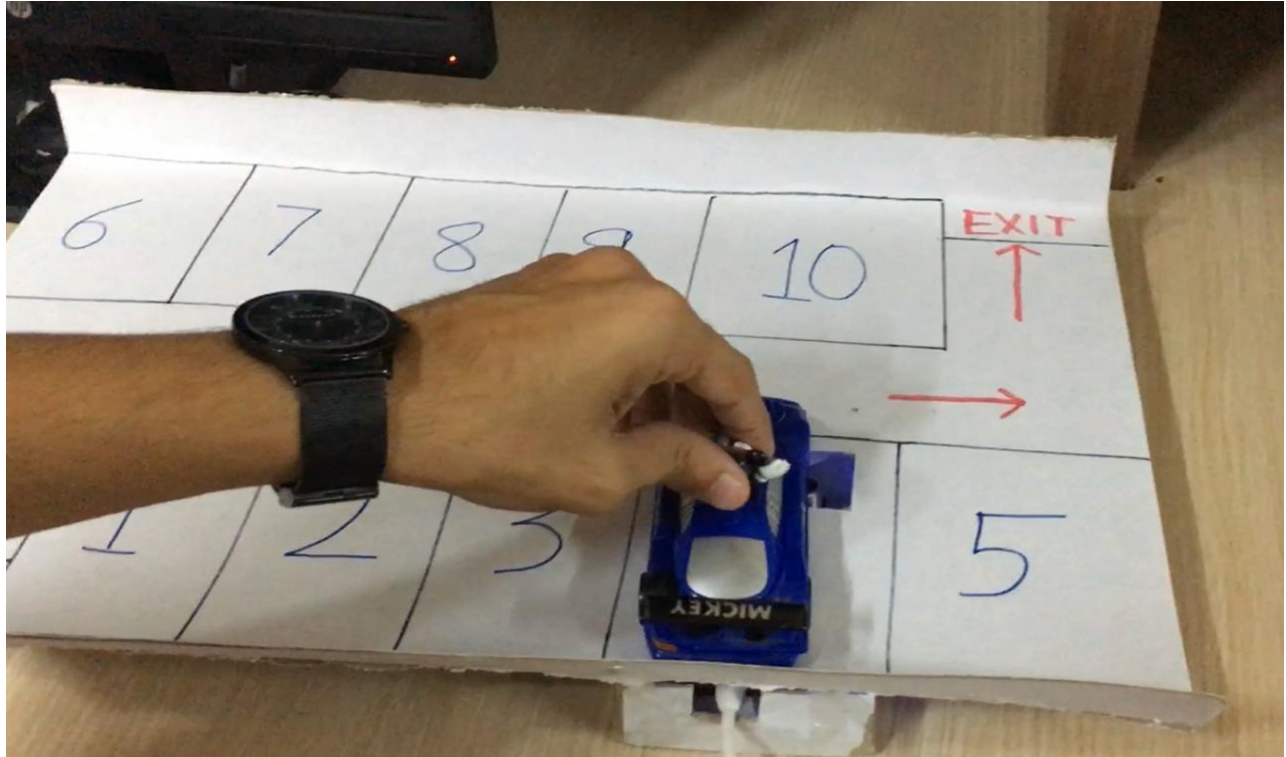


Fig 5.1.3 Car occupies the slot 4

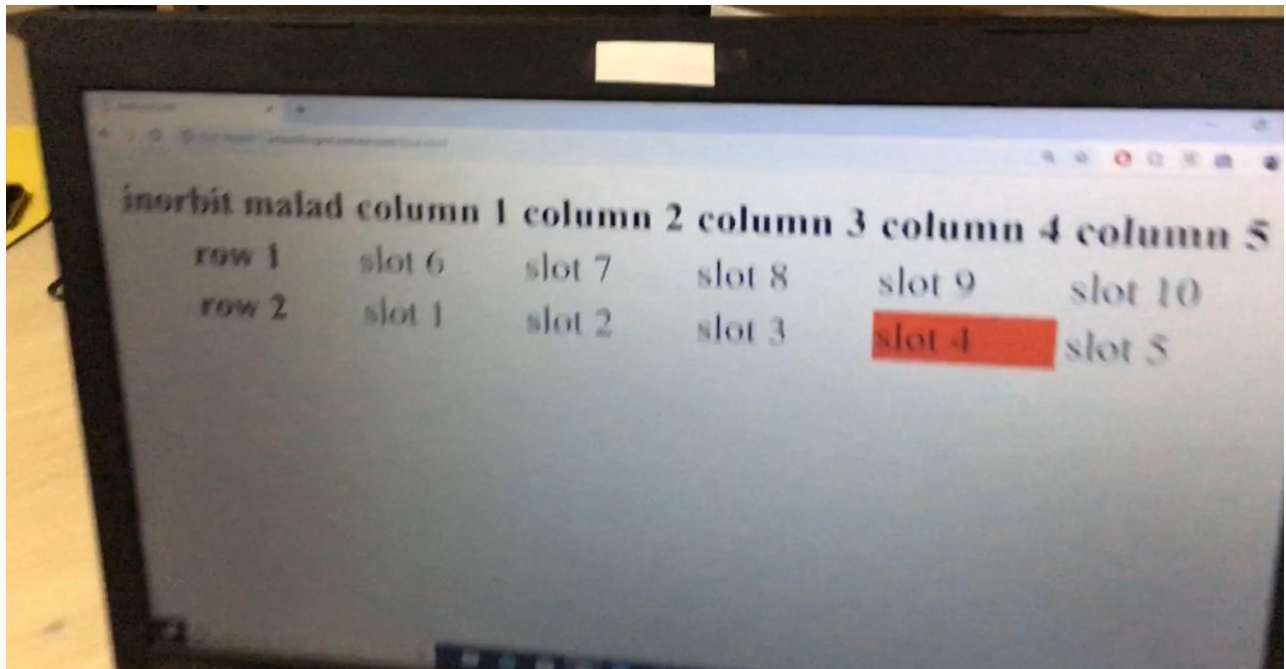


Fig 5.1.4 Website displays the occupied slot



Fig 5.1.5 Servo motor helps to resist cars with no Rfid tags by placing a bar

## **Output:**

Successfully implemented the Smart Parking System in an economical way. The Infrared sensor measures the distance between the sensor itself and the vehicle parked above it. The vacancy data is sent to the Firebase through the NodeMCU and then onto the web application for the user to view.

### **Phase 1 Analysis:**

- Creating the synopsis, literature survey and feasibility study for proposed solution

which will act as an input to the design phase.

### **Phase 2 Planning:**

- Proposing Statement of work, scope definition and scope boundary for planning the prototype from the problem definition to decide what needs to be done and what not

to be done

### **Phase 3 Designing:**

- Proposing design architecture of Smart Parking System for implementing the surveyed case studies and synopsis.

## **Outcomes:**

The following are the outcomes were observed as a result of implementing the product:

- Transmission of data wirelessly from the NodeMCU to the Firebase at the back end.
- Status of the real-time occupancy is presented to the users on the web application which can be accessed even when the user is not present at the parking premises.

## 5.2 Future Scope

The main objective of the proposed system has been fulfilled, yet, there are many more things that could be integrated with the already existing system to make it more responsive and smart.

The following features could be integrated in the future:-

- An App based application could be designed instead of the existing website
- Geo-location of the parking lots can be provided to the users to help them find the nearest parking lots instead of parking on the streets. This can be implemented using the Google maps API at an initial level.
- A secure payment gateway can be developed at the exit on basis of the period of time the user had parked his/her vehicle in the premises. The time can be recorded by providing a randomly generated key with the timestamp printed on a parking slip provided at the entrance which has to be scanned at the exit for commencing payment.

## 5.3 Testing

System testing is a critical phase implementation. Testing of the system involves hardware devise and debugging of the computer programs and testing information processing procedures. Testing can be done with text data, which attempts to stimulate all possible conditions that may arise during processing. If structured programming Methodologies have been adopted during coding the testing proceeds from higher level to lower level of program module until the entire program is tested as unit. The testing methods adopted during the testing of the system were unit testing and component testing.

### Unit Testing

Unit testing is basically done to check whether the software it running properly or not. In this testing we vigorously tested out website so as to look for several errors and debug them thoroughly. The website was then checked in various conditions so as to match the several expectations and to deliver the best output possible.

## **Component Testing**

This test is basically done to check whether the hardware peripherals are working properly with the software and that is the website and the other hardware components work uniformly and efficiently.

## **5.4 Deployment**

Project deployment is the most important and sole reason for which the project is made, so that it can reach out to its potential buyers and is beneficial for them. In our case it is the Smart parking system which encompasses both , software as well as hardware components. Deployment not only consists of solely selling the product to its market but also, making sure that if there are any problems faced by a customer, they are rectified and newer versions can also be provided later on for better experience and smoother functioning at their disposal.

# CHAPTER 6

## Conclusion



## **6.1 Conclusion**

The concepts of smart cities have always been a dream. There have been advancements made from the past couple of years to make smart city dream to reality. The advancement of internet of things and cloud technologies has given rise to the new possibilities in terms of smart cities. Smart parking facilities have always been the core of constructing smart cities. The system provides a real time process and information of the parking slots. This mainly focuses on the best allocation and indicates a user of this service whether the space is occupied or not and does inform on a prior basis about the required space. It will be able to re direct the user based on the availability of the parking space. The basic Idea is that the sensor detects if there is a vehicle parked on a given area and the sends the information across using Wifi technology and informs the system about the space. This helps to avoid nuisance and keeps the disturbances at lows. Thus this technology in tern helps the users to get through their busy day at a faster pace by allocation of spaces for their vehicles at any given instances. The technology is much cheaper and easier to use than the existing systems that exist today.

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