



# **IoT based Mobile Vehicle Reservation System**

**A dissertation submitted for the Degree of Master of Information Technology**

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## **Declaration**

The thesis is my original work and has not been submitted previously for a degree at this or any other university/institute.

To the best of my knowledge, it does not contain any material published or written by another person, except as acknowledged in the text.

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This is to certify that this thesis is based on the work of  
Mr./Ms.

under my supervision. The thesis has been prepared according to the format stipulated and is of an acceptable standard.

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**Supervisor Name:** Dr. (Mrs). M.G.D.K Fernando

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**Signature:**

**Date:** 20/11/2020

## **Abstract**

Finding a reasonable parking space in occupied urban communities is a tedious and difficult task. During the looking through the procedure, drivers become baffled and occupied. Motor vehicle drivers may not at first locate a free spot and will leave the zone by making a circle to discover another spot near their goal. Thus, there is expanded blockage out and about, some of the time causing mishaps, and burning through important time. To address this issue, we accept that a parking reservation system is important and will help lessen the high volume of traffic that may somehow or another lead to mishaps and have numerous other natural and wellbeing impacts. This venture expects to make a model of parking, android application and a web application known as IoT based Mobile Vehicle Reservation System. This system will be utilized by the college, shopping centre and any parking territory around. The principal motivation behind this venture is to build up a system that will facilitate the parking procedure around shopping centres, schools and anyplace around. The system will help control the parking space accessibility and permit drivers to book for a parking opening before arriving at the parking region. The booking will be for a specific time of which if the driver doesn't arrive at the parking territory, their reservation will be terminated. The android application will assist individuals with booking and see accessible parking openings. While the site, which can be gotten to anyplace around will be utilized to see the accessible space and restore the booking when they are terminated. For this project, tools and programming dialects required to effectively assemble the system will be given and talked about.

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# Table of Contents

Declaration.....	i
Abstract.....	ii
Acknowledgments .....	iii
Table of Contents.....	iv
Table of Figures .....	vi
1. Introduction.....	1
1.1 Motivation.....	1
1.2 Aim of the Project.....	1
2. Background.....	3
2.1 Introduction.....	3
2.2 Requirement Analysis.....	3
2.2.1 Requirement Gathering.....	3
2.2.2. Functional requirements .....	3
2.2.3. Non-Functional requirements .....	3
2.2.4. Requirements breakdown .....	3
2.3 Vehicle Parking System.....	4
2.3.1 Smart Vehicle Parking System .....	4
2.3.2 Advantages of Developing Smart Parking System.....	4
2.3.3. Safety and Security .....	5
2.4 Related Work .....	5
3. Methodology.....	7
3.1 Introduction.....	7
3.2 Purpose .....	7
3.3 Methodology.....	7
3.4 Design .....	8
3.5 System Overview .....	11
3.6 System Architecture.....	11
3.7 Implementation .....	13
3.7.1 Presentation Tier.....	15
3.7.2 Application Tier.....	22
3.7.3 Data Tier .....	23
4. Evaluation .....	26
4.1 Approach to Evaluation .....	26
4.2 Procedures of Evaluation.....	26
4.3 Evaluation Tasks.....	27
4.3.1 Website Evaluation.....	27

4.3.2 Android Application Evaluation.....	27
4.3.3 Parking Spot Evaluation .....	27
4.4 Evaluation by Questionnaire.....	27
4.4.1 Types of Questions .....	27
4.4.2 Questionnaire .....	28
4.5 Test Results.....	31
4.6 Maintenance after Evaluation .....	31
5. Conclusion and Future work.....	32
5.1 Conclusion .....	32
5.2 Difficulties faced .....	32
5.3 Future work.....	33
Bibliography .....	34

## Table of Figures

Figure 1: Bird View of the System .....	8
Figure 2: IR Sensor .....	9
Figure 3: Arduino Uno Board .....	9
Figure 4: Male to Female Jumper Wires .....	9
Figure 5: Led Bulb .....	9
Figure 6: ER Diagram of the System .....	10
Figure 7: Architecture of System .....	12
Figure 8: IR Sensor reading vehicle movement .....	13
Figure 9: Parking Boundary Calculation within 2 km .....	14
Figure 10: The Distance calculation .....	14
Figure 11: Creation of Parking Slot .....	15
Figure 12: Login Page .....	16
Figure 13: Sign Up page .....	17
Figure 14: Main Page .....	18
Figure 15: Parking Slot Selection .....	19
Figure 16: Confirmation Page .....	20
Figure 17: Reservation List .....	21
Figure 18: Application Tier tools .....	22
Figure 19: phpMyadmin Database .....	23
Figure 20: Database Creation .....	23
Figure 21: Create Table User .....	24
Figure 22: Create Table Parking Spot .....	24
Figure 23: Create Table Parking Spot User .....	25
Figure 24: Create Table Booking .....	25
Figure 25: Result Question 1 .....	28
Figure 26: Result Question 2 .....	28
Figure 27: Result Question 3 .....	28
Figure 28: Result Question 4 .....	29
Figure 29: Result Question 5 .....	29
Figure 30: Result Question 6 .....	29
Figure 31: Result Question 1 .....	30
Figure 32: Result Question 2 .....	30
Figure 33: Result Question 3 .....	30

# **1. Introduction**

## **1.1 Motivation**

Most nations face an extreme parking issue because of the fast development of vehicle populace. Parking spot just as streets are not straight extending to make up for the quick development of vehicles. Because of the popularity of the vehicle populace, even with off-road or private leaving, leaving requests can't be completely illuminated or fulfilled. Right now, there is no appropriate system to lessen workers hanging tight an ideal opportunity for a parking space or probability to choose a parking spot early before arriving at a stopping zone. At present, suburbanites need to physically visit all parking areas to check for an accessible parking space.

## **1.2 Aim of the Project**

The aim of the project is a smart parking system that provides commuters a methodical and promising online parking reservation system via handheld mobile devices. Further, we proposing an algorithm nearest available parking spot considering the commuter's destination location. Our project offers an android based mobile application that will have a separate backend for the services to a link between the mobile application and a server, where users can view available parking areas and able to reserve the nearest available parking spot while commuting. If the booking space is available, then he/she can book it for a specific time slot. The booked space will be marked as reserved and will not be available for anyone else for the specified time. Our prototype system incorporates IR sensors to detect the availability of the parking stop. Back end web module will be integrated with the sensor readings where sensors are placed in the parking spots to detect the availability of the spot. The system will periodically detect the availability of the parking spot and report to the backend server. A periodic detection window will be empirically verified considering performance factors such as accuracy, waiting for delay and efficiency of the reservation system. Upon receiving a commuter request, the back-end system will query for the nearest parking spot based on the commuter's destination and it will send a notification about the availability of the nearest parking spot. whereas the backend of the server, we are proposing an algorithm which will be using the user current GPS coordinates/ destination location (upon the availability of commuter data) and find the best and closest parking spot near to the commuter. In anticipation of a parking reservation, our system captures the current location of the commuter and picks the nearest available parking spot. This system provides an additional feature of extending the booking period, payments via credit vehicle gateways and booking cancellation. Commuters can cancel their book space anytime. Upon making a payment, end users are notified regarding the reservation via email and SMS along with a unique parking number. If the commuter wants to extend the parking time, the commuter can extend the parking time through our mobile application. When reserving parking for an extended period, commuters require to pay the extra amount and select the amount of time they would like to extend the parking. And if an overtime stay is used by a commuter without extending through the system for a parking user will be charged the appropriate amount when the user leaves the premises



automatically. This will be notified to the user in the system as well and they can pay through the system or they can pay as cash when they exit but it will be added to the system by the guard who is deployed at the parking lot.

The objectives of the system in a nutshell:

- Incorporate IR sensors to detect the availability of each parking spot in the parking areas.
- Reservation can be made considering commuters the current location (assume destination is nearby) and we propose an algorithm that will efficiently find the nearest parking spot based on his/ her destination location.
- Reservation can be made if the commuter is nearby (radius of  $< x$  meters) or less than  $y$  minutes to the parking area. This will prevent time ahead reservations. These  $x$  and  $y$  numbers will be empirically verified during the testing phase to reduce the waiting overhead of commuters, to improve the efficiency of the reservation system.
- Reservations can extend their current reservation, payments via payment gateway, cancel the reservation.
- Notifications mechanism is incorporated via emails and SMS to aware of the commuter about the made reservation, expiration of reservation duration, payment details, ...etc.

## **2. Background**

### **2.1 Introduction**

In this section, we will take a gander at various parking systems that are identified with the Automated Parking System. Three unique kinds of stopping frameworks will be examined which are: Automated Parking System, Semi-Automated Parking System and Parking Marshal System. The themes will be talked about in the specific request that has been referenced.

### **2.2 Requirement Analysis**

#### **2.2.1 Requirement Gathering**

The necessities are isolated into two distinct sorts to be specific functional and non-Functional prerequisites. The useful prerequisites speak to what the system ought to do. Along these lines, their needs are for the most part high. The non-functional prerequisites speak to the look and feel of the system. Even though the speed and steadiness of the system are significant, these prerequisites are viewed as lower because the system is still in the planning stage.

#### **2.2.2. Functional requirements**

These are the sort of prerequisites that characterizes the functionalities of the system. Taking a gander at the parking system, the parking ought to be robotized. Robotized means incorporate counterfeit keen viewpoint to it so it ought to perform the majority of the errands without the guide of the person. These incorporate the account status of the parking and demonstrate to the user when the parking is full. Permit the user to book for the parking utilizing the android application from any place around the city yet the parking ought to permit the user a base chance to arrive at the parking opening before the reservation ought to be canceled.

#### **2.2.3. Non-Functional requirements**

These are necessities that show viewpoints that can be utilized to break down the activity of a system. Looking at the parking system, the highlights included inside the parking ought to be clear and simple to utilize with the goal that users ought not to burn through their time attempting to utilize the system. Pointless highlights ought to be maintained at a strategic distance from so the system ought not to be moderate while handling information. Highlights, for example, parking booking ought to be easy to use and compelling to limit the information preparing speed.

#### **2.2.4. Requirements breakdown**

##### **Functional Requirements**

1. Design the parking
2. Develop automated parking System

3. Connect the parking system to a web server
4. Send parking status to the server
5. Update server every time data is received
6. Develop an android application
7. Book parking from the Mobile application
8. Set time limitation for slot booked
9. Check parking availability from the android application
10. Android application send parking status to the server
11. Give booking acknowledgment

### **Non-Functional Requirements**

1. No deferrals in the application
2. Quick information preparing
3. Basic booking process
4. Predictable highlights
5. Quick system preparing
6. Simple to utilize

## **2.3 Vehicle Parking System**

### **2.3.1 Smart Vehicle Parking System**

Parking areas have consistently been significant by permitting drivers to securely leave their vehicles while they can go on to their day by day work. For the most part, the data furnished along with direction actualized by the smart parking system has been very valuable by helping drivers to locate an accessible space [1]

The installment of the parking has likewise been made simpler with the execution of the innovation. Sensors are utilized to help recognize the nearness of the vehicle. This is completely fundamental with regards to the advancement of the smart parking system since data of the left vehicle is required. From the sensor, the data can without much of a stretch be accumulated so as the system can utilize it and similar data will likewise be sent to the driver.

### **2.3.2 Advantages of Developing Smart Parking System**

While executing the Smart Parking System, the vehicle proprietor, the parking administrator and nature profits from it. When taking a gander at the parking administrator, the future stopping example can without much of a stretch be anticipated from the data assembled from the Smart Parking System.[2] The stopping cost can likewise be founded on the data get to improve the association's benefits. When taking a gander at nature, the degree of contamination can be diminished by diminishing air contamination noticeable all around. The measure of time spent to discover stopping is diminished bringing about efficiency and fuel utilization. The vehicle proprietors likewise

advantage from the System because the system naturally shows parking spot accessible which legitimately lessens the measure of vehicle venture out and an opportunity to look for an accessible spot. With the data gave by the framework, vehicle drivers can without much of a stretch abstain from leaving that is full and find the empty spot [3]. The quantity of unlawfully left vehicles is additionally diminished. Likewise, traffic clog is diminished. Another bit of leeway that accompanies the Smart Parking System is that it gives wellbeing, security. These points of interest make it simple for users. Some more favorable circumstances can be efficient and proficient in space and an agreeable situation in the parking [4].

### **2.3.3. Safety and Security**

While utilizing a vehicle parking system, drivers don't need to invest energy scanning around for an accessible spot rather they can legitimately move to an accessible space which is either appeared on the board, demonstrated by the sensor or appeared in their portable relying upon the sort of parking system being actualized. Driving around looking for parking can be hazardous because drivers don't have a full fixation out and about because their emphasis is on observing an accessible spot. Along these lines, arriving at a parking space certainly makes it simple for drivers and evacuates pressure and disappointment which expands security around the vehicle parking. The parking framework likewise screens the drivers' vehicles which additionally expands wellbeing.[5]

## **2.4 Related Work**

Deepthi. S, Anil A R has proposed A Survey on Smart Parking System Based on the Internet of Things. In today's life, individuals don't rely on public transport. They utilize their vehicles to travel. Along these lines, traffic increments. At the point when individuals travel through a city the most troublesome issue is to leave the vehicle. It causes not just an exercise in futility and fuel for drivers searching for parking however it likewise prompts extra exercise in futility and fuel for different drivers because of traffic blockage. From the outset, we use PGI (Parking Guidance Information) for better parking administration. Parking data might be shown on VMS (Variable Message Sign) at significant streets or lanes or it might be scattered through the web. In PGI frameworks e-parking is a creative stage that permits drivers to acquire parking data previously or during an outing and hold a parking spot.

To defeat the impediments of the PGI framework Yanfeng Geng proposes another idea "Ideal parking dependent on asset designation and reservation". It utilizes the idea of a blended whole number straight issue. At the point when individuals experience a midtown zone, there much surge and traffic. For this situation to locate an accessible area for parking is extremely troublesome. Along these lines, actualizing ideal parking individuals can without much of a stretch park vehicle in the holding areas. At the point when an individual with incapacity attempting to leave a vehicle in a city having substantial traffic, so he faces a few issues in such a circumstance to look and park the vehicle troublesome. The crippled individual can leave the vehicle in an exceptionally planned area. Smart parking finds the best accessible parking, limiting the expense. The parking and unparking should be

possible with the assistance of an android application. The user needs to introduce the android application on his/her PDA gadgets, which would have the office to pre-book the parking space.

Abhirup Khanna-2016 has taken a shot at IOT based smart parking system - Recent occasions the idea of keen urban areas has picked up grind fame. On account of the advancement of the Internet of things keen city currently is by all accounts reachable. Predictable endeavors are being made in the field of IoT to boost the profitability and unwavering quality of the urban framework. Issues, for example, traffic clog, constrained vehicle parking offices and street security are being tended to by IoT. In this paper, we present an IoT based cloud incorporated shrewd parking system. The proposed Smart Parking system comprises of an on-location sending of an IoT module that is utilized to screen and signalize the condition of accessibility of each single parking space. The idea of Smart Cities has consistently been a fantasy for mankind. Since recent years enormous headways have been made in making savvy urban areas a reality. The development of the Internet of Things and Cloud advances have offered to ascend to additional opportunities regarding savvy urban areas. Keen parking offices and traffic the board systems have consistently been at the center of building smart urban areas. In this paper, we address the issue of parking and present an IoT based Cloud coordinated smart parking system. The system that we propose gives continuous data concerning the accessibility of parking spaces in a parking zone. Users from remote areas could book a parking space for them by the utilization of our portable application. The endeavors made in this paper are intended to improve the parking offices of a city and in this manner planning to upgrade the personal satisfaction of its kin.[6]

## **3. Methodology**

### **3.1 Introduction**

This section will expound on the undertaking necessities and the various systems that will be utilized to gather and assess them. This part is defined by joining all the project segments and their functionalities. This section will likewise address all the user necessities to explain the idea of the project.

### **3.2 Purpose**

The motivation behind this segment is to expound on the user prerequisites for the smart parking system in a much understanding and predictable way. The system will have an android application that will empower users to book accessible parking from anyplace for a specific sweep of the separation of the vehicle. The Android application ought to have the option to gather data on the parking from the Arduino segment and send the booking report to the Arduino to affirm the parking reservation.

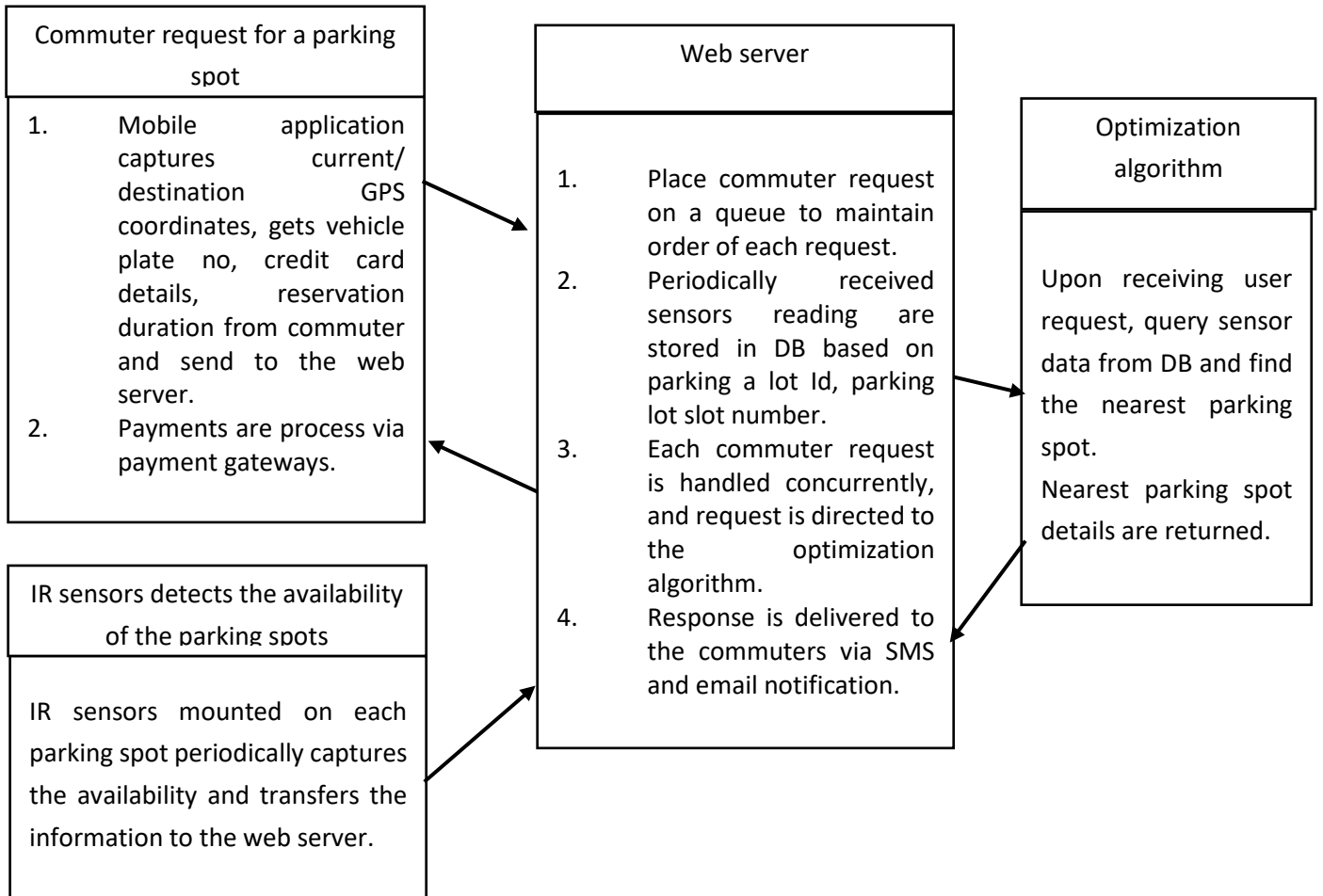
Taking a gander at the Smart Parking System, the principle focuses on the system are the drivers and diverse vehicle parking. The principal objective of this system is to permit users to book parking and spare them time when searching for a spot to stop. This venture will be made to meet user prerequisites as precise as could be expected under the circumstances.

### **3.3 Methodology**

In our days, numerous philosophies have been made of which can be applied and utilized relying upon the projects. For this undertaking, the "Incremental" model will be utilized; By utilizing the incremental model, the method of social affair a few necessities will be through meetings, overviews and surveys. The reason for the survey is to assemble what clients are anticipating from the Smart Parking System. The motivation behind the meeting is to have a smart thought on how the booking and parking process works and how to improve these procedures by utilizing the web. From the criticisms that will be gathered, the model of the Smart Parking System will be assembled so users may assess the system.

### 3.4 Design

Bird-eye view of our proposed system along with the main functionalities are listed as follows:  
Please note that the order of actions is marked in numbered arrows.



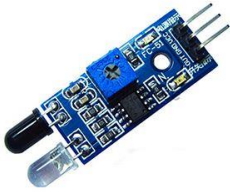
*Figure 1: Bird View of the System*

#### *Modules of the System:*

- **IR Sensor Design:** We have used IR Infrared Obstacle Avoidance Sensor Module integrated with Arduino UNO board, which will receive the signal from the IR sensor and send it to our backend, Arduino converts the infra-red signals to 0 and 1 based on the object detection.

*The list of items we used for this IR Sensor integration:*

### *IR Sensor*



*Figure 2: IR Sensor*

### *Arduino Uno Board*



*Figure 3: Arduino Uno Board*

### *Jumper Wires*



*Figure 4: Male to Female Jumper Wires*

### *Red Led Bulb*



*Figure 5: Led Bulb*

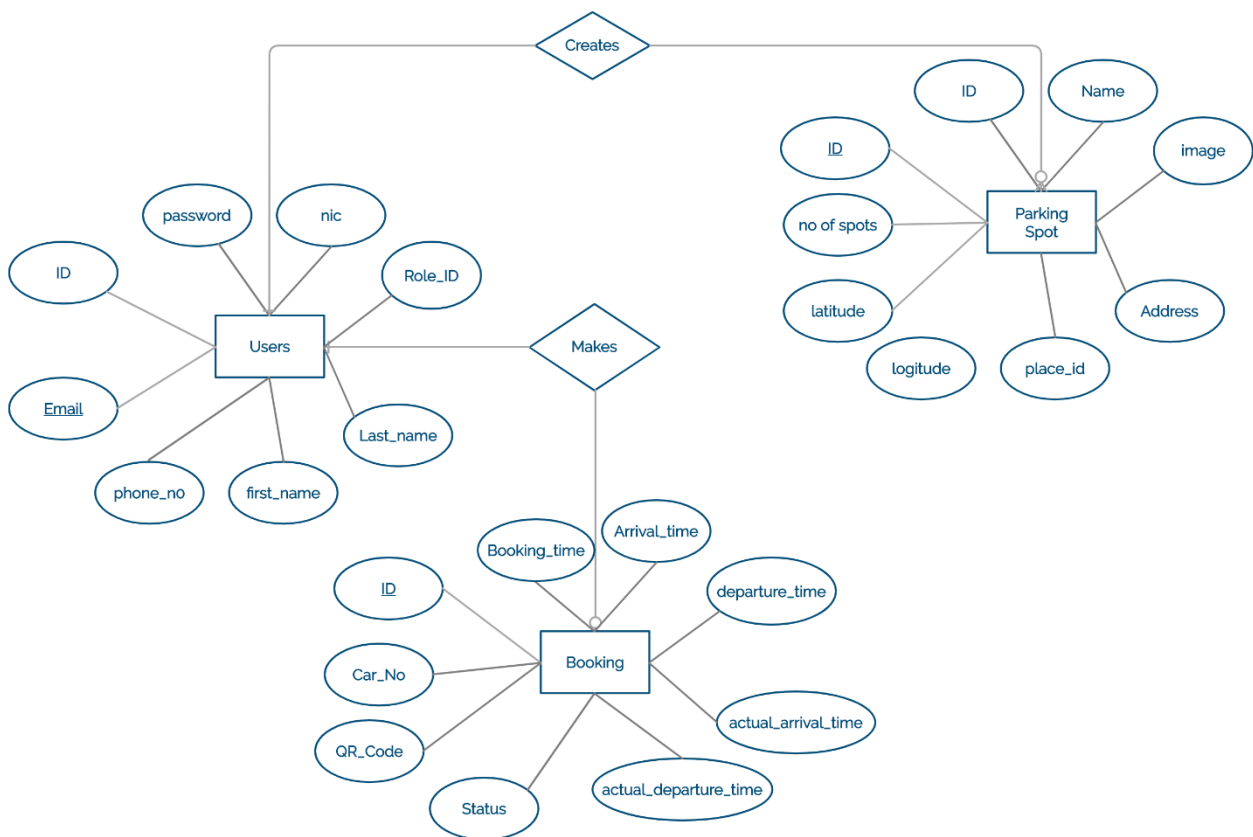
- **Admin/ Guard Module:** The guard will see reserved spaces just for the current date. When any vehicle leaves from the parking garage, the guard can empty that opening. When the guard will abandon space, it will open up for new users to book that opening. What's more, the guard will charge extra and get installments for additional time. The administrator of the system can make the parking spot utilizing the topographical directions this will be done at the underlying phases of conveying the system.
- **User Module:** Users can reserve a spot nearby in the wake of joining and signing into the site. When the user holds the parking space for the ideal date. User needs to spare their credit vehicle subtleties when they register into the system alongside Name, NIC number, vehicle number and phone User will get an affirmation email from site affirming reservation is finished effectively. When the user books the opening for a specific date and time it will get inaccessible for different users. This implies no other user can book that opening for that



specific date and time. Further simultaneousness systems will be fused to deal with the synchronization of online reservations.

- **Payment Module:** The payment module consists of a payment gateway that facilitates the users to make the payments for slot confirmation. We will be using the existing payment gateway method Sandbox from Pay Pal which is free in the market.
- **System Notifications:** Modify the online Vehicle Parking System to send Email and SMS notices both to users and administrators when another booking, installment, undoing of booking or broadening the hour of booking which has been submitted through our portable application.

**ER Diagram for the system**



**Figure 6: ER Diagram of the System**

### **3.5 System Overview**

The fundamental goal of this venture is to actualize a parking system that will empower users to know about what's going on inside the parking. Users can have this data from an android application. The system will empower users to book for parking; of which the booking keeps going for a specific timeframe before it terminates.

Our system development will be more descriptive in the build and integration phases, as discussed below.

- In the first build phase, we will investigate IR sensors. After selecting an optimal sensor product, we will capture the sensor reading of each sensor mounted on each parking slot area and directed to the database in the web back end. The sensor reading detection rate will be empirically investigated to find an optimal sensor reading detection window.
- In the second build, the back-end web server UI will be integrated to return the nearest available parking spot based on our proposing optimization algorithm.
- In the third build, we will integrate the outcome of our optimization algorithm to send notifications via SMS and via Email to the mobile application as notifications.
- In the fourth build, we will integrate the payment gateway.

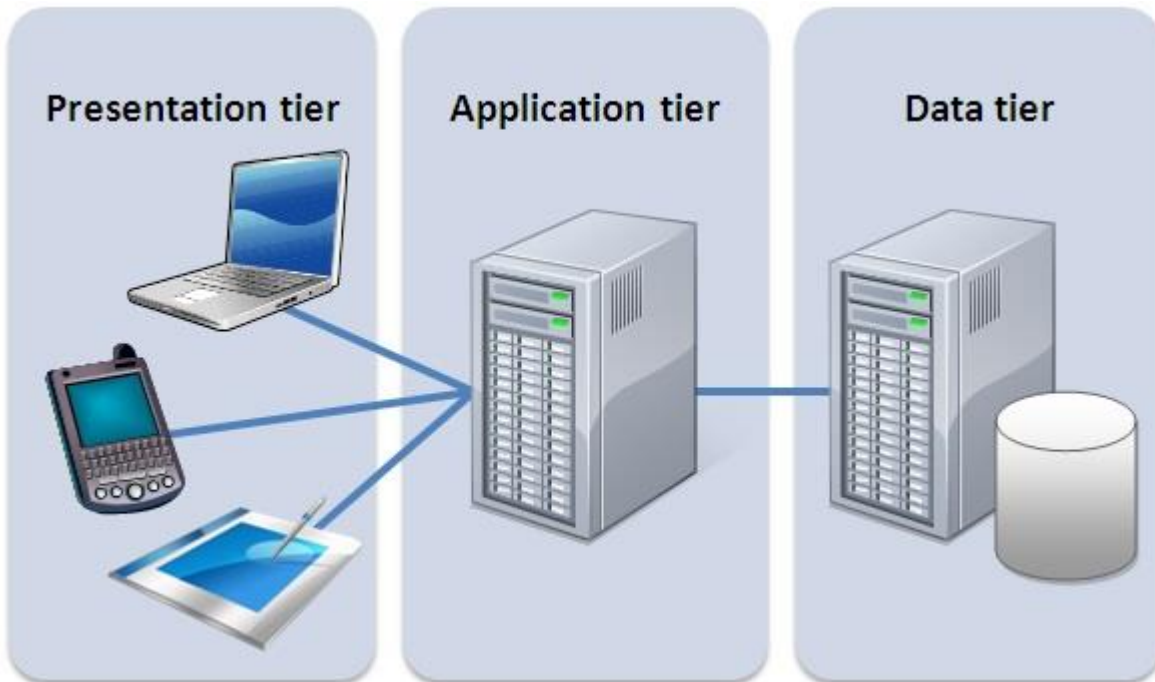
At each of the build testing, phases will be carried out each build in a modularized manner.

### **3.6 System Architecture**

It will be a client-server architecture. Client/server design is a processing model in which the server has, conveys and oversees the greater part of the assets and administrations to be devoured by the client. This sort of engineering has at least one client PCs associated with a focal server over a system or web association. This system shares figuring assets. Client/server architecture is otherwise called a systems administration figuring model or client/server arrange because all the solicitations and administrations are conveyed over a system.

When the client enters his/her booking demand (consequently distinguishes the current area utilizing google map interface, parking span, ...and so on.) through portable UI will be sent to the data information server. Where the data server runs our enhancement calculation to discover the closest parking spot dependent on the user's present area and the choice is coordinated to the user utilizing SMS and email warning components.

This has three distinct layers specifically: the top layer which is known as the UI (Presentation Tier), the center layer which is known as the Application layer and afterward the Data layer which is known as the information layer. The Smart Parking System venture utilizes different apparatuses to create three-level models. Of which the top-level depends on the PHP scripting language and the center level is utilized to decipher each solicitation originating from the top layer and afterward move to the base level of the engineering. The base engineering manufactured utilizing MySQL to execute each question originating from the center level of the design.



**Figure 7: Architecture of System**

❖ **Presentation Tier**

This is known to be the Presentation level of the design. The top-level is utilized to show data dependent on the administrations identified with the site. Taking a gander at the Smart Parking System, the top level is the UIs from the site and the android application. The site's top-level is manufactured utilizing HTML and PHP scripting language. The principle capacity of this level is to speak with different levels in the design. It sends results and gets results from different levels inside the system.

❖ **Application Tier**

This is known to be the application level of the design. The center level is utilized for preparing demands originating from different levels inside the design. Taking a gander at the Smart Parking System, the center level is the server-side which forms each question originating from the top level. This is developed utilizing PHP scripting language.

❖ **Data Tier**

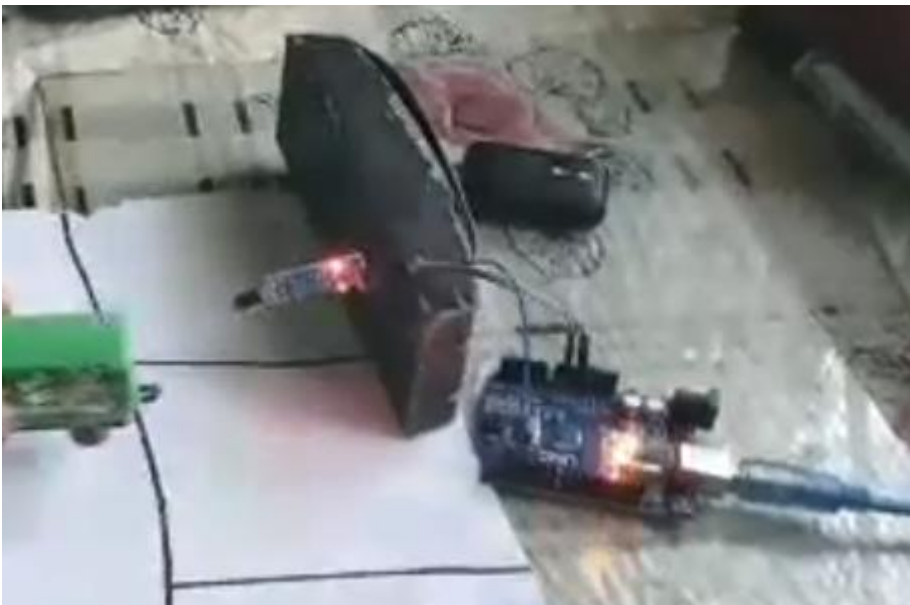
This is known to the data level. The base level is utilized to store and recover data dependent on their orders. Taking a gander at the Smart Parking System, the base level is dealt with by MySQL server through Xampp.

### 3.7 Implementation

The implementation procedure will be clarified dependent on the three levels of the framework design specifically: Presentation Tier, Application Tier and Data Tier

#### *IR Sensor Integration*

The purpose of the IR sensor in the project is to identify whether the booked car has reached the parking spot. When the vehicle reaches the parking the IR sensor will detect the vehicle and the led bulb will light up, which indicates the sensor is working and the signal will be converted to a digital signal by Arduino board and will be sent to the back-end server to update the status as the vehicle has reached the parking. The below image will show how the IR sensor works when a vehicle reaches the parking spot.



***Figure 8: IR Sensor reading vehicle movement***

#### *Optimization Algorithm*

We have a written logic to find the nearest parking location, based on the current user geographical location through the phone, based on the current location of the vehicle the nearest parking spot will be calculated. Currently, our system finds any parking areas within the 2km areas as its better for to reach the parking in the correct time, as we have a policy if a vehicle never reached the parking in 15 minutes, the booking will be canceled, to avoid these discrepancies we have searching only in 2km radius. We did a driving test in worst case scenario which is during a congested town to reach a particular spot in 15 minutes with a given radius, we tried from 5 km to 2km, any radius with less than 2km we were able to reach the spot, anything more we could not reach on time, So we used 2Km as a radius. The below code snippet shows how the logic works

```

public function getParkingByBoundary(Request $request){
    $places=ParkingSpot::whereBetween('longitude', [$request->west, $request->east])
        ->whereBetween('latitude', [$request->south, $request->north])->get();
    $placeArray=[];
    foreach ($places as $place){
        $distance=CommonClass::distance($place->latitude,$place->longitude,$request->currentLat,$request->currentLon,"K");
        $place['is_bookable']=$distance<2?true:false;

        $placeArray[]=$place;
    }

    return CommonClass::response(collect($placeArray), 200);
}

```

**Figure 9: Parking Boundary Calculation within 2 km**

```

172 public static function distance($lat1, $lon1, $lat2, $lon2, $unit) {
173     if (($lat1 == $lat2) && ($lon1 == $lon2)) {
174         return 0;
175     }
176     else {
177         $theta = $lon1 - $lon2;
178         $dist = sin(deg2rad($lat1)) * sin(deg2rad($lat2)) + cos(deg2rad($lat1)) * cos(deg2rad($lat2)) * cos(deg2rad($theta));
179         $dist = acos($dist);
180         $dist = rad2deg($dist);
181         $miles = $dist * 60 * 1.1515;
182         $unit = strtoupper($unit);
183
184         if ($unit == "K") {
185             return ($miles * 1.609344);
186         } else if ($unit == "N") {
187             return ($miles * 0.8684);
188         } else {
189             return $miles;
190         }
191     }
192 }

```

**Figure 10: The Distance calculation**

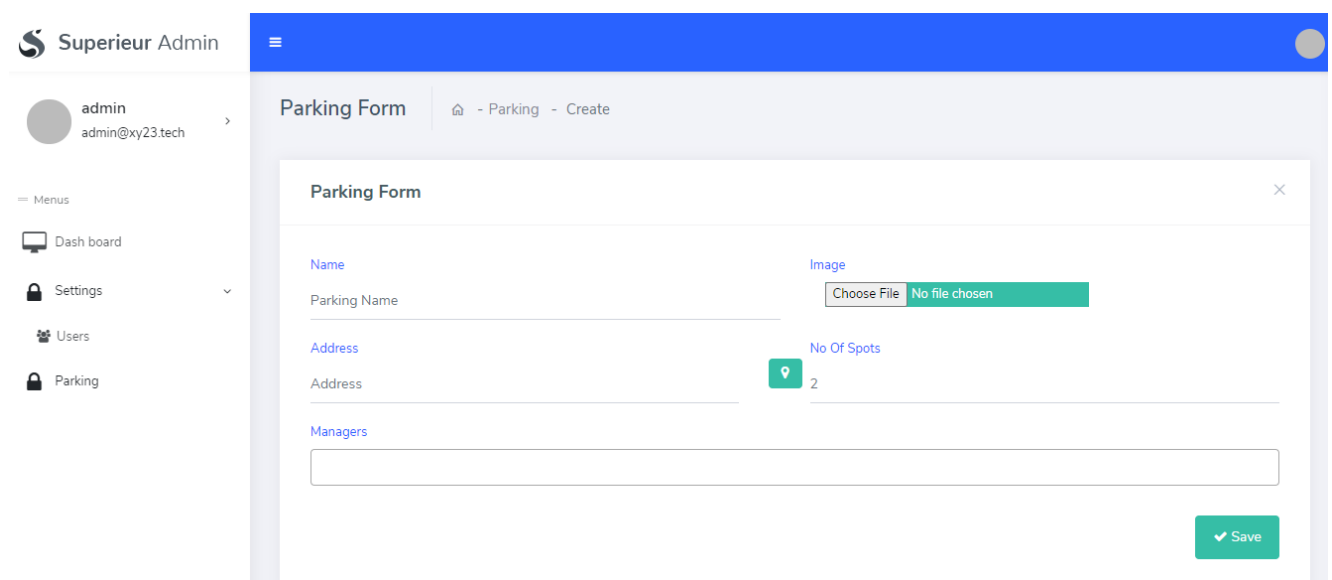
### 3.7.1 Presentation Tier

The presentation tier execution is partitioned into two segments. The principal segment will show the Administration section, the subsequent area will show the android application execution.

#### *Web portal - Admin Portal*

This portal is mainly used to create a parking slot for each parking area. This section will be used only by the System admins to maintain parking and user credentials.

This portal contains the left navigation menu of Dashboard, User setting and Parking setting.



The screenshot displays the 'Superieur Admin' web portal interface. On the left, there is a navigation menu with options: 'Dash board', 'Settings', 'Users', and 'Parking'. The user profile 'admin' (admin@xy23.tech) is visible. The main content area is titled 'Parking Form' and includes a breadcrumb trail: 'Home - Parking - Create'. The form contains the following fields:

- Name:** A text input field labeled 'Parking Name'.
- Image:** A file upload area with a 'Choose File' button and the text 'No file chosen'.
- Address:** A text input field labeled 'Address'.
- No Of Spots:** A numeric input field with a location pin icon and the value '2'.
- Managers:** A large empty text area.

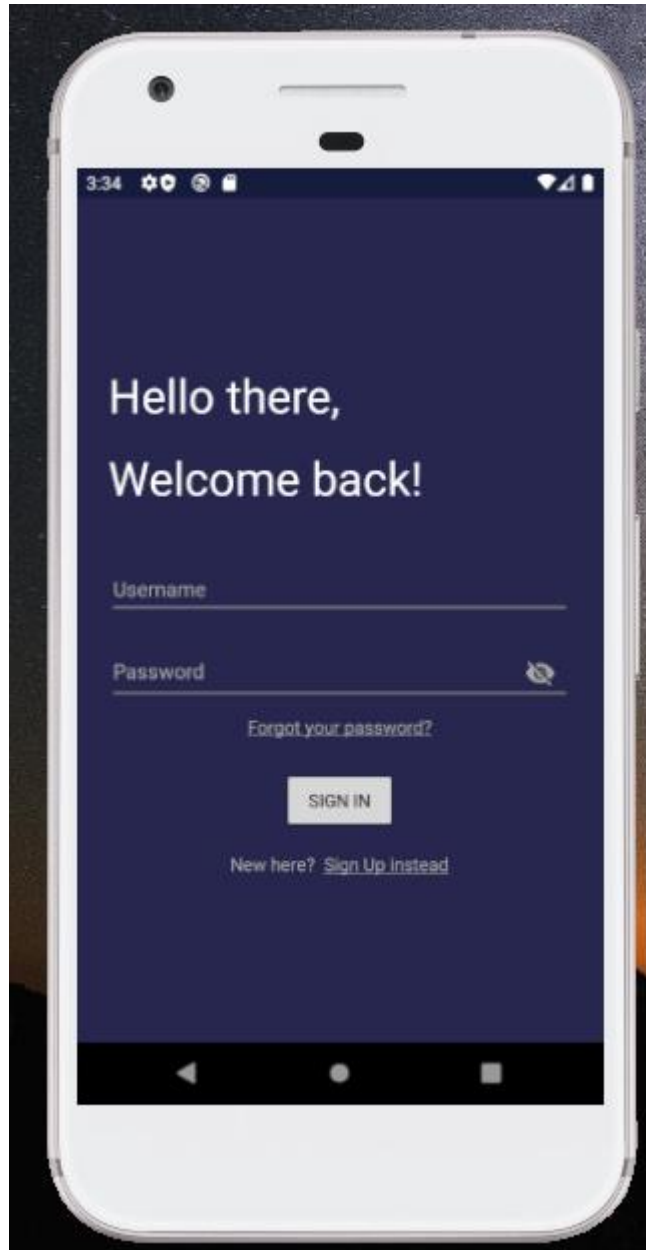
A green 'Save' button is located at the bottom right of the form.

*Figure 11: Creation of Parking Slot*

## *Android Application - Login Page*

When the application is opened initial page will be the Login page. This is to make sure we have the correct details of the user and the security of the user.

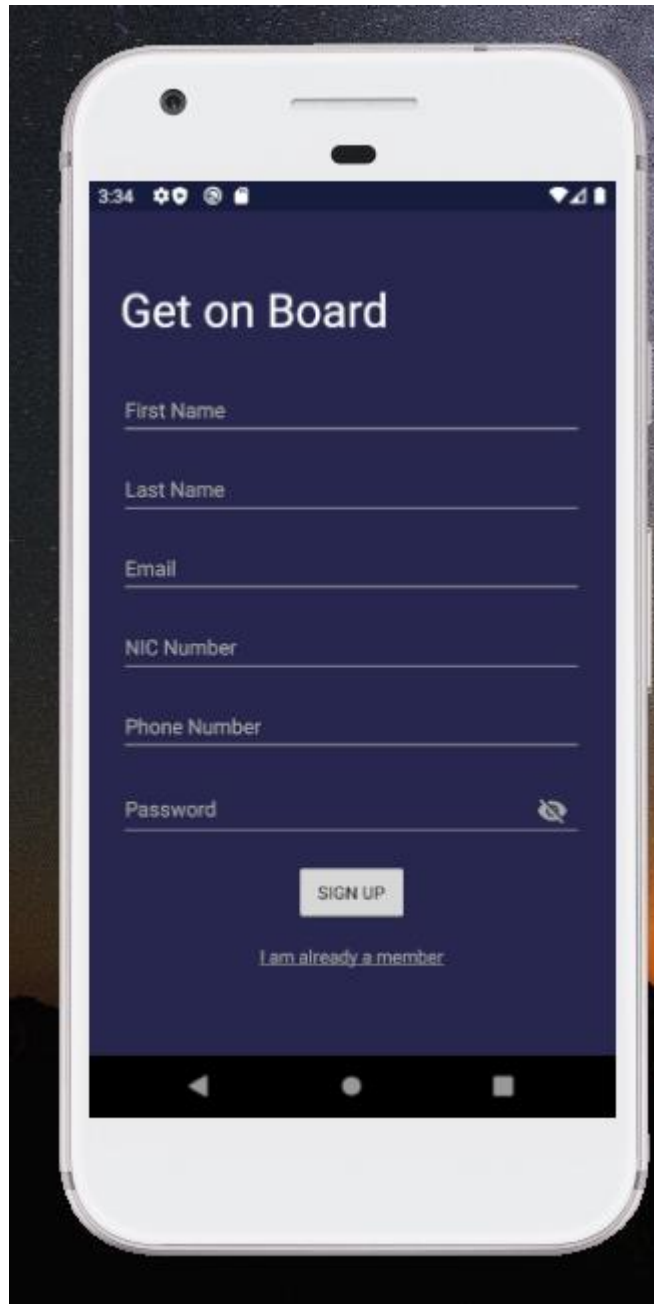
This screen contains the username which will be email, password and Sign in Button. Additionally, to this, we have a Sign-up page link if the user is not registered. The figure below shows the first landing page of the system.



*Figure 12: Login Page*

### *Android Application - Sign Up page*

Registration page, where user details will be gathered for sending notification via email and SMS, in a system like this it would be grateful to have a Signup page so user traceability and privacy can be maintained.

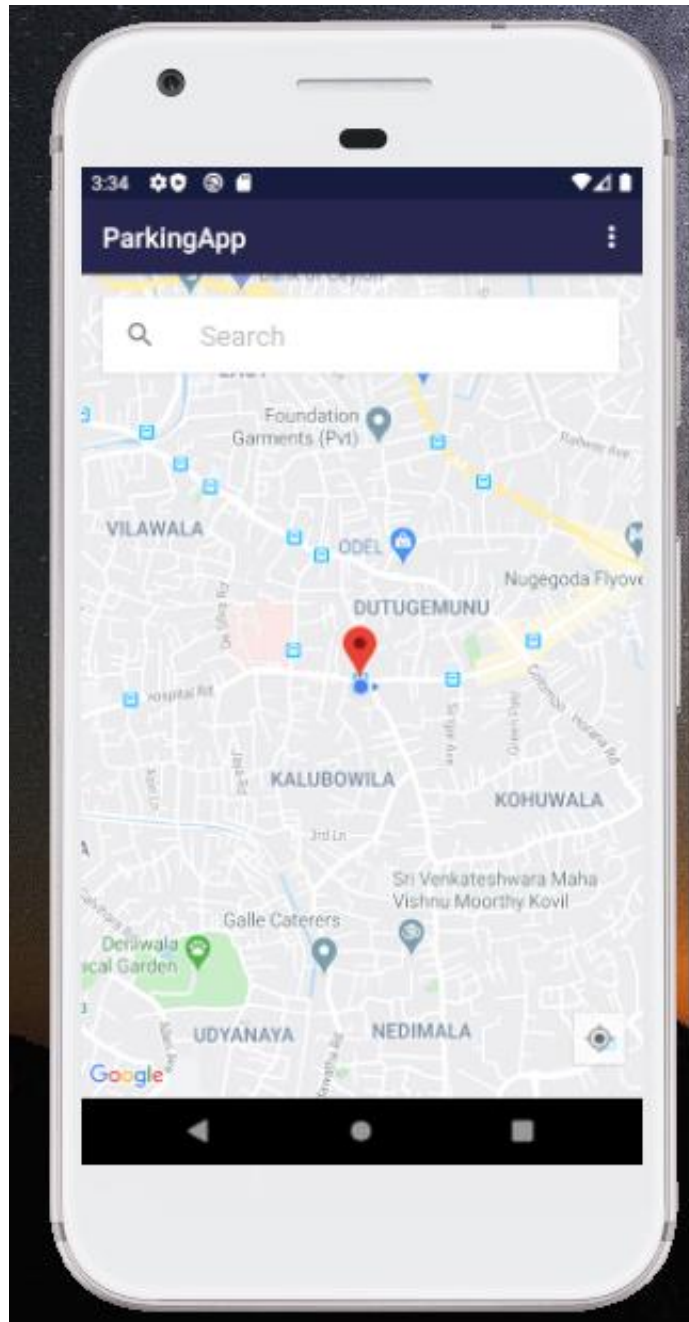


*Figure 13: Sign Up page*



### *Android Application - Main page*

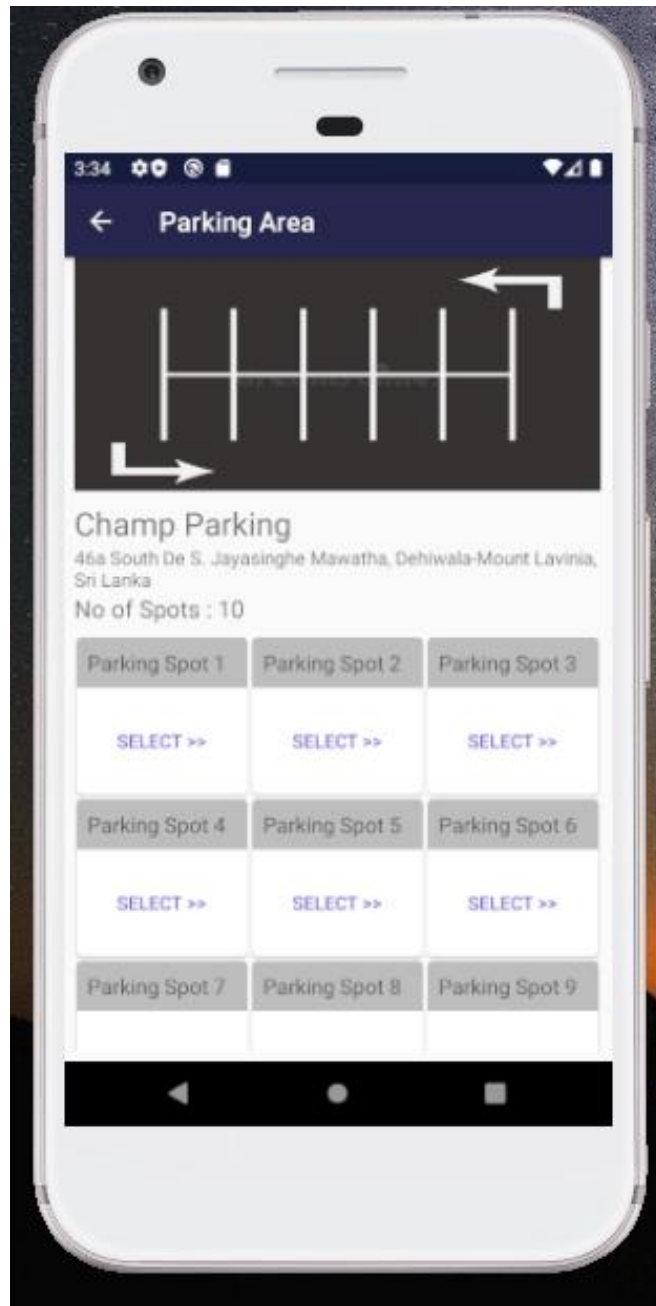
After you successfully log in to the system. The system will show your current location and closet parking near to you with a red marker. In this selection, it will only enable us to select parking which is less than 2 Km radius. But it will show all the parking which is in those areas.



*Figure 14: Main Page*

*Android Application - Parking Slot Selection page*

This will show the selected parking and how many parking that belongs to our system and it will show the availability of the parking

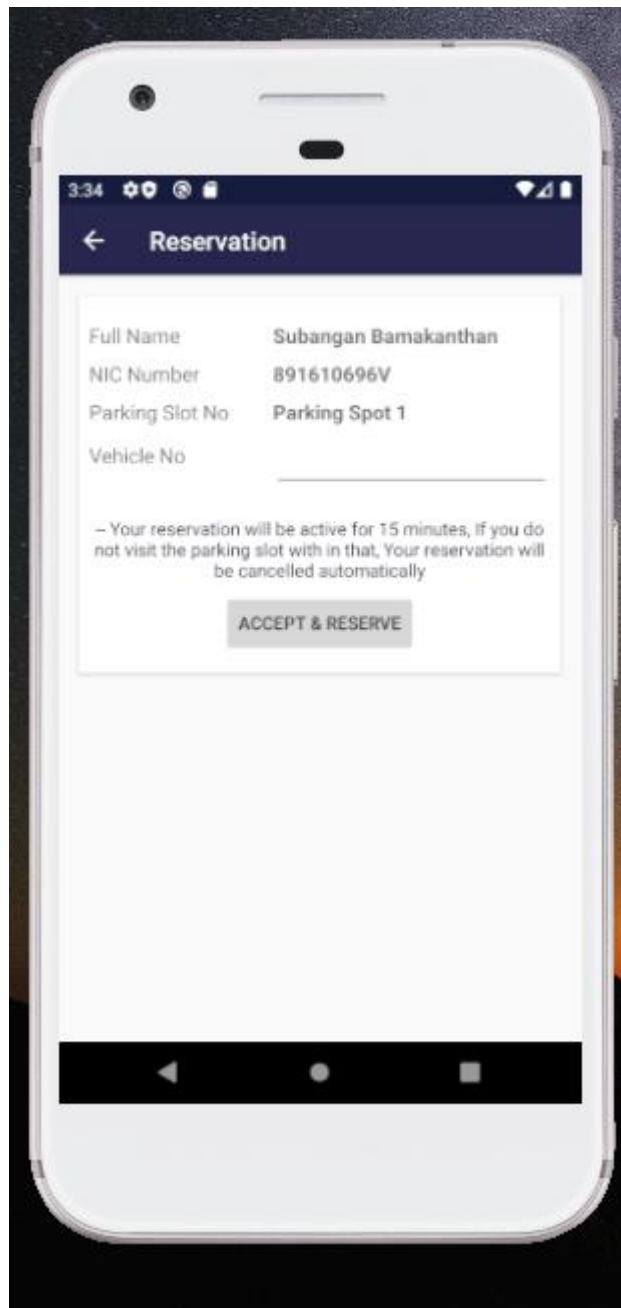


*Figure 15: Parking Slot Selection*

### *Android Application - Reservation page*

This page will show the reservation confirmation and once you confirm you will be sent an email as a reservation confirmation. This will be only valid for 15 minutes and if you do not reach the slot within 15 minutes the slot will be available for another user. Once you reach the parking a QR Code will be generated and will be sent to you as confirmation of the time you reached the parking. This QR code will be used to calculate the number of hours you have used the parking and calculate the amount according to it. The payment has to be done at the gate as payment within the mobile app will not be applicable as the time taken for the stay cannot be calculated.

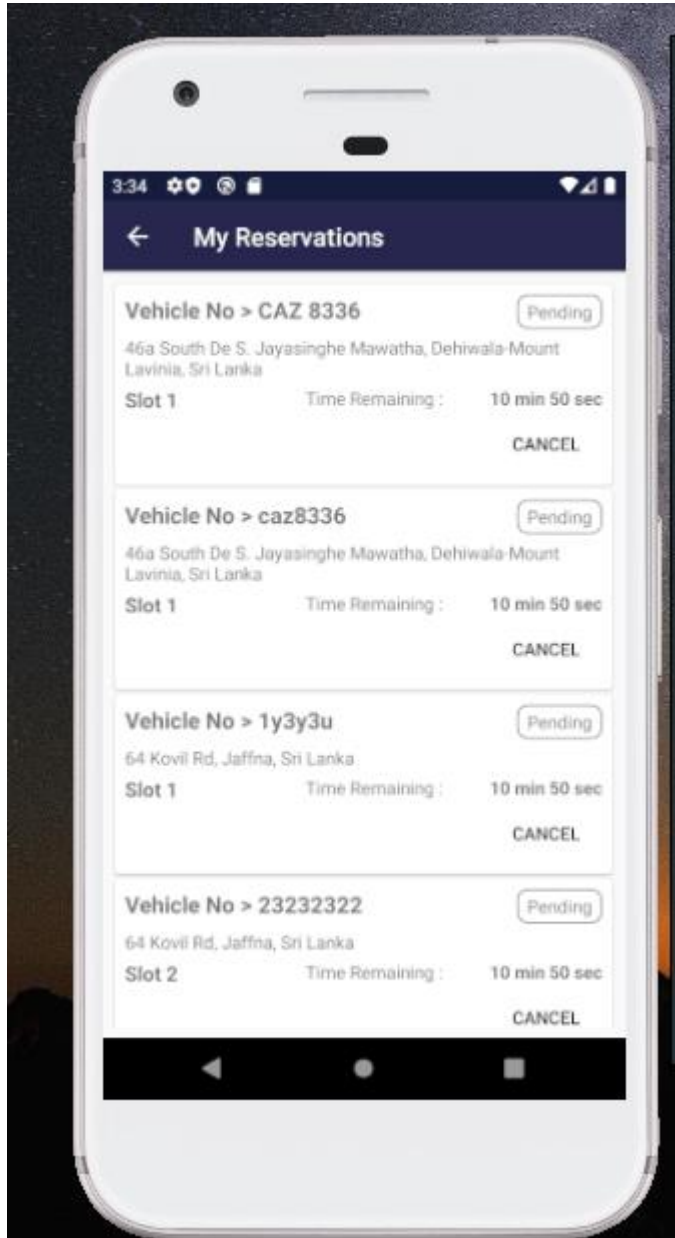
The below figure shows the confirmation screen



*Figure 16: Confirmation Page*

### *Android Application - List of Reservation*

This will show as a user how many reservations you have made through our system. This will appear after we make the confirmation.



*Figure 17: Reservation List*

### 3.7.2 Application Tier

The application tier is utilized for handling demands originating from different levels inside the design. Taking a gander at the Smart Parking System, the server-side must be prepared for the framework to run effectively. With the goal for it to process each inquiry originating from the presentation tier.

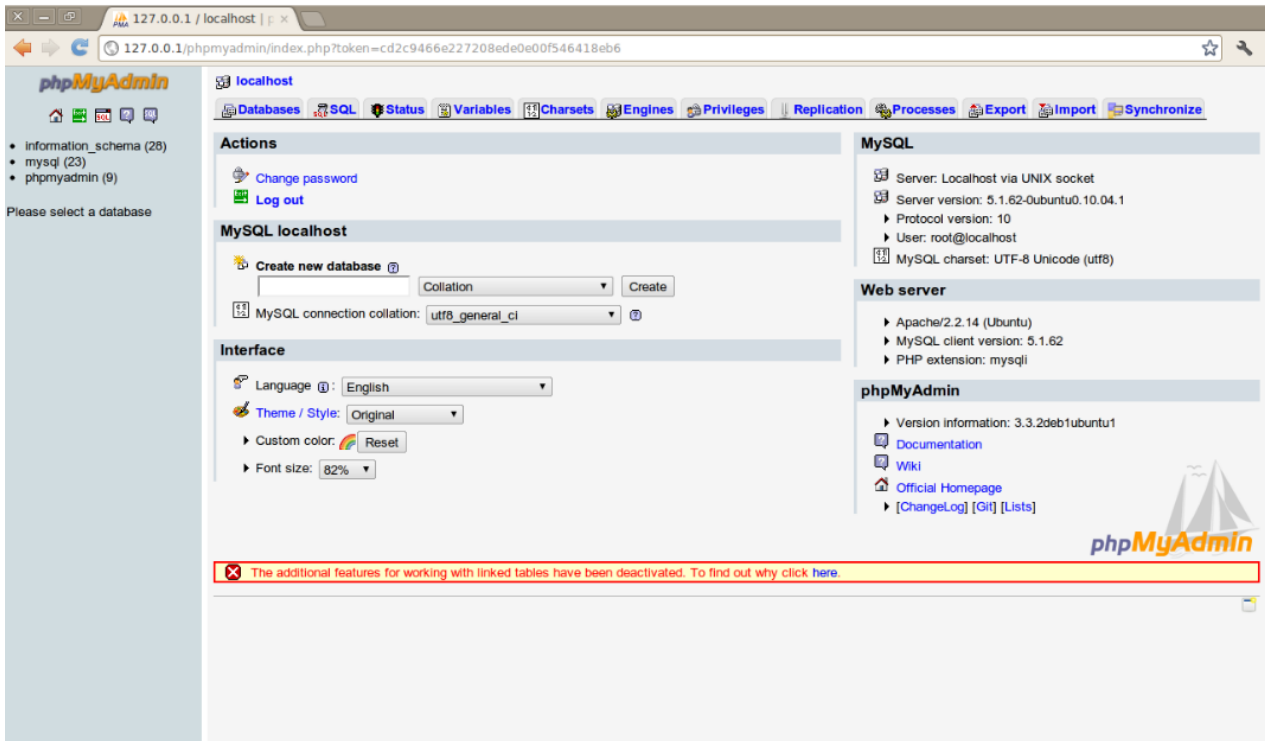
Smart Parking System was created utilizing Java, PHP and MySQL; of which, java(android) was utilized for the presentation tier, PHP for the server-side and MySQL for the data tier. All together for the framework to effectively work, the cut-off side of the Smart Parking System required the Apache server along with MySQL and phpMyAdmin.



*Figure 18: Application Tier tools*

### 3.7.3 Data Tier

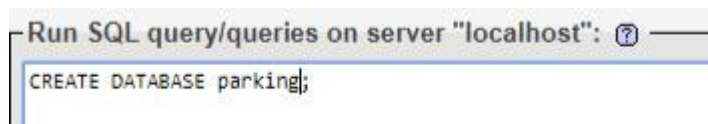
For the Smart Parking System, the database was made and overseen utilizing phpMyAdmin. This instrument permits the framework overseer to have control of the database by updating, deleting, viewing or inserting anything inside the database. As appeared in Figure, phpMyAdmin offers a straightforward interface.



*Figure 19: phpMyAdmin Database*

### *Database Creation*

This system database contains four tables that are created for the store and retrieve data. The system database name is parking



*Figure 20: Database Creation*

## Table creation

Smart Parking System is comprised of four tables specifically: users, parking spots Booking and parking spot users. Every one of the tables holds various information. The user table contains all the client details using the system. The Booking table holds all the booking that is made through the framework. At whatever point a client book a space in the parking, the data on the booking will be added to the booking table and parking spot user tables. The data will remain until the booked opening has lapsed. When the booking terminates, the data will be erased consequently. The Parking spot table holds the live information which is shown to the client. When an opening is reserved, the table will be refreshed which consequently shows the refreshed information to the client.

```
* Run the migrations.
*
* @return void
*/
public function up()
{
    $this->down();
    Schema::create('users', function (Blueprint $table) {
        $table->bigIncrements('id');
        $table->string('email', 191)->unique()->nullable();
        $table->string('phone_no', 20)->unique();
        $table->string('first_name')->nullable();
        $table->string('last_name')->nullable();
        $table->string('user_image')->nullable();
        $table->string('password');
        $table->string('nic')->nullable();
        $table->bigInteger('role_id');
        $table->text('fcm_token')->nullable();
        $table->rememberToken();
        $table->timestamps();
        $table->softDeletes();
    });

    $data = array(
        array('first_name'=>'admin', 'password'=>bcrypt('qwerty'), 'phone_no' =>'0767777777', 'email'=>'adminxy23.tech', 'role_id'=>1),
    );
    DB::table('users')->insert($data);
}

/**
 * Reverse the migrations.
 *

```

Figure 21: Create Table User

```
class CreateParkingSpotsTable extends Migration
{
    /**
     * Run the migrations.
     *
     * @return void
     */
    public function up()
    {
        $this->down();
        Schema::create('parking_spots', function (Blueprint $table) {
            $table->bigIncrements('id');
            $table->string('name');
            $table->text('image');
            $table->text('address');
            $table->text('place_id');
            $table->double('latitude', total: 8, places: 4);
            $table->double('longitude', total: 8, places: 4);
            $table->bigInteger('no_of_spots');
            $table->softDeletes();
            $table->timestamps();
        });
    }

    /**
     * Reverse the migrations.
     *
     * @return void
     */
    public function down()
    {
        Schema::dropIfExists('parking_spots');
    }
}

CreateParkingSpotsTable > down()
```

Figure 22: Create Table Parking Spot

```

* Run the migrations.
*
* @return void
*/
public function up()
{
    $this->down();
    Schema::create( table: 'parking_spot_user', function (Blueprint $table) {
        $table->bigInteger( column: 'parking_spot_id');
        $table->bigInteger( column: 'user_id');
    });
}

/**
 * Reverse the migrations.
 *
 * @return void
 */
public function down()
{
    Schema::dropIfExists( table: 'parking_spot_user');
}

```

*Figure 23: Create Table Parking Spot User*

```

* @return void
*/
public function up()
{
    $this->down();
    Schema::create( table: 'bookings', function (Blueprint $table) {
        $table->bigIncrements( column: 'id');
        $table->bigInteger( column: 'user_id');
        $table->string( column: 'car_no');
        $table->bigInteger( column: 'parking_spot_id');
        $table->bigInteger( column: 'spot_id');
        $table->dateTime( column: 'booked_time');
        $table->dateTime( column: 'arrival_time'->nullable());
        $table->dateTime( column: 'departure_time'->nullable());
        $table->dateTime( column: 'actual_arrival_time'->nullable());
        $table->dateTime( column: 'actual_departure_time'->nullable());
        $table->bigInteger( column: 'status');
        $table->string( column: 'qr_code'->nullable());
        $table->timestamps();
        $table->softDeletes();
    });
}

/**
 * Reverse the migrations.
 *
 * @return void
 */

```

*Figure 24: Create Table Booking*

In this part, the implementation procedure was examined. Various techniques that were utilized to effectively finish this task were additionally examined; including all the design execution were likewise clarified.



## **4. Evaluation**

The fundamental motivation behind this section is to test and assess the Smart Parking System. The assessment of the system will be done to see whether the users' necessities are met or not. To see whether the user's desires coordinates the system's structure, the ease of use and usefulness of the Smart Parking System should be analyzed. In this part, different procedures, systems and results will be explained.

### **4.1 Approach to Evaluation**

The methodology utilized for the assessment of the Smart Parking System was to test the functionality, ease of use and dependability of the system. The way toward assessing the convenience of the system was to find the battles looked at by users while utilizing the Smart Parking System. The way toward assessing the usefulness of the system was to see whether the system meets the user's desires.

### **4.2 Procedures of Evaluation**

The decision of philosophy used to evaluate the Smart Parking System relies upon the kind of users that were associated with the evaluation by performing different assignments on the system. The strategy, for example, perception, users' opinions, polls and reviews. The perception strategy was performed while users were performing different assignments inside the system, the admin has watched them and took notes on the ease of use of the system. Users feeling was performed by gathering inputs from users after they wrapped up their assignments on the system. The surveys were given to all the clients in the wake of utilizing the system. The survey depended on: the ease of use, usefulness and plan of the system.

These evaluations helped in seeing if the system meets the normal execution and the clients' fulfillment with the system.

## **4.3 Evaluation Tasks**

### **4.3.1 Website Evaluation**

During the evaluation procedure of the Smart Parking System site, this was mainly administration testing as this was only used for system admins. Developers evaluated this through smoke testing and the product owner tested the whole functionality of the system. As this was a very small part of the application limited testing was needed.

### **4.3.2 Android Application Evaluation**

During the evaluation procedure of the Smart Parking System android application, users were approached to accomplish various errands. Right off the bat, clients were approached to check the structure and design of the application. At that point to peruse through the application to check on the off chance that they had the option to see the available parking areas around their current location. At that point, users were approached to book for parking by giving their right subtleties. In the wake of booking, users were approached to browse their email on the off chance that they got an affirmation email. After this, users were approached to come back to the parking area section of the application to check if the parking spot they picked has turned red after they reached the destination and a QR code was generated at the time of parking to calculate the number of hours they occupied the parking.

### **4.3.3 Parking Spot Evaluation**

During the evaluation procedure of the Smart Parking, a toy car was utilized to check whether the parking is performed what is normal from it., Users are allowed to park inside the parking spot. Users were approached to put the vehicle in the parking spot and check if the light proceeds to flag that space is taken. Users were asked to check how far the sensor reads the object and were asked to move around the parking spot to check the sensor reading, Once the vehicle is parked users were asked to generate the QR code as it will be used to make the payment when they leave the parking.

## **4.4 Evaluation by Questionnaire**

After the gathering wrapped up the Smart Parking System, they were asked to answer a question that evaluates the system. The point of the inquiries was to get the users fulfillment and impressions about the system

### **4.4.1 Types of Questions**

Numerous kinds of polls were asked relying upon the rules. Questions, for example, "Open" and "Close" questions were utilized for the evaluation of the system. Of which open inquiries were utilized to permit the user to have control while replying. Users were offered time to reflect and think before replying. Close inquiries were utilized to assemble increasingly solid data from the user.

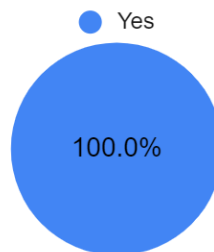
#### 4.4.2 Questionnaire

This area will help break down all the criticisms gathered from users dependent on the sort of questions that were posed. This segment is partitioned into two to be specific: android questions and parking surveys.

##### ❖ *Android Application*

Question 1: Was the data on the application important and accommodating?

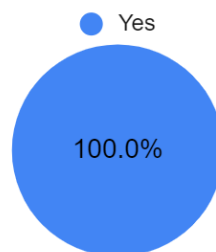
- Yes
- No



***Figure 25: Result Question 1***

Question 2: Was the design of the application adequate?

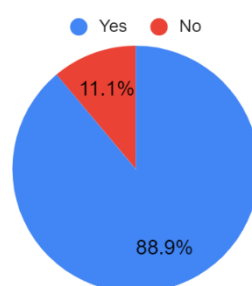
- Yes
- No



***Figure 26: Result Question 2***

Question 3: Is it accurate to say that you were happy with the text dimension?

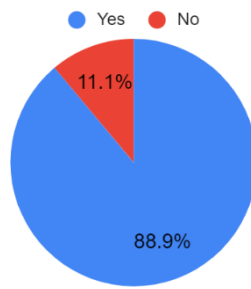
- Yes
- No



***Figure 27: Result Question 3***

Question 4: Was the Booking process easy to handle?

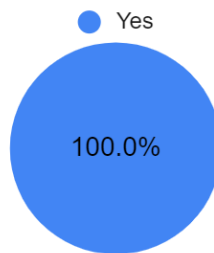
- Yes
- No



**Figure 28: Result Question 4**

Question 5: Did you receive an acknowledgment email after the reservation?

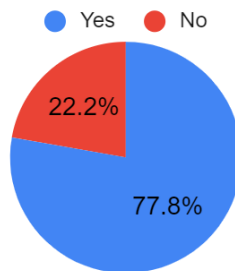
- Yes
- No



**Figure 29: Result Question 5**

Question 6: Did you receive the email on time?

- Yes
- No

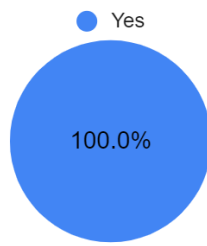


**Figure 30: Result Question 6**

❖ *Parking Spot*

Question 1: Was the parking Slot built correctly?

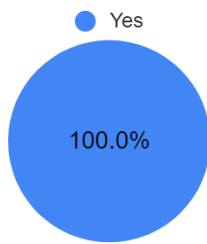
- Yes
- No



*Figure 31: Result Question 1*

Question 2: Was the parking responsive to Vehicle parking?

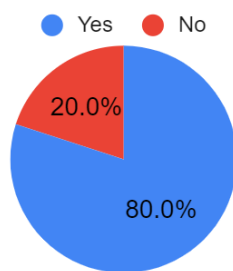
- Yes
- No



*Figure 32: Result Question 2*

Question 3: Was the layout of parking was satisfied?

- Yes
- No



*Figure 33: Result Question 3*

## **4.5 Test Results**

Taking a gander at the outcomes from users, it shows that the evaluation contrasts from users' conclusions and reflection on the Smart Parking System. While assessing the site, users concurred that the Main Page contained helpful data, straightforward and was likewise straightforward. Everybody appears to be happy with the general format and mien of the site; albeit some were not happy with the text dimension and others had an issue with the booking procedure. While assessing the system android application, users were happy with the entire procedure however same with the site, a few users had issues with the text dimension. While assessing the parking, users mentioned that the format of the parking ought to be changed because the reality parking spaces were excessively near one another which made it hard for vehicles to leave. Generally speaking, users were happy with how the system joins three diverse innovation.

## **4.6 Maintenance after Evaluation**

After accepting different evaluations from users who assessed the system, various alterations were made to the system dependent on the inputs. The alterations had numerous parts of the system, for example, the parking design, the text dimension and a few functionalities.

- ❖ System text dimension: The Smart Parking System Android Application text dimension was altered with the goal that it should meet the user's input.
- ❖ Parking design: The Smart Parking System format was changed to a sixty - degree point.

## **5. Conclusion and Future work**

This section will analyze all the sections of this report and then sum up it by sketching out the troubles that were confronted when building up the system. At last, the future application will depict highlights that could be added to improve the task.

### **5.1 Conclusion**

Taking a gander at the world in our days, Internet Technology has assumed a significant job in different viewpoints, for example, Marketing, Business, Banking and some more. Web Technology has helped individuals in building web applications. A genuine model is the Smart Parking System. The initial step of this venture was to construct a model that is associated with the web to encourage clients to utilize the system. Stage two of this undertaking was to make a site to permit the parking model to speak with the site of this system. Numerous advances were utilized to help construct the system, for example, Android (Java), PHP, JavaScript, Android and MySQL. The task has been executed in various stages, for example, Literature Review, User Requirements, Design and implementation, System Evaluation, System Maintenance. In conclusion, we have to mention as we proposed in the proposal in our first phase to build the IoT based Mobile application, which includes the functionalities of creating the user from the mobile application, searching for parking and making a reservation. This section also includes creating QR codes when a reservation is made and send an email notification to each user when the reservation is made has been completed.

In addition to that, we are making time stamps at each point of the process of reservation, when a reservation is made. When the vehicle enters the parking area and when the vehicle reaches the parking spot, we do a status update and make a timestamp, so during that time no other user will be able to make a reservation during that period, this timestamp update also helps us to calculate the time the vehicle has been parked in the spot and make the calculation for the parking fee.

The desire for this examination is to give a few manners by which an automated parking system may help improve the way of life of numerous vehicle proprietors and spare their time while requiring parking around a specific region, for example, shopping center, school, or any route around.

Albeit all the goals and necessities were met, a portion of the destinations despite everything should be actualized later on so the task could be increasingly proficient and work adequately.

### **5.2 Difficulties faced**

While building up the Smart Parking System, different hindrances were looked at in changed regions of the undertaking. The impediments were fundamental with the Literature Review and learning distinctive programming dialects, for example, Android (Java), PHP, Android, Arduino and MySQL.

Different hindrances were looked at in making the surveys, meeting and composing the report by likewise remembering the language troubles.

#### ❖ **Literature Review**

While composing the report, more often than not was spent on composing the literature review. Because of the way that fitting data should have been gathered for all the situations engaged with the project. The most troublesome part was dissecting various sorts of parking systems.

#### ❖ **Programming Languages**

While developing this system, diverse programming dialects should have been learned because of the way that a large portion of those dialects, for example, PHP, Android and Arduino were not that familiar with the developer.

#### ❖ **Report writing**

For this project, report writing was the most troublesome area. Because of the way that insufficient time was assigned to it and realizing that the individual who composed the report is certainly not a local English speaker. In this manner, much time must be spent on language structure checking and dissecting the style of composing.

### **5.3 Future work**

Programming dependent on Artificial Intelligent is getting applied all over as innovation is being enhanced with a consistent schedule. Techniques to utilize continuous inclining are being utilized all around. Calculations that help continuously information handling along with learning forms are being used and with regards to parking-related innovations, self-leave vehicles, discourse parking; sensor-based parking and mechanical parking are being utilized to improve our lives every day.

Effective turn of events and discoveries of the proposed project will be used to advance vehicle parking concentrates on which the spotlight will be more on self-parking vehicles dependent on the area of the vehicle. The principle point of the further examination is to have a more profound comprehension of how innovation can improve the way of life of individuals even with the vehicles we drive consistently. Up until this point, some examination done in the writing audit shows that because of restricted space inside the parking, most parking may have the propensity of extending their space which will result in an arrangement of little parking openings just to oblige enough vehicles. Hence, drivers may experience issues in getting down the vehicle once they have left. Execution of a self - parking vehicle will make their carries on with simple by dispensing an accessible space and simply going to leave there without the guidance of a driver.



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