

Chapter 1

INTRODUCTION

INTRODUCTION

1.1 Basic Concept

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.

Systematic approaches need to be followed, which is not being followed in current scenario. Hence, this leads to vehicle being parked at random places which causes inconvenience to the people as well other vehicles.

IOT involves extending Internet connectivity beyond standard devices, such as desktops, laptops, smartphones and tablets to physical devices and everyday objects. Embedded with technology, these devices can communicate and interact over the Internet, and they can be remotely monitored and controlled.

The proposed project 'Internet of vehicle parking system' is an on-site deployment of IOT module. It consists of a website as well as a mobile application. The entire procedure is very simple and easy to use as most complex tasks are performed by the machine. Web cameras will be used to capture images of the car's registration number. This number will be extracted by using image processing. Image processing is a method to convert an image into digital form and perform some operations on it, in order to extract some useful information from it. Data mining which is the process of discovering patterns in large data sets involving methods at the intersection of machine learning, will be used to predict the next week slots from the previous week's slot data.

Along with image processing and data mining various algorithms such as Shortest path algorithm and searching algorithms will be used to provide nearest parking lot and to search and navigate to empty parking slot. Sensors will be put into use to confirm the presence of vehicle. This project also provides security and reliability using principles of QR scanners. This project can be implemented in mall, educational institutions, work place or residential areas. It has a wide range of application. It can be used by anybody with a driving license and basic mobile knowledge.

1.2 Scope

The purpose of proposed project is to reduce the chaos caused in parking areas. The proposed system implements various IOT, image processing and data mining techniques to provide user a smooth parking experience. Various techniques are used to provide efficiency, reliability and security to the user.

The scope of project includes:

- Multiple car entry
- User registration and log-in
- Pre- booking of parking slots.
- Navigational support to search for provided empty slots.
- Provides the nearest empty slot to the user.
- various schemes for new users
- Sharing link of website to new user
- Integrated payment options
- Privileges for frequent users
- Confirmation of car and user while exit which provides security.
- History of previous week's data will be analyzed to predict next week parking slots.
- Confirm the presence of car by IR sensors.

1.3 Problem Statement

The field of IOT keeps on evolving. Due to this revolution efforts are made to address various problems. Major success of IOT in smart door lock, smart Bluetooth tracker, smart home Apps etc. are observed and the use and demand of these applications are increasing day by day. Also, various smart parking system projects are proposed. But these smart parking system projects are not as successful as other IOT projects. This is due to its high building as well as maintenance cost. Also some smart parking projects are built for a particular location the existing system is hence not useful for other locations. Due to limited applications and inflexibility, the existing projects are not being put into application.

Hence, to address these problems the project ‘Internet of vehicle parking system’ is proposed. Internet of vehicle parking system consists of an on-site deployment of an IOT module. This project is simple, inexpensive and also provides flexibility. It consists of a user friendly website as well as a mobile application. The role played by the user is very small as most of the complex tasks are performed by the machine which the user is not aware of. Principles of QR scanner, sensors and web cameras are utilized.

A system to eradicate the problems like traffic congestion, limited car parking areas, etc. by using techniques like image processing, data mining, shortest path algorithm and searching algorithm to provide a systematic parking system

1.3.1 Current Parking Scenario

The already existing system is that the users need to manually check for the empty space for the vehicle parking. A lot of time is been wasted in order to search for parking space. It might also happen that user might forget where he/she parked the vehicle. Also, security system is not been provided if user parks the vehicle somewhere.

1.3.2 Limitations of Existing System

- No feature of advance booking for parking slots.
- No proper Navigation for Parking Space.
- It does not include features like shortest path algorithm.
- It does not provide the feature of Status of parking slots.

Chapter 2

LITERATURE SURVEY

LITERATURE SURVEY

As nowadays one of the major problem of pollution is road traffic and major role takes the part of parking the car in that phase fuel wastage, noise and air pollution happens a lot. Many solutions has been developed like smartparkings.com, and many people developed systems which includes in parking in various parking areas, payment integration.

A system can be implemented that assigns the nearest vacant bay to drivers with necessary direction printed on the ticket so that drivers are able to find the 'best' lot with the minimum amount of time. The system can automatically check for the nearest empty lot and reserve the lot for the user so that the next user will not get the same lot again. Electronic components such as raspberry Pi, IR sensors and servo motors can be used to realize the system [4]

The system can be implemented for automated car number extraction so that it becomes fully automatic. The system can implement parking fee collection based on vehicle number plate recognition using OCR algorithm implemented in MATLAB [5]

The Parking Supply and Demand Analysis report is not a comprehensive parking study, nor does it make recommendations on how Portsmouth should manage its parking supply and demand.

- Estimate the existing private and public parking supply in the downtown
- Collect and analyze parking demand and utilization data in the downtown
- Identify whether or not there is an observed shortfall of parking in the downtown
- Identify sub-areas that may need additional parking spaces due to development projects in the pipeline. [6]

Chapter 3

SYSTEM DESIGN

SYSTEM DESIGN

3.1 Block Diagram

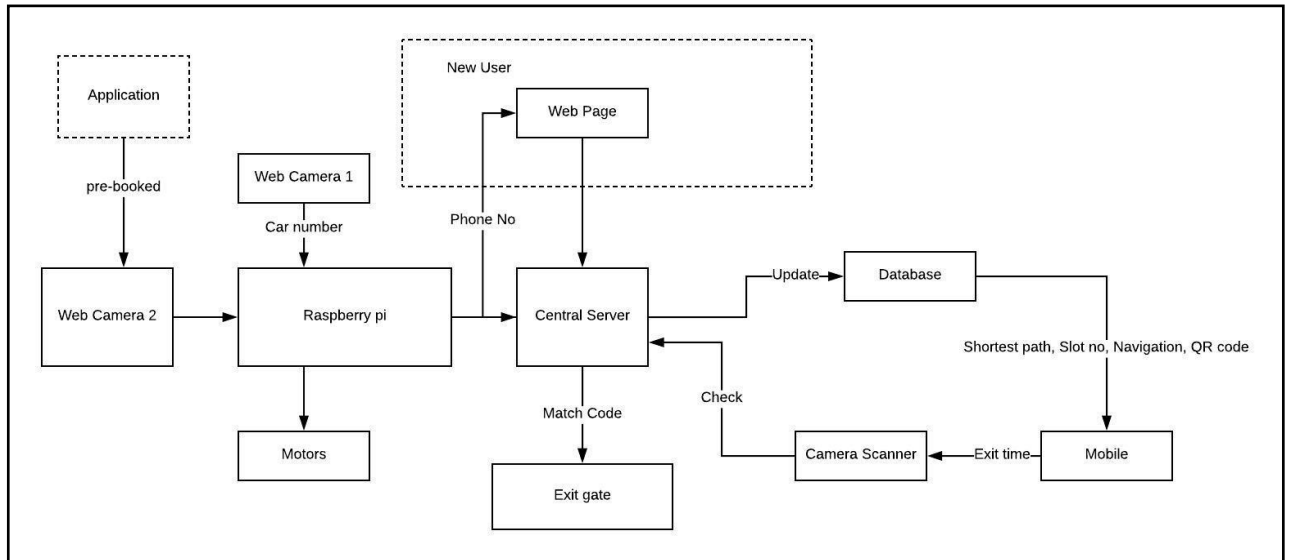


Figure 3.1.1: Block Diagram

3.2 Proposed System

As an IOT based parking system is being developed, it requires less of human interaction and more of automated features. The project consists of following features:

- The project is designed for **multiple entrances**. Vehicles can enter from multiple entry gate and can park their vehicles in the allotted slot.
- The status of parking slot is identified by **IR Sensors** to determine the whether the car parked at right slot.
- The **state of availability** of empty parking slots can be known prior coming to the parking area of any malls, theater, school, colleges etc.
- The **pre-booking** features of the system make it available for the user to book their slots so as to reserve their slot to avoid hassle.
- The **shortest path algorithm** make it easier for the user to reach to their allotted slot without searching for the slots and wasting their time.
- The project has **navigational assistance** features which is provided in the application which helps in navigating with the directions to allotted slots.
- The **integrated payment option (PayPal)** is very efficient for paying the amount, for the time the vehicle was parked which is integrated in the application.
- Owner can predict the next week ends car parking statuses using the data of previous parking data using **data mining** techniques.

IOT involves extending Internet connectivity beyond standard devices, such as desktops, laptops, smartphones and tablets to physical devices and everyday objects. Embedded with technology, these devices can communicate and interact over the Internet, and they can be remotely monitored and controlled.

3.2.1 Image Processing

Image processing is a method to convert an image into digital form and perform some operations on it, in order to extract some useful information from it. As a subcategory or field of digital signal processing, digital image processing has many advantages over analog image processing. It allows a much wider range of algorithms to be applied to the input data and can avoid problems such as the build-up of noise and signal distortion during processing.

Following are the steps involved

- Image acquisition
- RGB to gray conversion
- Image enhancement
- Image matching using edge detection Procedure

PHASE 1:

- The entrance of the car will be detected by IR sensors.
- Images of the cars entering the parking lot are captured using web camera.
- RGB to gray conversion is done on the sequence of captured images
- Now gamma correction is done on each of the captured gray image to achieve image enhancement
- Edge detection of these real time captured images of the cars is now done with the help of Prewitt edge detection operator

PHASE 2:

- After edge detection procedure both reference and real time images are matched and if they match each other by more than 90% the incoming car is allowed to enter the parking lot
- In this project the designed hardware has been considered to have a maximum capacity of 20 cars which is divided into four parts.

3.3 Algorithms

Searching algorithm and shortest path algorithm will play a major role in this:

3.3.1 Searching Algorithms

As soon as the car enters the parking area and the car number is detected and updated in databases, the searching algorithm will be applied.

Since our proposed project is flexible for multiple entrances, the nearest available parking slot will be allotted according to the entrance gates. Slot status will be marked as a waiting state.

3.3.2 Shortest path Algorithm

After the parking slot allocation, the navigational assistance will be provided to frequent user on App and on webpage for new user. In this page shortest path from the entrance to the provided parking slot will be provided so that he/she go to that slot easily.

After going to allotted slot the status of that slot will be marked as blocked so that no other car can park.

3.3.3 Additional features

In the app one option will be provided for pre-booking the slot in prior to 30 minutes.

So that user doesn't has to wait on the entrance. QR code will be used for security purpose. QR code will consist of parking information like entry time, exit time, car number, etc.

While exiting the car QR code sent is scanned first to ensure any other person should not take the car. After successful scanning payment page will be available and the user can pay via PayPal wallet.

ADMIN GUI

The lot will be locked for a certain time and will be available for the next driver if the time allocated has ended or if no car is parked as the sensor in that particular lot will always detect whether it is occupied or empty.

3.3.4 Demand Analysis

Usually on weekends the number of users in car parking area increases so admin should be aware of the number of people visiting.

This analysis is done using data mining techniques using the previous day's data and history as a data set.

3.4 Methodology

The proposed Parking system provides an optimal solution for parking problem in metropolitan cities. Due to rapid increase in vehicle density especially during the peak hours of the day, it is a difficult task for the drivers to find a parking space to park their vehicles. The aim is to resolve the above mentioned issue which provides the Smart Parking system. A suitable shortest path algorithm is used to find the minimum distance between the user and each car park in the system. Thus, the waiting time of the user is minimized. The system also introduces the usage of android application using smart phone for the interaction between the Smart Parking system and the user.

The webcam will capture the car number of the car entering into the parking area. The image processing technique will be used to convert an image into digital form and perform operations on it, in order to extract useful information from it.

The shortest path and the searching algorithm will be used for finding the nearest empty slot from the respective entrance in the multiple entrance environment.

Demand Analysis will help in predicting the scenarios from the past days

3.4.1 An IOT based vehicle parking system

This system provides a unique algorithm which increases the efficiency of the parking system. This system helps the users to find a free parking space with minimal cost ased on new performance metrics which is automatic. This metrics will calculate the user spaces in each car park. To enhance the parking management, an intelligent parking system will be developed which reduced the purpose of hiring people to maintain the parking system.

Advantages:

1. Better performance.
2. Low Cost.
3. Includes slot allocation mechanism.
4. Provides large scale parking system.

3.4.2 Workflow

The project is basically designed for the frequent visiting user and the new user.

For frequent visiting users the application is pre-installed. This provides them to pre-book their slots prior coming to the parking area. The pre-booking features also tell the availability of the empty slots. The user can then book the slots according to his/her convenience.

After coming to the parking area the number plate is scanned from the scanner which extract the vehicle number. User has to now provide his/her phone number to the administrator for entering it into the database.

Once verified the user is sent with the navigational details and also a QR code to his/her mobile application. Navigational details help user to reach till the allotted slot without searching for, it in less amount of time.

Here shortest path algorithm and searching algorithms helps in directing to the slot. Once user reach to the allotted slot the IR sensors detect the presence of the vehicle. Hence, the administrator comes to know about the parked vehicle and the detail is updated with the time being noted for parking. At the time when the user is about to go the sent QR code is scanned and

If the QR code is matched then payment page will pop up and you can pay via PayPal and user can exit.

For New user has to give car number, phone number (Car number is for confirmation) and link will be sent. Link will be consisting path to allotted slot and app download link so that user can download and after that process will as frequent user.

Owner has an advantage that they can predict parking data of net weekends using data using regression techniques, probability.

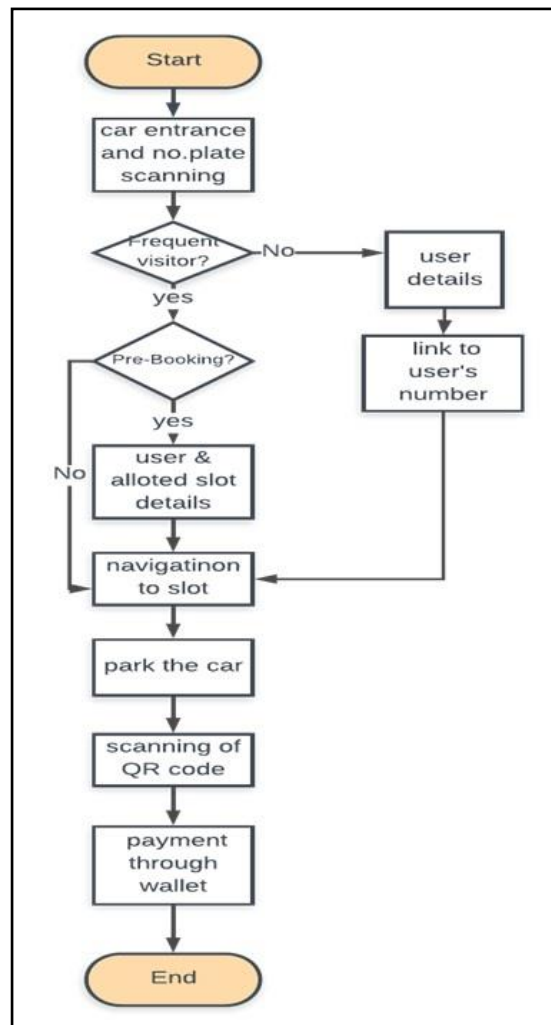


Figure 3.4.2.1 – Flow chart

3.5 Feasibility Analysis

3.5.1 Technical Feasibility

Image processing will be made using python and MATLAB. We will also build shortest path and searching algorithm. We will store database in MySQL. Demand analysis will be implemented using data mining techniques like regression and probability.

3.5.2 Economic Feasibility

The cost of the project might increase once the prototype is ready to be scaled to real time scenarios, since the application might require more resources like webcams, IR sensors etc.

3.5.3 Social Feasibility

Most of the parking areas are not provided with searching and shortest path algorithm techniques. Our proposed system have this techniques which help users to reach to their allotted slots without searching for the lots in less amount of time so that the searching time is saved.

The proposed system can be implemented in many of the malls, residential areas, schools, railway stations, airports, etc.

The system can be marked on its two main features- searching algorithm and demand analysis

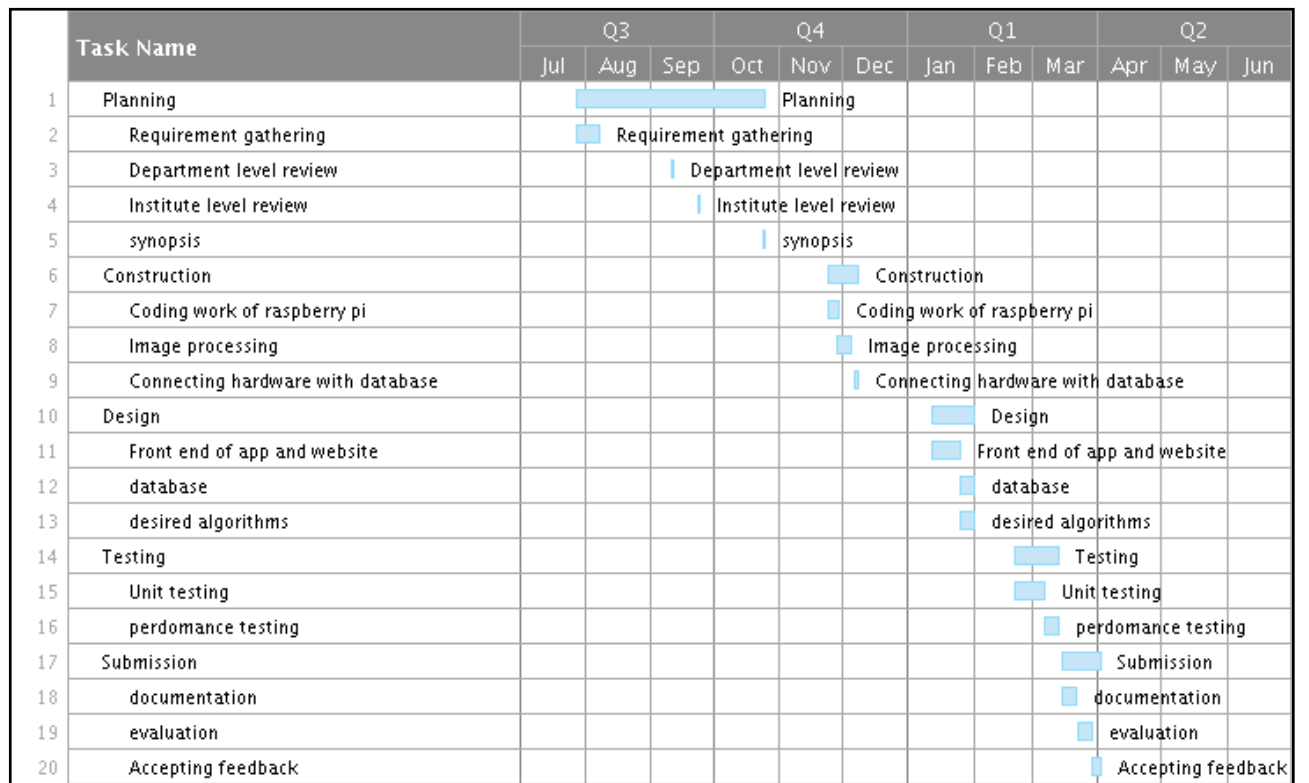


Figure 3.5.1 – Timeline Chart/Gantt Chart

3.6 Data design of Parking system

Data flow diagram can dive into progressively more detail by using levels and layers, zeroing in on a particular piece. DFD levels are numbered 0, 1 or 2, and occasionally go to even Level 3 or beyond. The necessary level of detail depends on the scope of what you are trying to accomplish. A data flow diagram can dive into progressively more detail by using levels and layers, zeroing in on a particular piece. DFD levels are numbered 0, 1 or 2, and occasionally go to even Level 3 or beyond. The necessary level of detail depends on the scope of what you are trying to accomplish.

3.6.1 DFD Level 0

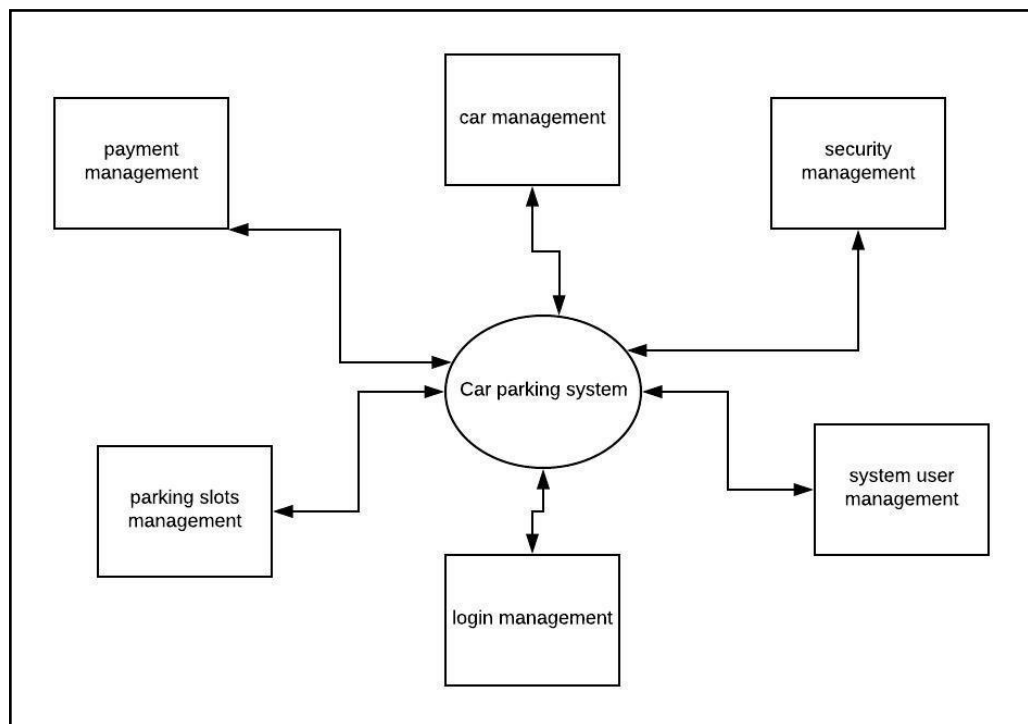


Figure 3.6.1.1: DFD level 0

Describes the overall Flow of our project. The main system through which the notification will be generated is through Web Portal. Here sensors on the parking entrance will sense the car and will read the number plate through image processing. Then Admin will access the web portal and

system will send parking details directly to the user. DFD Level 0 is also called a Context Diagram. It's a basic overview of the whole system or process being analyzed or modelled.

3.6.2 DFD Level 1

A data flow diagram can dive into progressively more detail by using levels and layers, zeroing in on a particular piece.

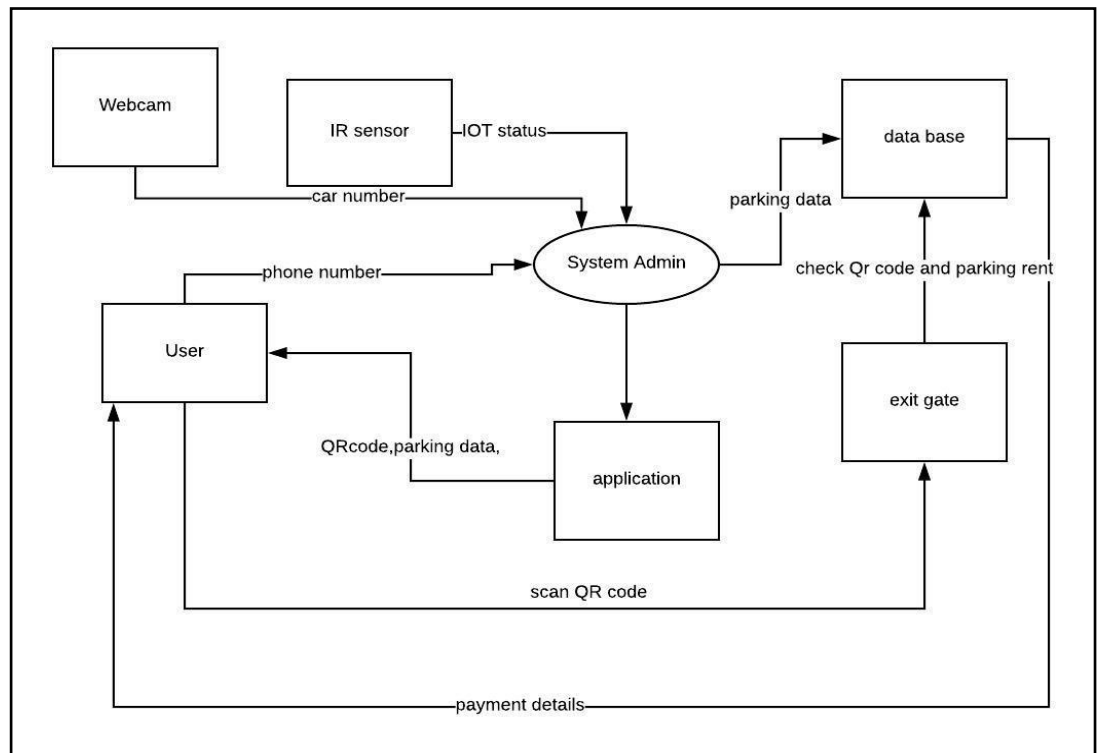


Figure 3.6.2.1: DFD level 1

The web portal has the following features: webpage, login, pre-booking, payment details. Sensors will send the sensed values to the cloud. The stored values on cloud can be accessed through web portal. User can access webpage by login the credentials and can also view notification panel and access updates.

3.7 UML Diagrams

3.7.1 Use Case Diagram

A use case diagram at its simplest is a representation of a user's interaction with the system that shows the relationship between the user and the different use cases in which the user is involved. A use case diagram can identify the different types of users of a system and the different use cases and will often be accompanied by other types of diagrams as well.

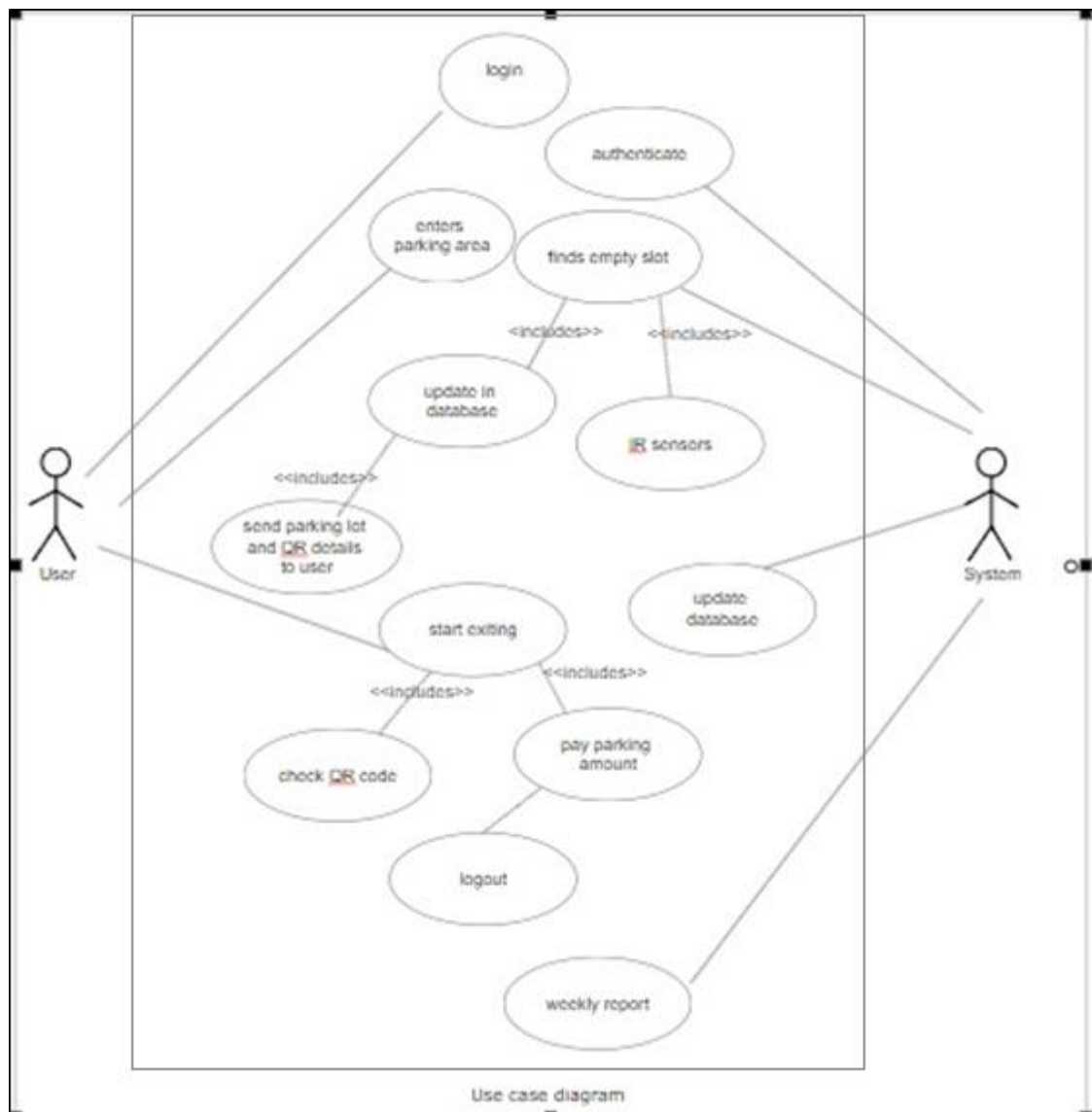


Figure 3.7.1.1: Use Case Diagram

The use case diagram of our project includes following actors: User, System. The user can view and receives notification which extends login on web portal. The system handles out all the parking management tasks like assigning slots, updating database, payment details and weekly reports.

3.7.2 ER Diagram

The Proposed System has 6 tables in our Database namely user, area, area1, area2, area3, area4, orders .In area table, there is area1, area2, area3, area4's status. Each areas has 4 slots and also their status is present. In order table there is information about parked cars.

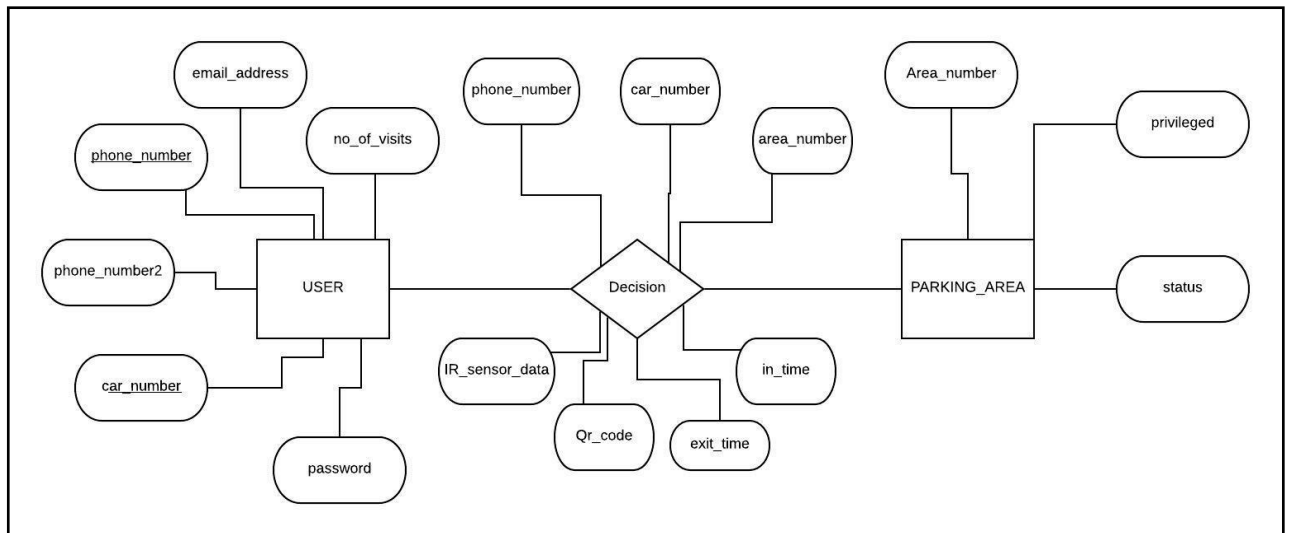


Figure 3.7.2.1 – ER diagram

Chapter 4

SYSTEM IMPLEMENTATION

SYSTEM IMPLEMENTATION

4.1 Hardware and Software Requirements

4.1.1 Hardware Requirements

- Power Supply
- Raspberry Pi
- IR Sensor
- Pi camera
- Desktop (User end)

4.1.2 Software Requirements

- Operating System
- Raspbian OS (Linux based RPi OS)
- VNC viewer: to access the raspberry pi
- Python 2.7
- HTML5 CSS3 JavaScript JQuery PHP : For website (front-end and back-end)
- OpenALPR

4.1.3 Tools Required

- OS Required : DEBIAN STRETCH WITH RASPBERRY PI DESKTOP
- Windows / Ubuntu Desktop minimum 2GB RAM

4.2 Hardware Description

4.2.1 Raspberry pi 2

Compared to the Raspberry Pi 1 it has:

- A 900MHz quad-core ARM Cortex-A7 CPU
- 1GB RAM

Like the (Pi 1) Model B+, it also has:

- 100 Base Ethernet
- 4 USB ports
- 40 GPIO pins
- Full HDMI port
- Combined 3.5mm audio jack and composite video
- Camera interface (CSI)
- Display interface (DSI)
- Micro SD card slot
- VideoCore IV 3D graphics core

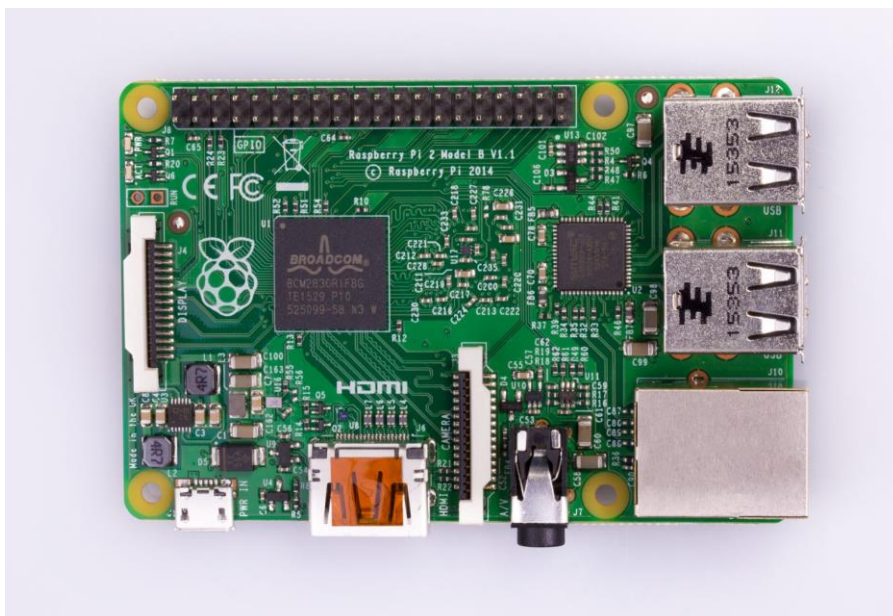


Figure 4.2.1.1: Raspberry pi 2 model B

4.2.2 IR sensor

Infrared technology addresses a wide variety of wireless applications. The main areas are sensing and remote controls. In the electromagnetic spectrum, the infrared portion is divided into three regions: near infrared region, mid infrared region and far infrared region.

The frequency range of infrared is higher than microwave and lesser than visible light. For optical sensing and optical communication, photo optics technologies are used in the near infrared region as the light is less complex than RF when implemented as a source of signal. Optical wireless communication is done with IR data transmission for short range applications.

An infrared sensor emits and/or detects infrared radiation to sense its surroundings.

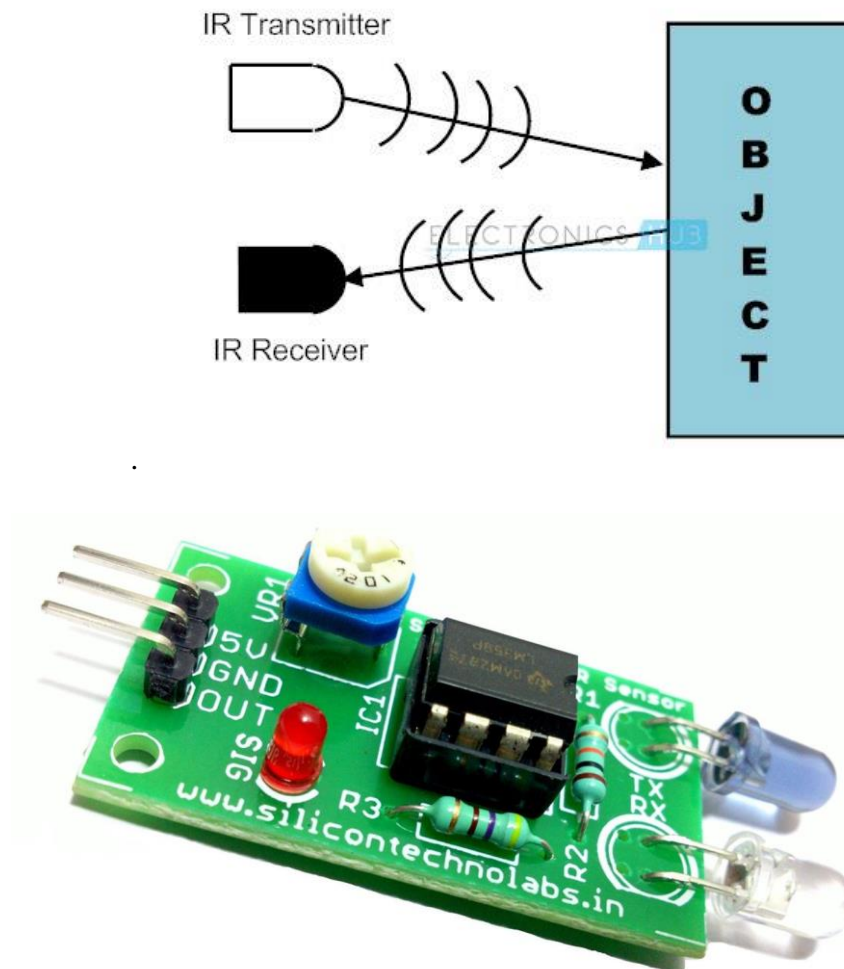


Figure 4.2.2.1: IR sensors

4.2.3 Pi camera

The Raspberry Pi Camera Module v2 replaced the original Camera Module in April 2016. The v2 Camera Module has a Sony IMX219 8-megapixel sensor (compared to the 5-megapixel OmniVision OV5647 sensor of the original camera).

The Camera Module can be used to take high-definition video, as well as stills photographs. It's easy to use for beginners, but has plenty to offer advanced users if you're looking to expand your knowledge. There are lots of examples online of people using it for time-lapse, slow-motion, and other video cleverness. You can also use the libraries we bundle with the camera to create effects.

You can read all the gory details about IMX219 and the Exmor R back-illuminated sensor architecture on Sony's website, but suffice to say this is more than just a resolution upgrade: it's a leap forward in image quality, colour fidelity, and low-light performance. It supports 1080p30, 720p60 and VGA90 video modes, as well as still capture. It attaches via a 15cm ribbon cable to the CSI port on the Raspberry Pi.

The camera works with all models of Raspberry Pi 1, 2, and 3. It can be accessed through the MMAL and V4L APIs, and there are numerous third-party libraries built for it, including the Picamera Python library. See the Getting Started with Picamera resource to learn how to use it.

The camera module is very popular in home security applications, and in wildlife camera traps.



Figure 4.2.3.1: Pi Camera

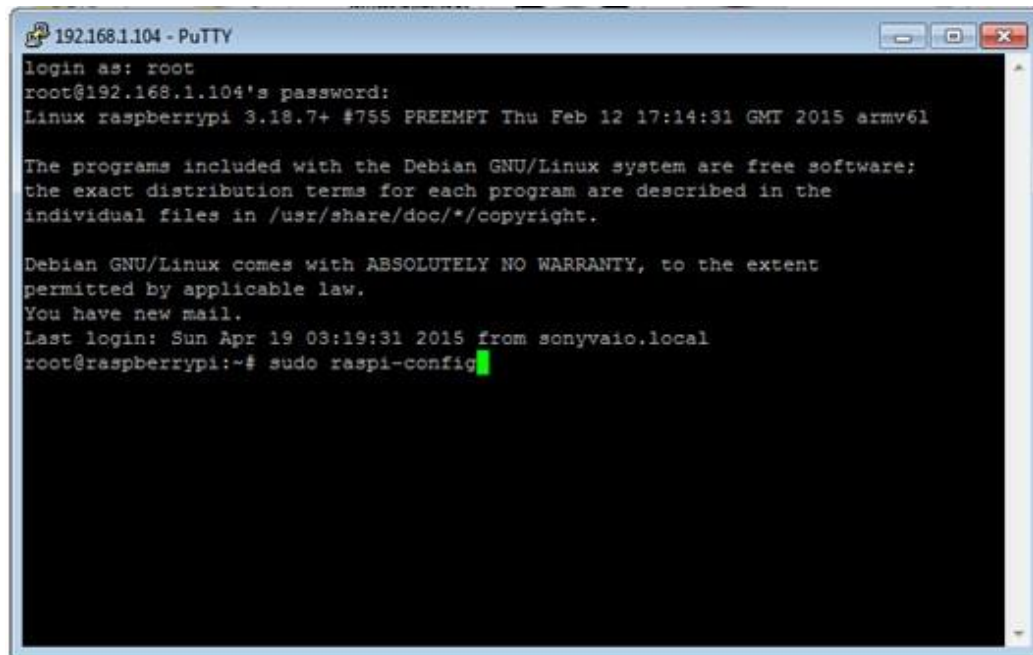
4.3 Installation of LINUX Raspbian operating system on RPI :

Step 1:

This is a Raspberry Pi configuration tool called **raspi-config**

You can skip this part, and run the tool later if you know what are you doing.

However, it is wise to go through the options for the first time setup.



```
192.168.1.104 - PuTTY
login as: root
root@192.168.1.104's password:
Linux raspberrypi 3.18.7+ #755 PREEMPT Thu Feb 12 17:14:31 GMT 2015 armv6l

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
You have new mail.
Last login: Sun Apr 19 03:19:31 2015 from sonyvaio.local
root@raspberrypi:~# sudo raspi-config
```

Figure 4.3.1: Config Command

raspi-config aims to provide the functionality to make the most common configuration changes. This may result in automated edits to /boot/config.txt and various standard Linux configuration files. Some options require a reboot to take effect. If you changed any of those, raspi-config will ask if you wish to reboot now when you select the Finish button.

`sudo raspi-config`

The sudo is required because you will be changing files that you do not own as the pi user.

It has the following options available: Setup

Options :

- Expand Filesystem
- Change User Password
- Enable Boot to Desktop/Scratch
- Interfacing options
- Enable Camera
- Enable gpio pins
- Overclock
- Advanced Options

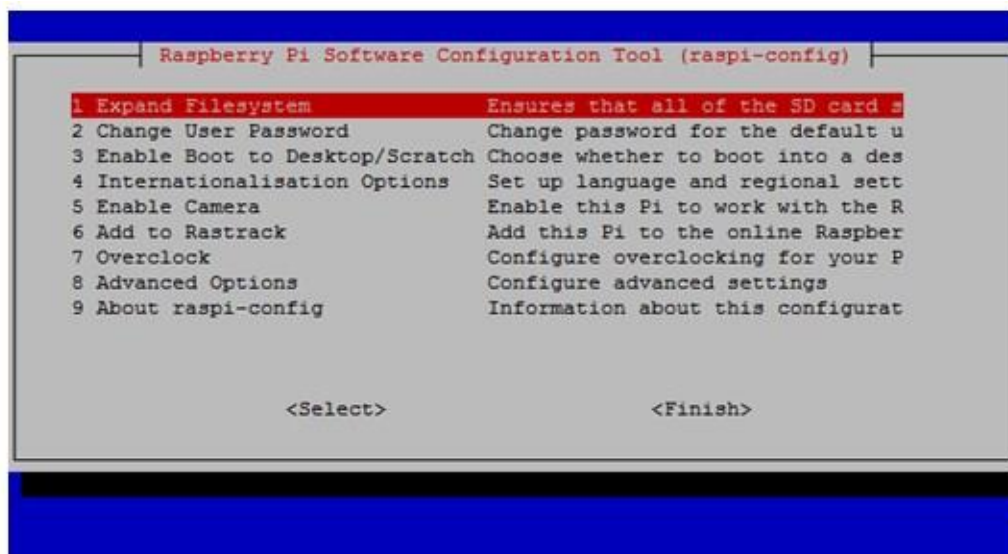


Figure 4.3.2: Setup Options

Step 2:

Menu Options

Expand File system

If you installed Raspbian using NOOBS, you can ignore this section as the file system was expanded automatically during installation. However, if you wrote the image to an SD card yourself, then a portion of the card will be unused; this can be any amount over 3GB. Choosing this option will expand your installation to fill the rest of the SD card, giving you more space to use for files. You will need to reboot the Raspberry Pi to make this available. Note there is no confirmation; selecting the option begins the partition expansion immediately.

```
Command (m for help):
Disk /dev/mmcblk0: 3965 MB, 3965190144 bytes
4 heads, 16 sectors/track, 121088 cylinders, total 7744512 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk identifier: 0x0002c262

   Device Boot      Start         End      Blocks   Id  System
/dev/mmcblk0p1        8192       122879        57344    c   W95 FAT32 (LBA)
/dev/mmcblk0p2     122880       7744511       3810816   83   Linux

Command (m for help): Partition number (1-4):
Command (m for help): Partition type:
   p   primary (1 primary, 0 extended, 3 free)
   e   extended
Select (default p): Partition number (1-4, default 2): First sector (2048-7744511, default 2048):
Last sector, +sectors or +size(K,M,G) (122880-7744511, default 7744511): Using default value 7744511
11

Command (m for help):
Disk /dev/mmcblk0: 3965 MB, 3965190144 bytes
4 heads, 16 sectors/track, 121088 cylinders, total 7744512 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk identifier: 0x0002c262

   Device Boot      Start         End      Blocks   Id  System
/dev/mmcblk0p1        8192       122879        57344    c   W95 FAT32 (LBA)
/dev/mmcblk0p2     122880       7744511       3810816   83   Linux

Command (m for help): The partition table has been altered!
```

Figure 4.3.3: Expanding File System

The resulting partition layout change will take effect after rebooting Raspberry Pi.

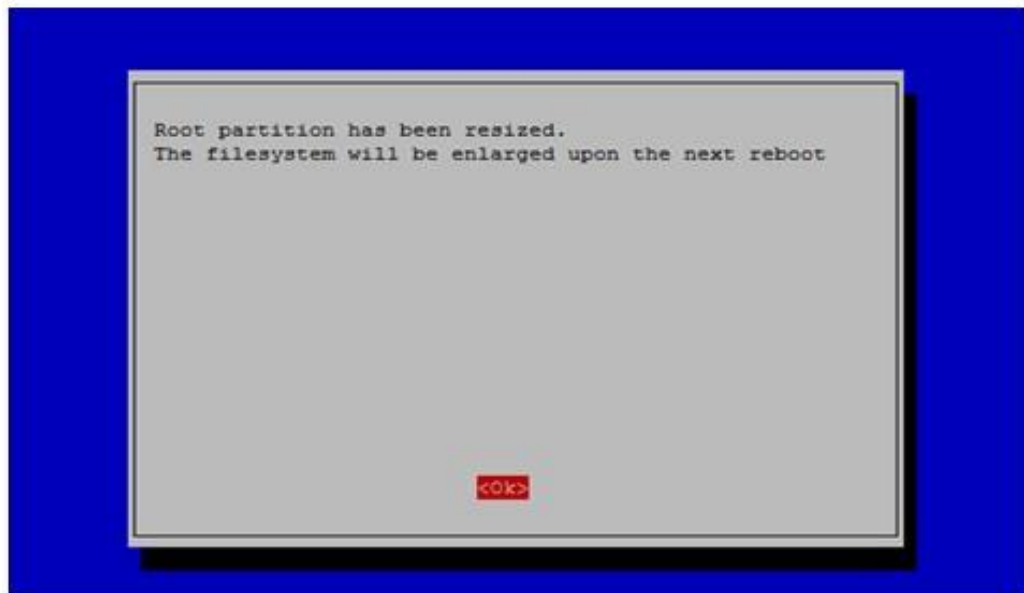


Figure 4.3.4: Root Partitioned

- Change User Password

The default user on Raspbian is pi with the password raspberry. You can change that here. Read about other users.

- Enable Boot to Desktop / Scratch

The menu option called “Enable Boot to Desktop” in raspi-config allows you to automatically launch and log in to the GUI desktop of Raspbian upon booting. You can also enable the Scratch programming environment. By default, Raspbian is set to boot into a text-based console log in. Depending on your use case, enable booting to desktop.

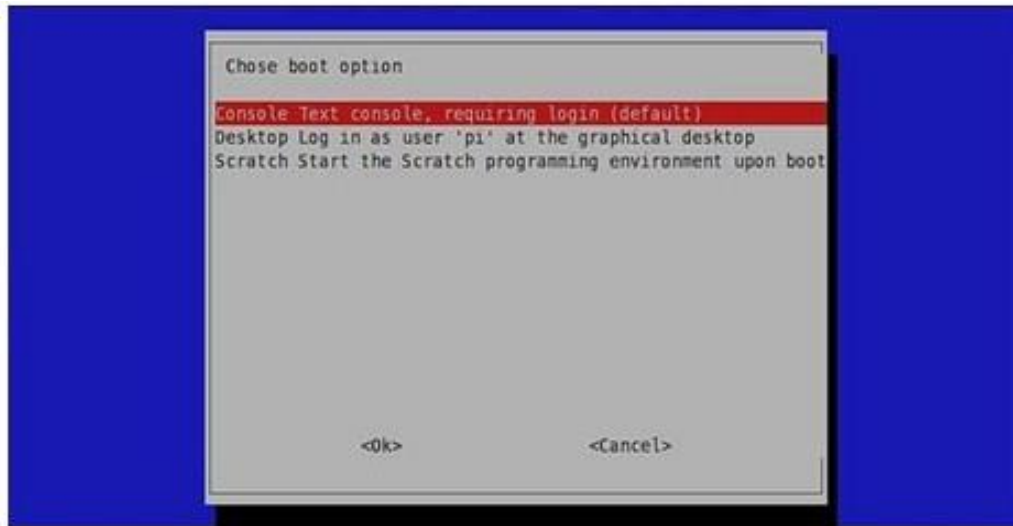


Figure 4.3.5: Enable Boot

- Internationalization Options

Select Internationalization Options and hit Enter to be taken to a sub-menu containing the following options:

- **Change Locale :**

- Select a locale, for example enGB, UTF 8

- **Change Timezone :**

- Select your local timezone, starting with the region such as Europe; then select a city, for example London. Type a letter to skip down the list to that point in the alphabet.

- Overclock

It is possible to overclock your Raspberry Pi's CPU. The default is 700MHz but it can be set up to 1000MHz. The overclocking you can achieve will vary; overclocking too high may result in instability. Selecting this option shows the following warning:

Be aware that overclocking may reduce the lifetime of your Raspberry Pi. If overclocking at a certain level causes system

instability, try a more modest overclock. Hold down ‘shift‘ during boot to temporarily disable overclock.

Step 3:

Advanced Options

- **Hostname**

Set the visible name for this Pi on a network.

- **Memory Split**

Change the amount of memory made available to the GPU.

- **SSH**

Enable/disable remote command line access to your Pi using SSH. SSH allows you to remotely access the command line of the Raspberry Pi from another computer. Disabling this ensures the SSH service does not start on boot, freeing up processing resources. Read more about using SSH. Note that SSH is enabled by default. If connecting your Pi directly to a public network, you should disable SSH unless you have set up secure passwords for all users.

- **VNC**

- VNC is platform-independent – there are clients and servers for many GUI-based operating systems and for [Java](#). Multiple clients may connect to a VNC server at the same time. Popular uses for this technology include remote technical support and accessing files on one's work computer from one's home computer, or vice versa.

- VNC was originally developed at the [Olivetti & Oracle Research Lab](#) in Cambridge, United Kingdom. The original VNC [source code](#) and many modern derivatives are [open source](#) under the [GNU General Public License](#).

4.4 Steps to Run the code in Raspberry Pi :

Step 1: Open Remote Desktop Connection

Go to start and type remote desktop connection. The following window will appear when you double click on remote desktop connection :

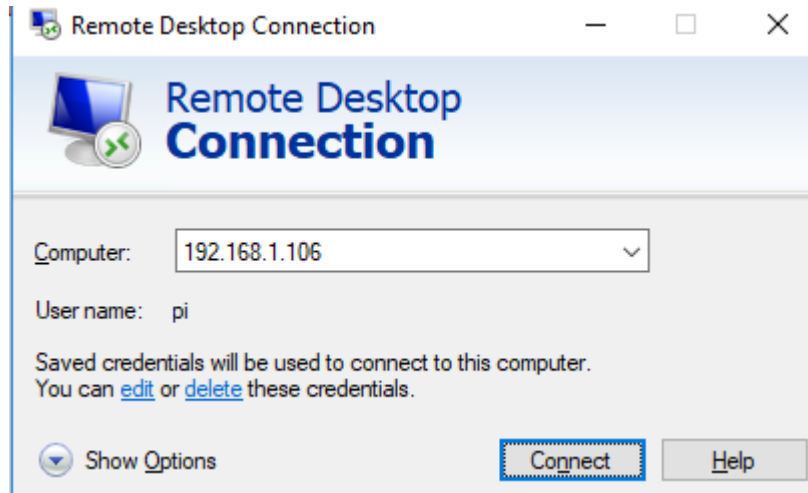


Figure 4.4.1: Remote Desktop Connection

Step 2: Enter IP Address Remote Desktop Connection

Enter IP Address of Raspberry Pi remote desktop connection. The following window will appear when you click connect :



Figure 4.4.2: Connecting to Raspberry Pi

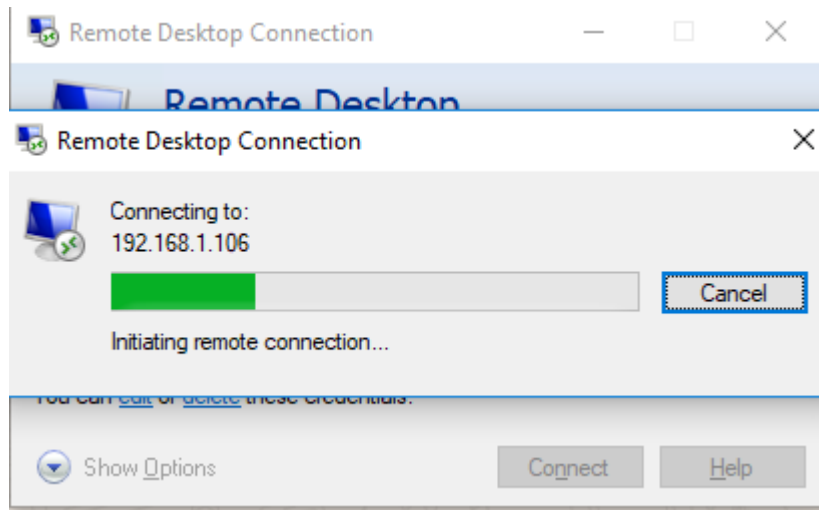


Figure 4.4.3: Enter username and password of Raspberry Pi

Step 3: Authentication to Raspberry Pi

A window will appear where you need to enter the ID and password to enter Raspbian OS of raspberry pi. Enter the username as Pi and the preconfigured password. It will appear as follows:

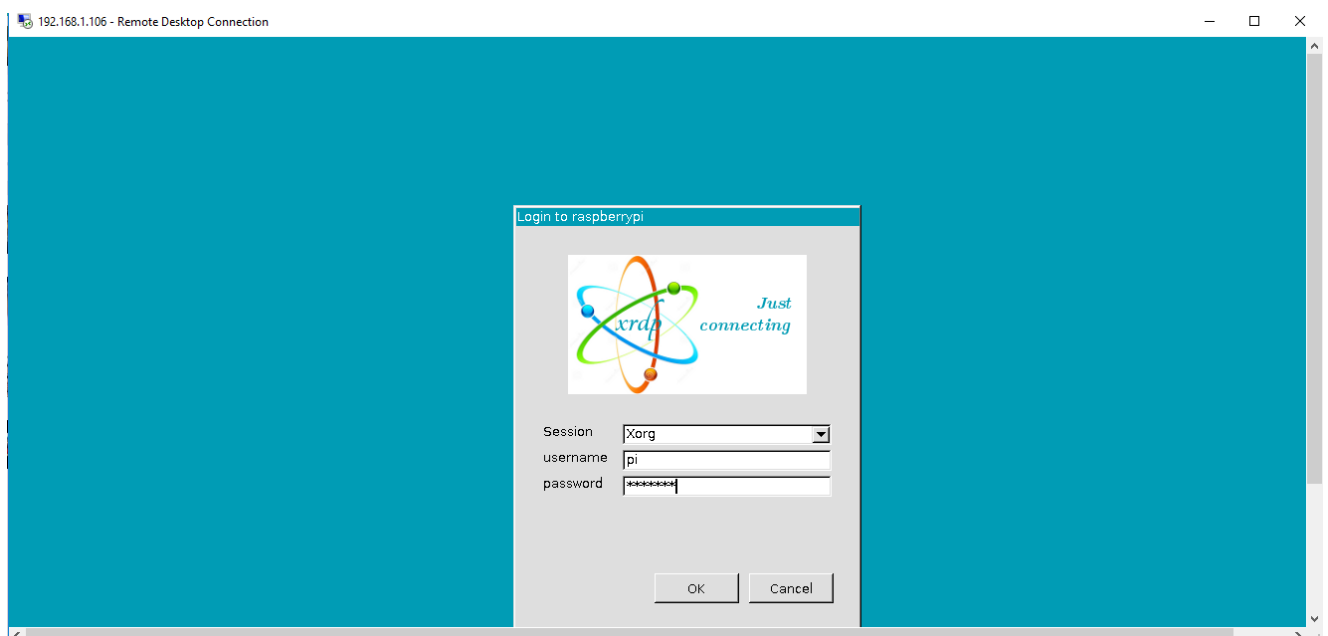


Figure 4.4.4: Entered username and password

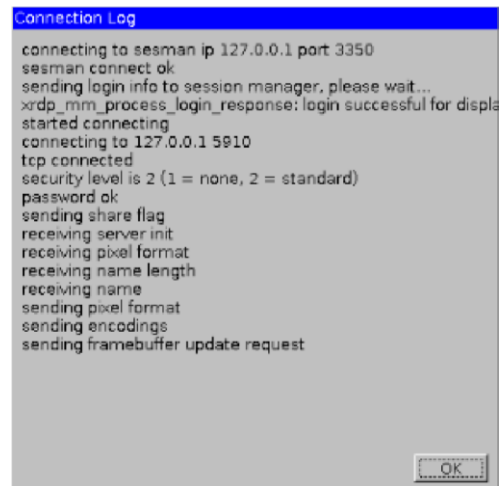


Figure 4.4.5: Entering into Raspberry Pi(Authenticating and Establishing Connection)

Step 4: UI of Raspberry Pi

After entering valid credentials, the user interface of Raspbian OS is displayed. The following window appears :

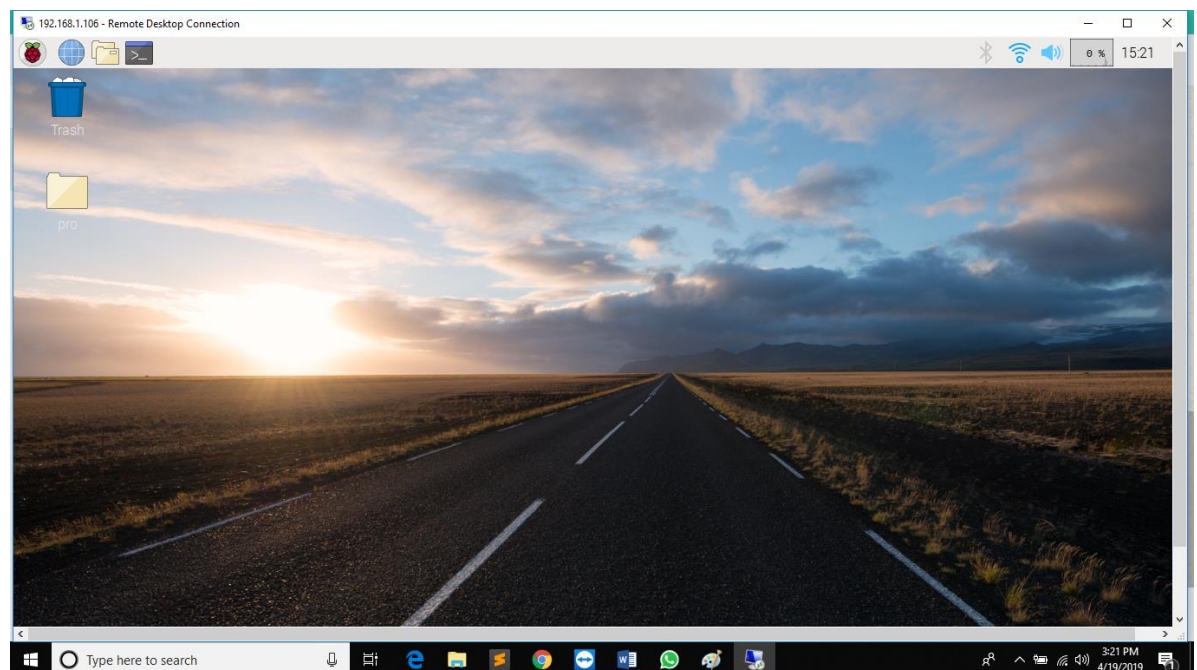


Figure 4.4.6: User Interface of Raspberry Pi

Step 5: Open the Python terminal using idle

pi@raspberrypi:~ \$ idle

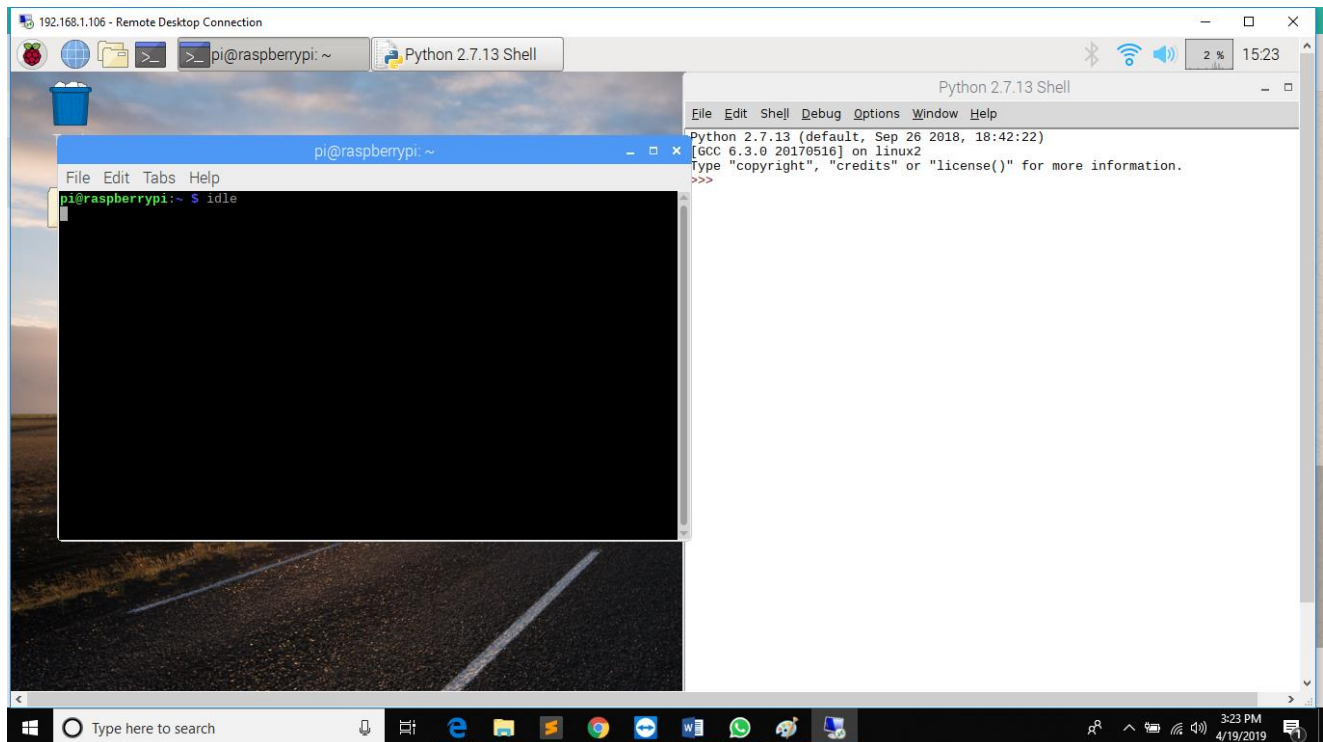


Figure 4.4.7: User Interface of Raspberry Pi

Step 6: Know the files in your folder

To get a brief about the files in the folder. Type "ls" command in terminal and press enter as shown below:

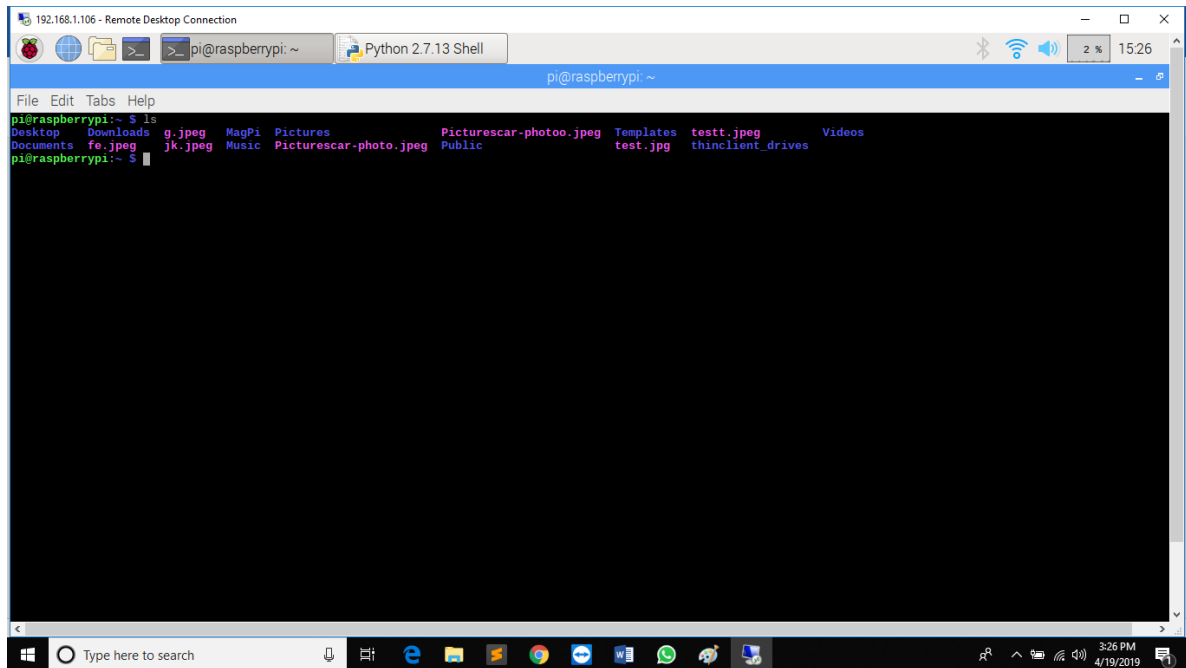


Figure 4.4.8: Files in the folder

Step 7: Run the Main file

Run the main file by opening python file from above python window and run it using F5 command

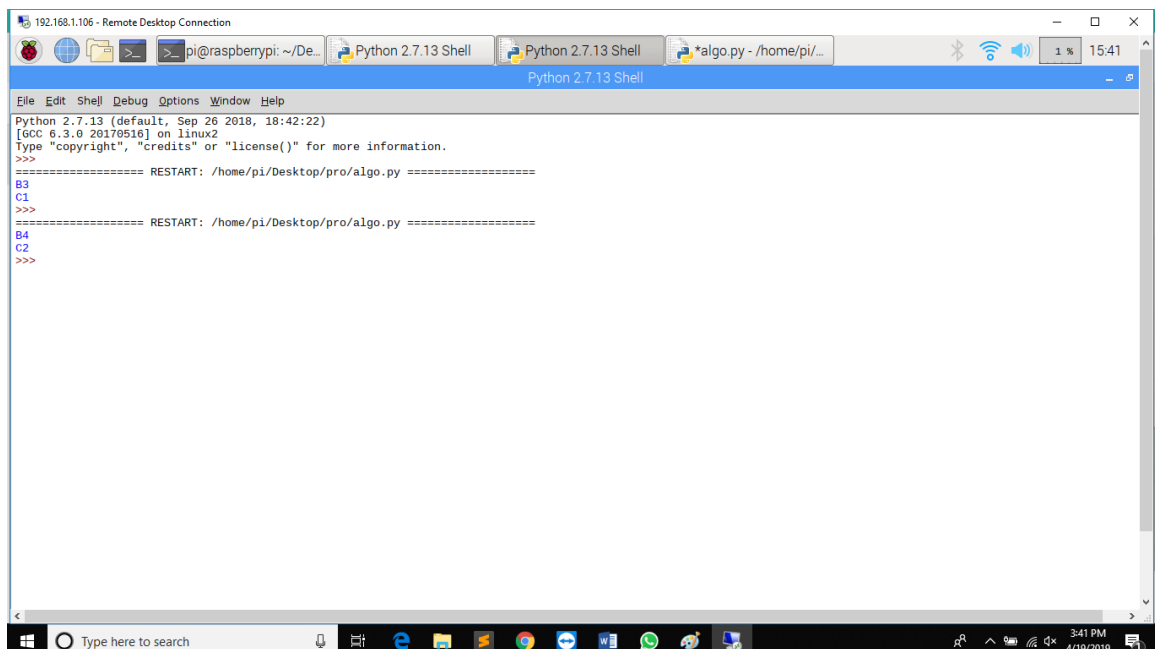


Figure 4.4.9: Run File

4.5 Results

4.5.1 Sensing the car using IR

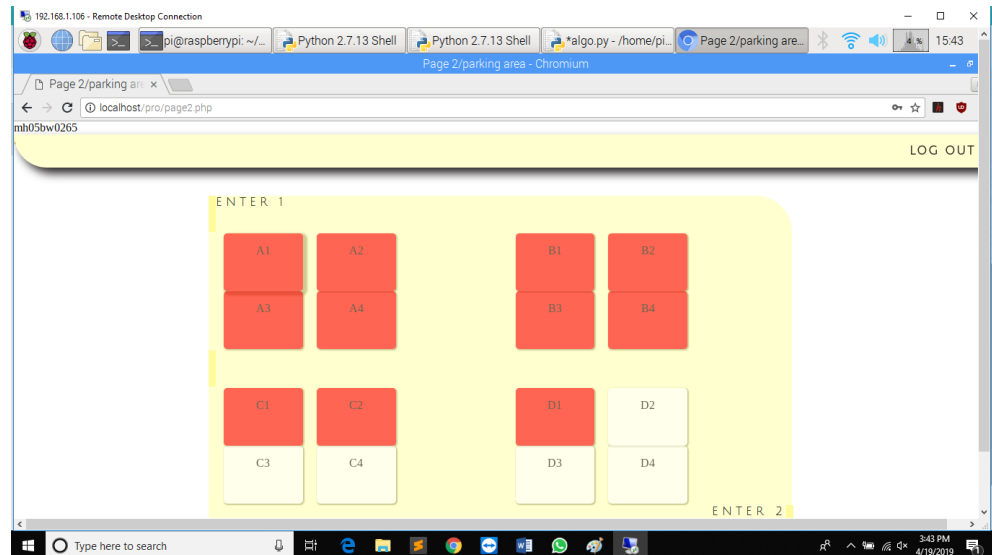
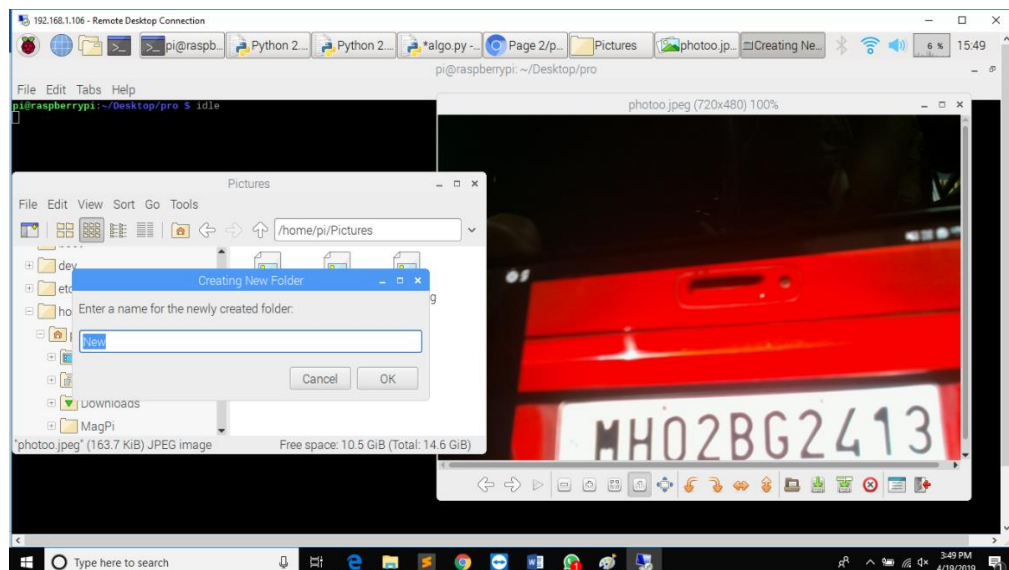


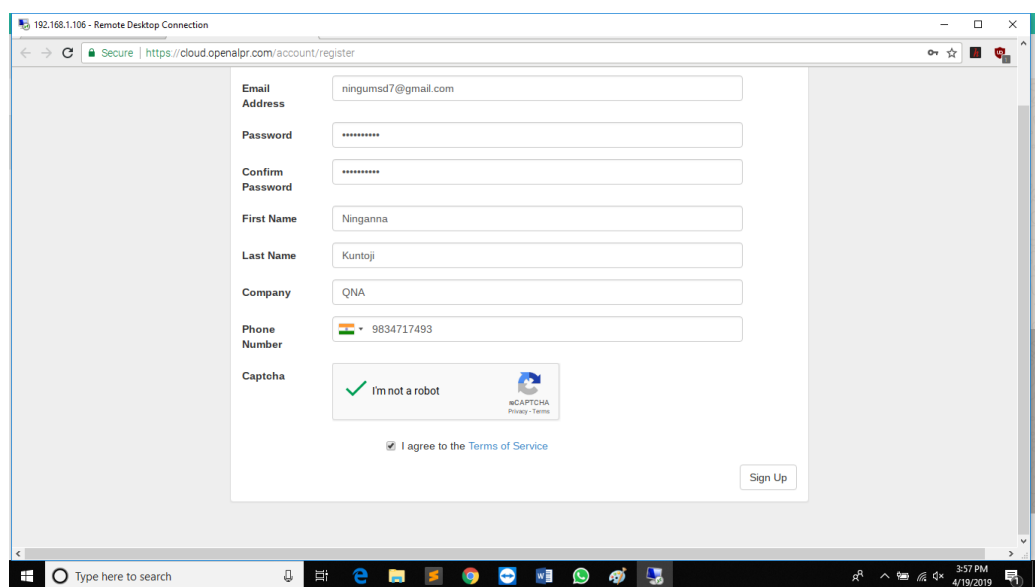
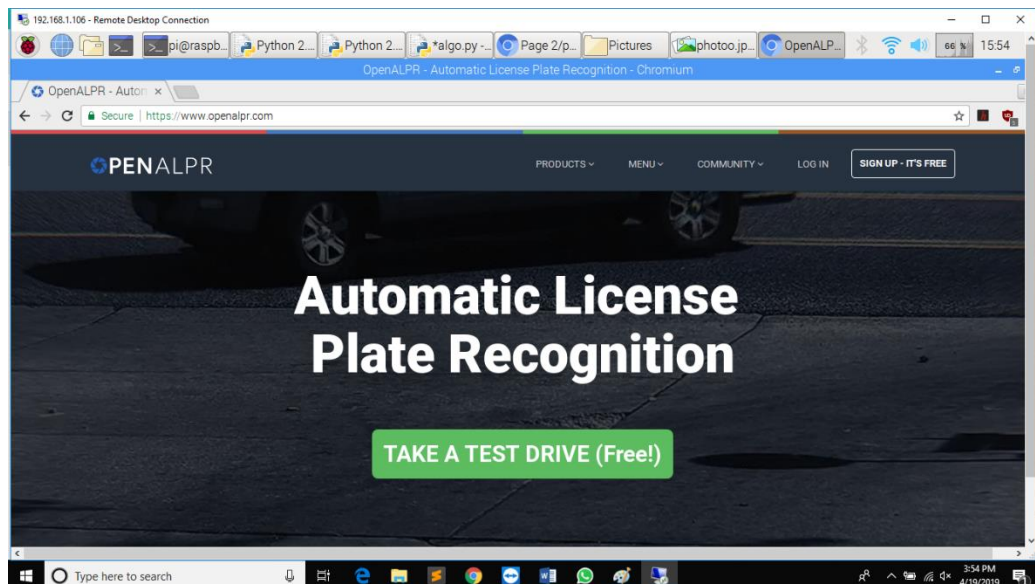
Figure 4.5.1: Slot Result

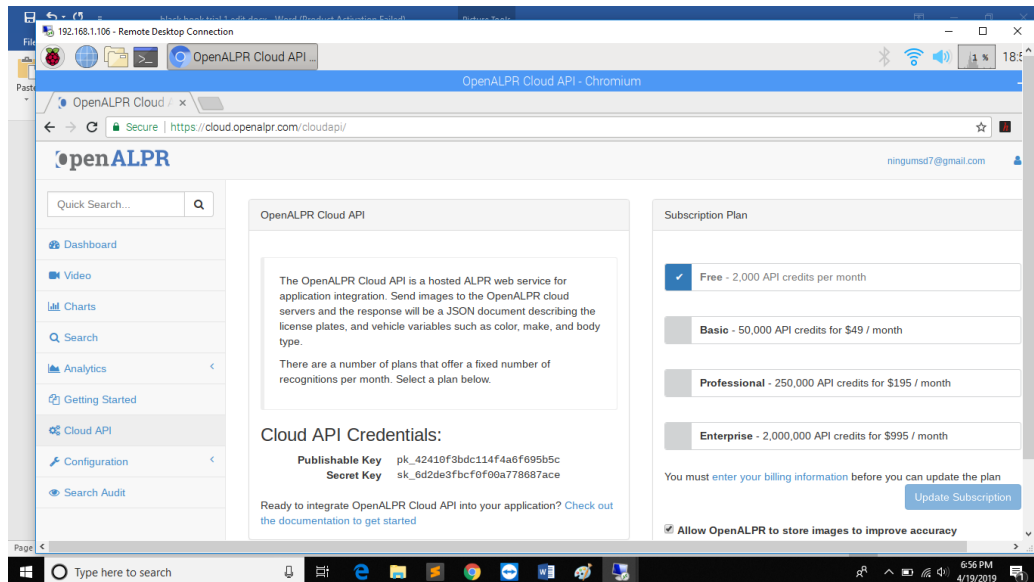
4.5.2 Pi Camera got activated and takes picture and saves it in picture folder of pi/desktop



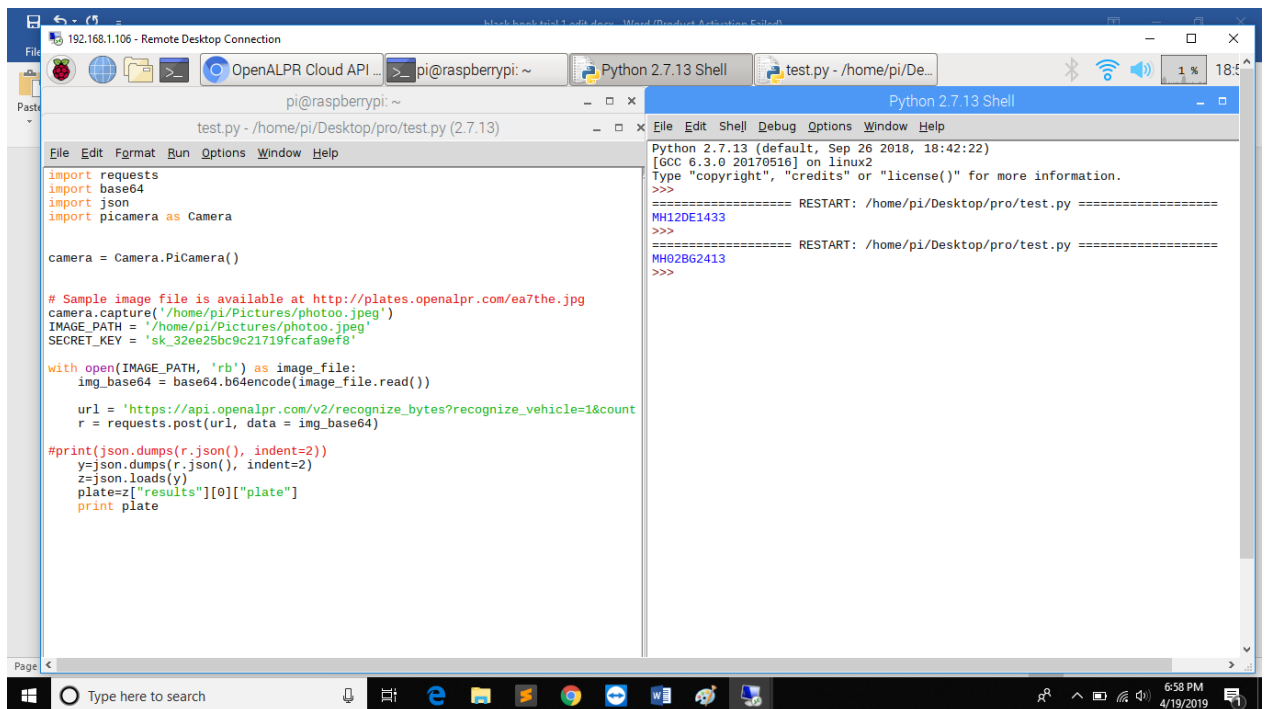
4.5.3 Account creation on open ALPR cloud copy

its secret key

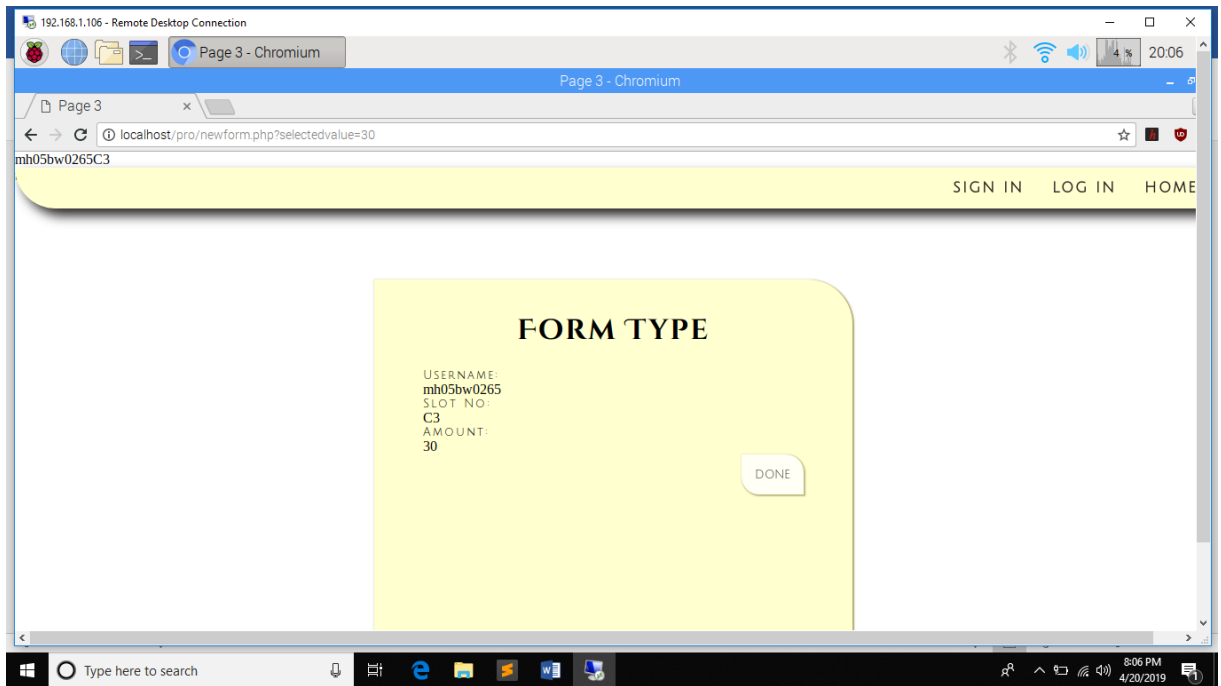




4.5.4 extracting car number using openalpr



4.5.5 alloting nearest slot available according to entry!



4.5.8 Booking details

Chapter 5

SYSTEM TESTING

SYSTEM TESTING

System Testing is evaluation of the system against requirements gathered from users and system specifications. Testing is conducted at the phase level in system development life cycle or at module level in program code. System testing comprises of Validation and Verification.

System testing is an activity to check whether the actual results match the expected results and to ensure that the system is Defect free. It involves execution of system component to evaluate one or more properties of interest. System testing also helps to identify errors, gaps or missing requirements in contrary to the actual requirements. It can be either done manually or using automated tools. [16]

Testing can either be done manually or using an automated testing tool:

- **Manual Testing:**

This testing is performed without taking help of automated testing tools. The tester prepares test cases for different sections and levels of the code, executes the tests and reports the result to the manager. Manual testing is time and resource consuming. The tester needs to confirm whether or not right test cases are used. Major portion of testing involves manual testing.

- **Automated Testing:**

This testing is a testing procedure done with aid of automated testing tools. The limitations with manual testing can be overcome using automated test tools.

5.1 Test Cases for Internet Of Vehicle Parking System

A test case is a document, which has a set of test data, preconditions, expected results and post conditions, developed for a particular test scenario in order to verify compliance against a specific requirement.

Test Case acts as the starting point for the test execution, and after applying a set of input values, the application has a definitive outcome and leaves the system at some end point or also known as execution post condition.

The following are the test cases created for Smart Electric Pole System:

Test Case Id	Test Case	Sub-Case	Description	Expected Output	Actual output	Result
TC-001	Installation Of raspbian	a)Enter username 2)key	This test case involves the testing of proper installation of the OS	Installation Successful	Installation Successful	PASS
TC-002	Running of Basic Codes	a)number plate extraction using openALPR cloud b)slot selection code c)Webpage Backend	The basic Programs present on the raspberrypi were executed to check working of it	Verified	Verified	PASS
TC-003	Individual Inspection of Hardware Components	a)Raspberry pi b)IR sensor c)Pi Camera	All hardware components are checked	All hardware components are working	All hardware components are working	PASS
TC004 a)	Initializing Raspberry Pi	RPi module	Check if the Rpi is being detected by Raspberry Pi	Rpi detected	detected	PASS

TC004 b)	Authentication of Raspberry Pi	Enter valid admin user- name and password	Click Login button	Username and Pas sword	Allow admin to proceed.	PASS
TC- 005	Signal Being Sent	a) Transmitter connection	Check if the connections being made by the IR sensors Raspberry Pi to database	Connection Estalished	Connecti on Establish ed your ip is 192.168. 43.87	PASS
TC- 006	Signal Being Sent	b)Enry exit sensor	Check if the connections being made by the Receiver Raspberry Pi to database	Connection Estalished	Connecti on Establish ed your ip is 172.168. 0.2.	PASS
TC- 007	Measuring sensor Connection	Enter choice on UI	Click Switch ON button	Lights should turn ON	Lights On	PASS
TC- 008	Working Of Sensors	a)IR sensor	Working of IR sensor checks for slot is busy or free	Changes in reading noticed	Changes in reading no- ticed	PASS

TC-009	Proper execution of If else loop	If else loop	The values generated by Sensors are matched with the values of if else loop	Switching of loads	All loads working fine	PASS
TC-010	Total project Integration	a)Hardware b)Software	The Total Integration of Various component is checked	TURNS on the IR sensor according to the scenerio	Performs Action According to Input in UI	PASS

Table 5.1: Test cases for Internet Of Vehicle Parking System

Chapter 6

CONCLUSION AND FUTURE SCOPE

CONCLUSION AND FUTURE SCOPE

6.1 Conclusion

The proposed system will reduce the chaos caused in parking area. This can be done as system can automatically check for the nearest empty lot and reserve the lot for the user. This overall will provide users with my features that would in turn provide efficiency in parking system. The entire system is very simple and easy to use as most of the tasks are performed by the System itself.

6.2 Future Scope

- Traffic control and parking areas in public places
- Multiple Parking Areas
- In-voice - Full Automation

Chapter 7

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INTERNET OF VEHICLE PARKING SYSTEM

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Abstract— Due to the consist evolution in the field of IOT, IOT is being utilized in various fields to overcome various problems. Problems such as traffic congestion, limited car parking facilities and road safety are also being addressed by IOT. The current traffic parking system doesn't follow a systematic approach. Hence, people tend to park at random places if no proper areas are allotted or available. This causes inconvenience to the people and other vehicles. Hence by using the techniques of IOT and image processing the proposed project is a user friendly project which will play a major role in helping users of wide range in systematic and secure vehicle parking.

Keywords – IOT, Multiple entrance, shortest path algorithm, Pre-booking, navigational assistance, IR sensors, QR code, Pi Camera, Raspberry Pi.

I. INTRODUCTION

In recent times the concept of smart cities had 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. Systematic approaches need to be followed, which is not being followed in current scenario. Hence, this leads to vehicle being parked at random places which causes inconvenience to the people as well other vehicles. IOT involves extending Internet connectivity beyond standard devices, such as desktops, laptops, smartphones and tablets to physical devices and everyday objects. Embedded with technology, these devices can communicate and interact over the Internet, and they can be remotely monitored and controlled. The proposed project 'Internet of vehicle parking system' is an on-site deployment of IOT module. It consists of a website as well as a mobile application. The entire procedure is very simple and easy to use as most complex tasks are performed by the machine. Web cameras will be used to capture images of the car's registration number. This number will be extracted by using image processing. Image processing is a method to convert an image into digital form and perform some operations on it, in order to extract some useful information from it. Data mining which is the process of discovering patterns in large data sets involving methods at the intersection of machine learning, will be used to predict the next week slots from the previous week's slot data. Along with

image processing and data mining various algorithms such as Shortest path algorithm and searching algorithms will be used to provide nearest parking lot and to search and navigate to empty parking slot. Sensors will be put into use to confirm the presence of vehicle. This project also provides security and reliability using principles of QR scanners. This project can be implemented in mall, educational institutions, workplace or residential areas. It has a wide range of application. It can be used by anybody with a driving license and basic mobile knowledge.

II. LITERATURE SURVEY

As nowadays one of the major problem of pollution is road traffic and major role takes the part of parking the car in that phase fuel wastage, noise and air pollution happens a lot. Many solutions has been developed like smartparkings.com, and many people developed systems which includes in parking in various parking areas, payment integration. A system can be implemented that assigns the nearest vacant bay to drivers with necessary direction printed on the ticket so that drivers are able to find the 'best' lot with the minimum amount of time. The system can automatically check for the nearest empty lot and reserve the lot for the user so that the next user will not get the same lot again. Electronic components such as raspberry Pi, IR sensors and servo motors can be used to realize the system [4]

The system can be implemented for automated car number extraction so that it becomes fully automatic. The system can implement parking fee collection based on vehicle number plate recognition using OCR algorithm implemented in MATLAB [5].

The Parking Supply and Demand Analysis report is not a comprehensive parking study, nor does it make recommendations on how Portsmouth should manage its parking supply and demand.

- Estimate the existing private and public parking supply in the downtown
- Collect and analyze parking demand and utilization data in the downtown
- Identify whether or not there is an observed shortfall of parking in the downtown
- Identify sub-areas that may need additional parking spaces due to development projects in the pipeline. [6]

III. PROPOSED SOLUTION

The field of IOT keeps on evolving. Due to this revolution, efforts are made to address various problems. Major success of IOT in smart door lock, smart Bluetooth tracker, smart home Apps etc. are observed and the use and demand of these applications are increasing day by day. Also, various smart parking system projects are proposed. But these smart parking system projects are not as successful as other IOT projects. This is due to its high building as well as maintenance cost. Also some smart parking projects are built for a particular location the existing system is hence not useful for other locations. Due to limited applications and inflexibility, the existing projects are not being put into application.

Hence, to address these problems the project 'Internet of vehicle parking system' is proposed. Internet of vehicle parking system consists of an on-site deployment of an IOT module. This project is simple, inexpensive and also provides flexibility. It consists of a user friendly website as well as a mobile application. The role played by the user is very small as most of the complex tasks are performed by the machine which the user is not aware of. Principles of QR scanner, sensors and web cameras are utilized. A system to eradicate the problems like traffic congestion, limited car parking areas, etc. by using techniques like image processing, data mining, shortest path algorithm and searching algorithm to provide a systematic parking system.

IV. SCOPE

The purpose of proposed project is to reduce the chaos caused in parking areas. The proposed system implements various IOT, image processing and data mining techniques to provide user a smooth parking experience. Various techniques are used to provide efficiency, reliability and security to the user.

The scope of project includes:

- Multiple car entry
- User registration and log-in
- Pre- booking of parking slots.
- Navigational support to search for provided empty slots.
- Provides the nearest empty slot to the user.
- Various schemes for new users
- Sharing link of website to new user
- Integrated payment options

V. PROPOSED SYSTEM

As an IOT based parking system is being developed, it requires less of human interaction and more of automated features. The project consists of following features:

- The project is designed for multiple entrances.
- Vehicles can enter from multiple entry gate and can park their vehicles in the allotted slot.
- The status of parking slot is identified by IR Sensors to determine the whether the car parked at right slot
- The state of availability of empty parking slots can be known prior coming to the parking area of any malls, theater, school, colleges etc.
- The pre-booking features of the system make it available for the user to book their slots so as to reserve their slot to avoid hassle.
- The shortest path algorithm made it easier for the user to reach to their allotted slot without searching for the slots and wasting their time.
- The project has navigational assistance features which is provided in the application which helps in navigating with the directions to allotted slots.
- The integrated payment option (PayPal) is very efficient for paying the amount, for the time the vehicle was parked which is integrated in the application.
- Owner can predict the next week ends car parking statuses using the data of previous parking data using data mining techniques.

IOT involves extending Internet connectivity beyond standard devices, such as desktops, laptops, smartphones and tablets to physical devices and everyday objects. Embedded with technology, these devices can communicate and interact over the Internet, and they can be remotely monitored and controlled.

VI. ALGORITHM

1. SEARCHING ALGORITHM:

As soon as the car enters the parking area and the car number is detected and updated in databases, the searching algorithm will be applied.

Since our proposed project is flexible for multiple entrances, the nearest available parking slot will be allotted according to the entrance gates. Slot status will be marked as a waiting state.

2. SHORTEST PATH ALGORITHM:

After the parking slot allocation, the navigational assistance will be provided to frequent user on App and on webpage for new user. In this page shortest path from the entrance to the provided parking slot will be provided so that he/she go to that slot easily.

After going to allotted slot the status of that slot will be marked as blocked so that no other car can park.

3. ADDITIONAL FEATURES:

In the app one option will be provided for pre-booking the slot in prior to 30 minutes.

So that user doesn't have to wait on the entrance. QR code will be used for security purpose. QR code will consist of parking information like entry time, exit time, car number, etc.

While exiting the car QR code sent is scanned first to ensure any other person should not take the car. After successful scanning payment page will be available and the user can pay via PayPal wallet.

VII. WORKFLOW

The project is basically designed for the frequent visiting user and the new user.

For frequent visiting users the application is pre-installed. This provides them to pre-book their slots prior coming to the parking area. The pre-booking features also tell the availability of the empty slots. The user can then book the slots according to his/her convenience.

After coming to the parking area the number plate is scanned from the scanner which extract the vehicle number. User has to now provide his/her phone number to the administrator for entering it into the database.

Once verified the user is sent with the navigational details and also a QR code to his/her mobile application. Navigational details help user to reach till the allotted slot without searching for, it in less amount of time.

Here shortest path algorithm and searching algorithms helps in directing to the slot. Once user reach to the allotted slot the IR sensors detect the presence of the vehicle. Hence, the administrator comes to know about the parked vehicle and the detail is updated with the time being noted for parking. At the time when the user is about to go the sent QR code is scanned and If the QR code is matched, then payment page will pop up and you can pay via PayPal and user can exit.

For New user has to give car number, phone number (Car number is for confirmation) and link will be sent. Link will be consisting path to allotted slot and app download link so that user can download and after that process will as frequent user.

Owner has an advantage that they can predict parking data of net weekends using data using regression techniques, probability.

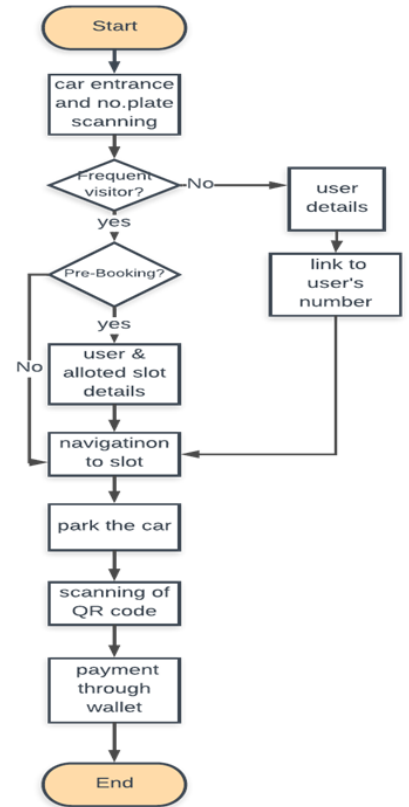


Figure 7.1 – Flow chart

VIII. FUTURE SCOPE

- Traffic control and parking areas in public places
- Multiple Parking Areas
- In-voice - Full Automation

IX. CONCLUSION

The main intention of this proposed system is to develop a car parking system using Internet of Things. IoT is the present trending area in internet, used to access the information remotely. Present days everybody uses smart phones and internet, so online

booking provided solution to the predicting the parking space issue and user can pay parking fee online. Image Processing technology is used to detecting the car identity (number plate) within fraction of seconds. The parking management provided solution to the perfect parking and reduces man power. This system employed in airports, multiplexes and corporate offices. It give the users an insight of the navigation to the parking slot, which reduces the complex tasks of searching the slot. User need not remember the parked slot as it will be provide in the mobile application. The project enables pre booking of parking slots which is efficient in saving time. Provides awareness of empty slots using IR sensors, so the user can check before coming to the respective place. Uses of web cameras, IR sensors and image processing techniques as alternative of RF ID tags, reduces cost and efficiency. The problem of traffic congestion is also addressed. It also provides various secure techniques which helps IOT in security

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