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A Project Report on

A smart system to avoid congestion at the charging pool

Submitted in Partial Fulfilment of the Requirement

for the IV Semester MCA Academic Minor Project – I
18MCA46

MASTER OF COMPUTER APPLICATIONS
By

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DEPARTMENT OF MASTER OF COMPUTER APPLICATIONS

CERTIFICATE

This is to certify that the project entitled "A smart system to avoid congestion at the charging pool" submitted in partial fulfillment of Minor Project-I (18MCA46) of IV Semester MCA is a result of the bonafide work carried out by (Sachin.S.Bharamayyanawar 1RZ19MCA34), during the Academic year 2020-21.

Dr.Mohanaradhya	Dr. Andhe Dharani
Assistant Professor	Professor and Director
Department of MCA,	Department of MCA,
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UNDERTAKING BY THE STUDENT

I **, Sachin. S. Bharammayanawar 1RZ19MCA34,** hereby declare that the Minor project-I "A smart system to avoid congestion at the charging pool" is carried out and completed successfully by us and is our original work.

SIGNATURE

(Sachin.S.Bharamayyanawar)

Acknowledgement

The successful presentation of this project is acknowledgments of the immense support extend by RV College of Engineering, Bengaluru which has provided an opportunity to fulfill the most cherished desired to reach our goal.

We would like to express our heartfelt thanks to Rashtreeya Sikshana Samithi Trust and We would like to express our sincere and heartly thanks of gratitude to our beloved Principal, Dr. K N Subramanya and our Director of MCA, Dr. Andhe Dharani who gave us the golden opportunity to do this project on the topic "Real Time Notification System with Mobile and Web Interface", which also helped us in doing a lot of research and while doing so we were exposed to lot of new information which would help us in our mere future.

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We also thank our beloved Parents whose blessings have been there at all moments. We pray that their wishes and blessings will be there to guide our entire endeavor in the future to success.

Sachin.S.Bharamayyanawar
(1RZ19MCA34)

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Abstract

A Chraging pool is a collection of one or more charging stations and accomadating parking lots A charging pool is managed by one Charge Point Operator(CPO) at one location/address.A charging station is a physical object with one or more charging points through which electrical energy is delivered to the charge to the electronic vehicle where charging point may have one or more charging connectors and where only one connector can be used at time ,means only one vehicle charged at a time suppose electronic driver comes to charging pool without knowingly wheather charging slots are available in station and he has to wait certain amount of time in station which leads to waste of time also it may create congestion at station

Methodolgies is used in this projects are the web interface developed by using streamlit and using Arduino software writing code for the hardware components where sensored are used suppose the vehicle approaches to the certain distance the sensor allows whether slots are empty or not

This System outcome is to overcome all limitations and drawbacks with a help web interface where the charging slot,availability information is communicated to the rider in advance soon as he/she enters into the region of charging pool,rider may avoid entering into the charging station.so that time is saved and vehicle congestion at charging pool

Table of Contents

LIST OF FIGURES

Chapter-1

INTRODUCTION

1.1 Project Description

charging pool is a collection of one or more charging stations and the accommodating parking lots A charging pool is managed by one Charge Point Operator (CPO) at one location/address

A charging pool is managed by one Charge Point Operator (CPO) at one location/address and A Charging Station is a physical object with one or more charging points through which the electric energy is delivered to charge the Electric Vehicle where charging point may have one or more charging connectors to charge vehicles where only one connector can be used at a time, meaning that only one vehicle can be charged at a time.

So in a charging station the number of charging points and parking spots are equal suppose electronic driver comes to the charging pool without knowingly whether charging slots are available in station and he has to wait for certain amount of time in a station which leads to waste of time and also it may create congestion at the charging pool/station.

If the charging slot, availability information is communicated to the rider in advance as soon as he/she enters into the region of Charging Pool, rider may avoid entering into the Charging station. So that his/her time is saved and vehicle congestion is avoided at the charging place.

CHAPTER 2

LITERATURE REVIEW

The literature review is a survey of intellectual resources on a particular topic. It delivers the summary of the present knowledge, technologies and tools, letting you to recognize similar methods, theories and breaks in the existing research.

2.1 Literature Survey

Felix Tuchnitz ,Niklas Ebell ∗ , Jonas Schlund, Marco Pruckner in his article, To avoid the grid overload that results from simultaneously charging too many electric vehicles, there is a need for smart charging coordination systems has been discussed[1]

Ivan Pavić , Hrvoje Pandžić, Tomislav Capuder standpoint, however, suffers from two major issues. First, the charging stations need to anticipate important parameters of the incoming vehicles[2]

Rui Carvalho,1, Lubos Buzna,2, Richard Gibbens,3, and Frank Kelly1 We analyse the inequality in the charging times as the vehicle arrival rate increases, and show that charging times are considerably more uneven in max-flow than in proportional fairness[3]

Abishek S, Non-Member, IEEE, and Balakrishnan Narayanaswamy Member, IEEE,In this paper we showed that using semi-definite programming based approaches to state estimation along with TCP like signalling approaches allows us to reduce grid congestion and losses using only smart meter measurements[4]

Kyriacos Petrou, Jairo Quiros-Tortos, Luis F. Ochoa High penetration of Electric Vehicles (EVs) in residential UK Low Voltage (LV) networks may result in significant asset congestion , particularly during peak hours. Therefore, this work proposes an implementable that manages EV charging points to mitigate congestion[5]

S. Rasoul Etesami, Walid Saad, Narayan B. Mandayam, H. Vincent Poor The goal of this framework is to control and balance the electricity load in a

distributed manner across the grid while taking into account the traffic congestion and the waiting time at charging stations[6].

Godwin C. Okwuibe, Zeguang Li, Thomas Brenner, Ole Langniss to effectively manage the EV user's charging requests and ensure that there charging needs are satisfied while not exceeding the distribution grid capacity. If this is not done, there is no doubt that in few a years, EV owners will be faced with the problems of unavailability of charging stations and congestion in grid[7]

K.S. Phadtare1, S.S. Wadkar2, S.S. Thorat3, A.S. Ghorpade4, Mr.A.B. Jadav5 by taking in views these issues we can provide a smart parking with charging availability to the most commercial buildings. This will reduce the efforts of roaming for slot of parking. Also, there is no need to invest more time for finding charging station and for charging at charging station [8]

Jyoti M. Kharade; Mangesh P. Gaikwad; Saurabh P. Jadhav; Parag D. Kodag; Sweta P. Pawar; Supriya T. Yadav The paper provides a solution technique to save time and avoid the inconvenience of EV users. This system will indicate the availability of charging slots at each charging station in our journey. Also, it will show from what time the vehicle is plugged to the charging station so that we can plan our journey accordingly.[9]

Rahul George, Srikumar Vaidyanathan, K Deepa In the proposed work, the State of Charge (SoC) of the EVs battery is displayed constantly and the nearest charging stations are displayed on the screen. From a list of suggested charging stations nearest to the EV driver, the screen in the vehicle will direct the driver to the slot booking website through which all the available slots are displayed. As EVs become more commercial, there will be a need to create an efficient slot booking system as the charging process can be time consuming and the need for more stations will be demanding[10]

Bharatiraja Chokkalingam ,Sanjeevikumar Padmanaban , Pierluigi Siano , Ramesh Krishnamoorthy and Raghu Selvaraj The proposed server-based real-time forecast charging infrastructure avoids waiting times and its scheduling management efficiently prevents the EV from halting on the road due to battery

drain out. The proposed model is implemented using a low-cost microcontroller and the system etiquette tested.[11]

Yousif Allbadi1,4, Jinan N. Shehab2 and Musaab M. Jasim3 This paper presents a smart parking system using infrared and ultrasonic sensors, which is controlled by Arduino Mega 2560. The Radio Frequency Identification (RFID) reader provides authorization to enter the smart parking system. On the other hand, a mobile application is added to allows users to know about the empty spaces based via WiFi application. This smart parking system is implementing in a small-scale model, and the results show that simulates the car parking with the mobile application, all the sensors, and the Liquid Crystal Display (LCD) screen display, to describe a view of the system architecture.[12]

J.Keerthika Mrs. T. Sivasakthi The existing system aren't completely automated and need some level of human interference. The proposed system is fitting for multi-floor building and send a message to vehicle about the status of parking slot.[13]

Li Zhang, Ke Gong * and Maozeng Xu Navigation systems can help in allocating public charging stations to electric vehicles (EVs) with the aim of minimizing EVs' charging time by integrating sufficient data. However, the existing systems only consider their travel time and transform the allocation as a routing problem In this paper, we involve the queuing time in stations as one part of EVs' charging time, and another part is the travel time on roads. Roads and stations are easily congested resources, and we constructed a joint-resource congestion game to describe the interaction between vehicles and resources.[14]

M,A.Lopez,S.Martin,Aguado,s,de la Torre An approach is proposed to address V2G strategies for congestion management issues. Power distribution factors (DFs) are used to determine the amount of energy that a specific EV should contribute to alleviate the congestion in a line. It is assumed that EVs can decrease or increase their battery energy level, stop their charging or even inject energy to the grid aiming for the secure state of the system. This approach is tested for a reference microgrid (MG) example containing several EVs and it is shown to be suitable to solve this kind of technical problems.[15]

2.2Existing and Proposed System

Problem Statement

In a charging station the number of charging points and parking spots are equal suppose electronic driver comes to the charging pool without knowingly whether charging slots are available in station and he has to wait for certain amount of time in a station which leads to waste of time and also it may create congestion at the charging pool/station.

Scope of the Project

The main purpose of the project is to avoid congestion at the charging pool by providing information about the charging slot, availability information communicated to the rider in advance as soon as he/she enters to the region of charging pool ,rider may avoid entering to the charging station.

Methodology adopted in the Proposed System

In this project sensors are being used to determine whether slots for charging vehicles are available or not, If the vehicle approaches certain distance the sensor notifies us about the availability of slots .This information is sent to the EV Owner which helps in saving the time and avoid congestion at charging pool.

2.3 Tools and Technologies used

Arduino

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

Designers and architects build interactive prototypes, musicians and artists use it for installations and to experiment with new musical instruments There are many other microcontrollers and microcontroller platforms available for physical computing. Parallax Basic Stamp, Netmedia's BX-24, Phidgets, MIT's Handyboard, and many others offer similar functionality. All of these tools take the messy details of microcontroller programming and wrap it up in an easy-to-use package

Streamlit

Streamlit is an awesome new tool that allows engineers to quickly build highly interactive web applications around their data, machine learning models, and pretty much anything.

The best thing about Streamlit is it doesn't require any knowledge of web development. If you know Python, you're good to go!

Here's the full code for this tutorial if you would like to follow along as you progress through the tutorial.

2.4Hardware and Software Requirements

Hardware Requirement

- **Desktop or Laptop:** The devices the programmer requires to use must have
- Windows or Linux platform.
- **RAM:** 4 GB or more
- **Processor:** Intel i5 and above or AMD Athlon
- **Hard Disk Space:** 8 GB (minimum) free space available
- **Screen Resolution:** 1366 x 768 or above
- Arduino uno,Ultrasonic sensors HC-SR04(Generic),Led Lights,Jumper Wires (Generic),solderless Breadboard Full Size

Software Requirements

- **Programming language :** C , python.
- **Tool :** Arduino CC,Stremalit

Chapter 3

Software Requirements Specifications

The Software Requirement Specification describes a significant segment of the progress of the strategic, significant record for the client audit. The rules fundamentally contain some basic data about the specific item impediments, useful and non-usefulpreconditions. The depiction of the computer essential goes about as an organized understanding between the engineer and the organization.

3.1Introduction

Definitions

- **Checking Slot availability**

  Checking for Whether the slot availability for the vehicle with the help of ultrasonic sensor

- **Displaying the information to the user**

  After checking the slot availability the information is displayed to user in the web application

3.2 General Description

Charging pool is a collection of one or more charging stations and the accommodating parking lots , A charging pool is managed by one Charge Point Operator (CPO) at one location/address A which denoted by using LED lights.

A charging pool is managed by one Charge Point Operator (CPO) at one location/address and A Charging Station is a physical object with one or more charging points through which the electric energy is delivered to charge the Electric Vehicle where charging point may have one or more charging connectors to charge vehicles where only one connector can be used at a time, meaning that only one vehicle can be charged at a time.So in a charging station the number of charging points and parking spots are equal suppose electronic driver comes to the charging pool without knowingly whether charging slots are available in station and he has to

3.3 Functional Requirement

Module 1 :User Registration

Given that user has to open web page ,then user has to register/signup with help of web page

- Input: username and password
- Process: user will add username and password it will check whether user entered valid username and password
- Output: It will display user has registered

Module 2:User Login

Once the user registered user has to login with registered username and password

- Input: Registerd username and password
- Process: user will add the register username and password if the it matches with the register username and password it will login otherwise it will not login
- Output: It will display welcome

Module 3:Data Acquisation:

A **data acquisition** system converts physical conditions into digital form, for further storage and analysis. Typically, signals from sensors

- Input: when the Electronic vehicle reaches cerain range input considered
- Process: checks for slot availability
- Output : displays how many slots are available and not available

Module 4: Ultrasonic sensor for calculating distance

- Input: HC-SR04 Ultrasonic Sensor PinoutTrig (Trigger) pin is used to trigger the ultrasonic sound pulses
- Process: the sensor determines the distance to a target by measuring time lapses between the sending and receiving of the ultrasonic pulse

- Output: Echo pin produces a pulse when the reflected signal is received

3.4 External Interfaces Requirements

User Interfaces

- Front -end:
  User: Browser
- Back-end:
  Text file: storing username and password

3.5 Non-functional Requirements

- **Efficiency:** Efficiency refers to the speed of prediction by the model. Current project aims to work efficiently regardless of the exponential growth in the data
- **Correctness:** Correctness is the probability of the system to generate correct output. The fundamental requirement of the project is to get acceptable and exact output
- **Robustness:** Robustness is defined as the degree by which system can operate correctly in existence of invalid inputs. This project purposes to have high robustness towards the inputs invalid in nature
- **Usability:** Usability is the level of straightforwardness with which the client will communicate with the reports and measurements to take better choices
- **Fairness:** This project is adopted to make decisions based on the statistical methods. The predictions made by the system is fair enough to make decisions without any error and bias in the output

3.6 Design Constraints

- Limited to only one Charging station
- User has to register with help of web application

Chapter 4

System Design

System design is the procedure for identifying the configuration, components, frameworks and information for a system that meets the defined specification system design is often seen as the implementation of advanced analysis to project management

4.1 System Perspective /Architectural Design

Problem Specification

In a charging station the number of charging points and parking spots are equal suppose electronic driver comes to the charging pool without knowingly whether charging slots are available in station and he has to wait for certain amount of time in a station which leads to waste of time and also it may create congestion at the charging pool/station.

BLOCK DIAGRAM

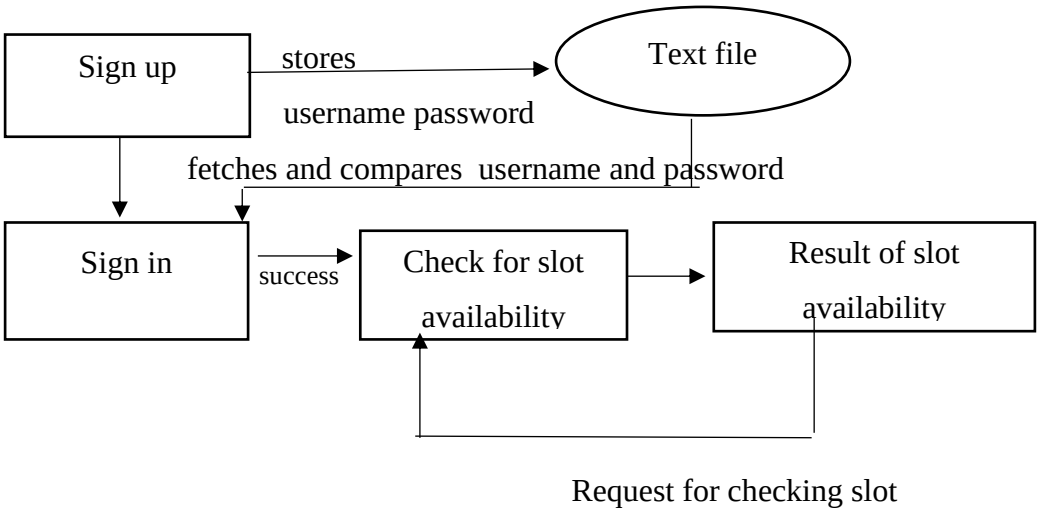


Figure 4.1 Conceptual Block Diagram of avoiding congestion at charging pool

Figure 4.1 describes the overall process carried out in the avoiding congestion at charging pool. In the first phase, the user has to sign up. Then User has to sign in with registered username and password . after the sign in the ultrasonic sensor is used to calculate the distance and it will check for the weather slot available or not, after checking in web application information displays the which slot is empty to the user. repeatedly it will check for the certain amount of time and it will be displaying the information.

Module Specification

User Registration

- The first step in this application is to get the users registered to the web applicaton
- For this, user will provide username and password. When user clicks on the sign up button the username and password will be saved in textfile

User Sign in

- To sign in user has to add registered username and password
- In textfile it will check wheather registered username and password is available in textfile it will sign in otherwise it will not

Data Acquisition

- when the Electronic vehicle reaches cerain range input considered checks for slot availability
- displays how many slots are available and not available

Ultrasonic sensor for calculating distance

HC-SR04 Ultrasonic Sensor PinoutTrig (Trigger) pin is used to trigger the ultrasonic sound pulses

the sensor determines the distance to a target by measuring time lapses between the sending and receiving of the ultrasonic pulse

Echo pin produces a pulse when the reflected signal is received

4.2Context Diagram

The Context Diagram shows the system as feasible as a Single Relevant Level Technique and also shows the interaction that the mechanism has with other external substances (application, organizational meetings, outside knowledge stores, etc.).

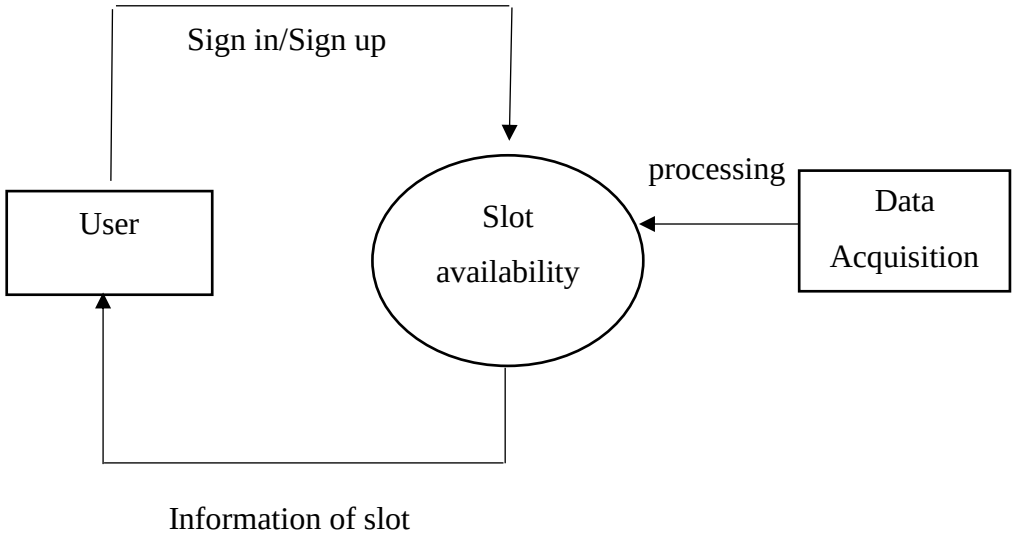


Figure 4.2 Conceptual Context Diagram of Avoiding congestion at charging pool

CHAPTER 5

Detailed Design

5.1System Design

The System Design is the execution of theoretical information into the useful application. The Framework design portrays how the segments of the process both static and dynamic procedure of the gadget and how it is framed. This additionally outlines how the customer imparts through the gadget and furthermore clarifies various relations.

- **Dynamic Modelling**

The dynamic model speaks to the time–subordinate parts of a framework describing the transient changes in the conditions of the articles in a framework.

Use Case Diagram

The use case graph is a dynamic UML operation graph. Use case sketches to create a training schedule that includes actors and use cases. Use Cases depicts the process that the system has to execute.

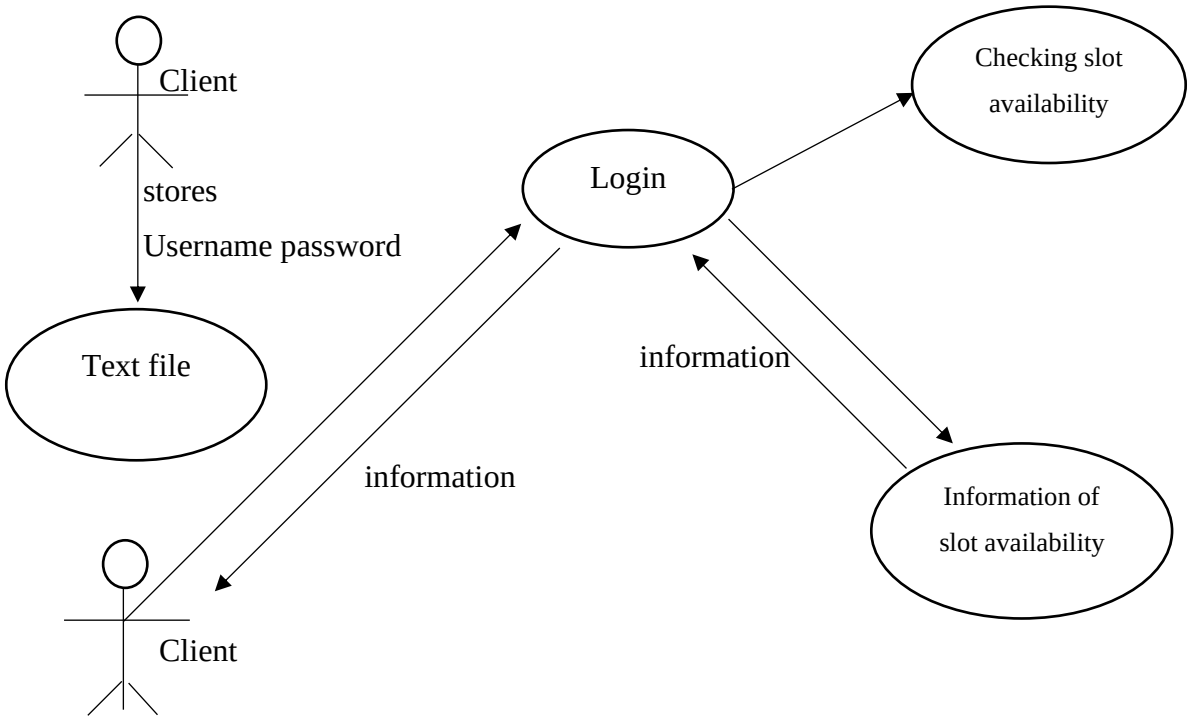
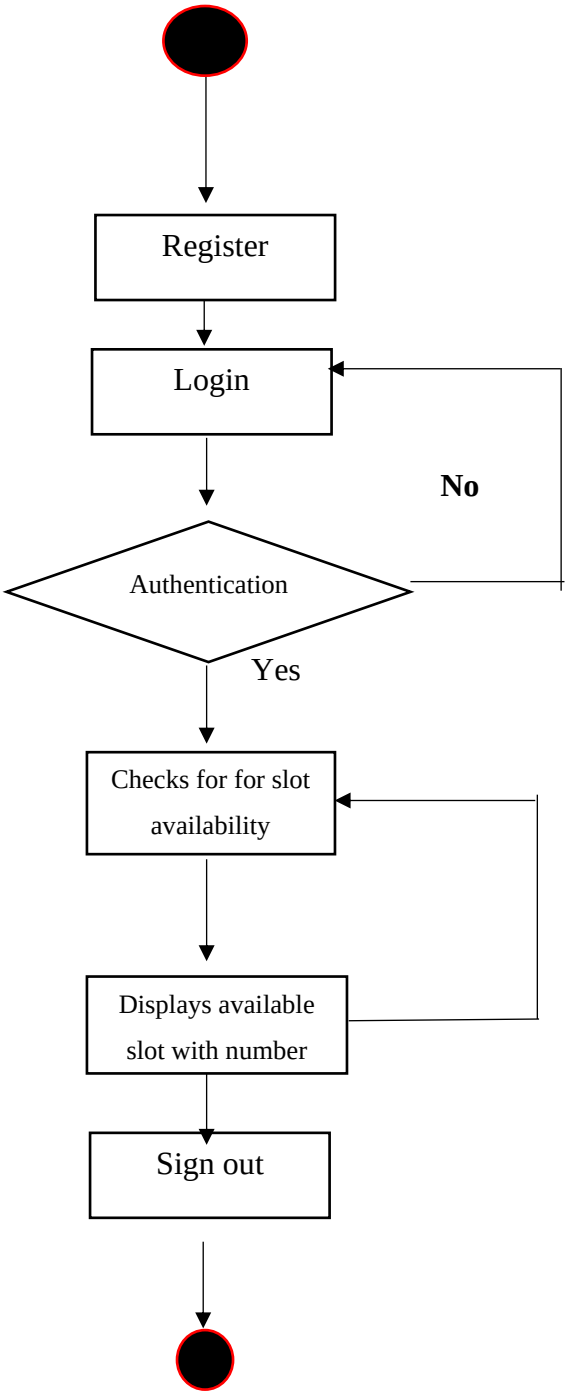


Figure 5.1 Use Case Diagram

Activity Diagram

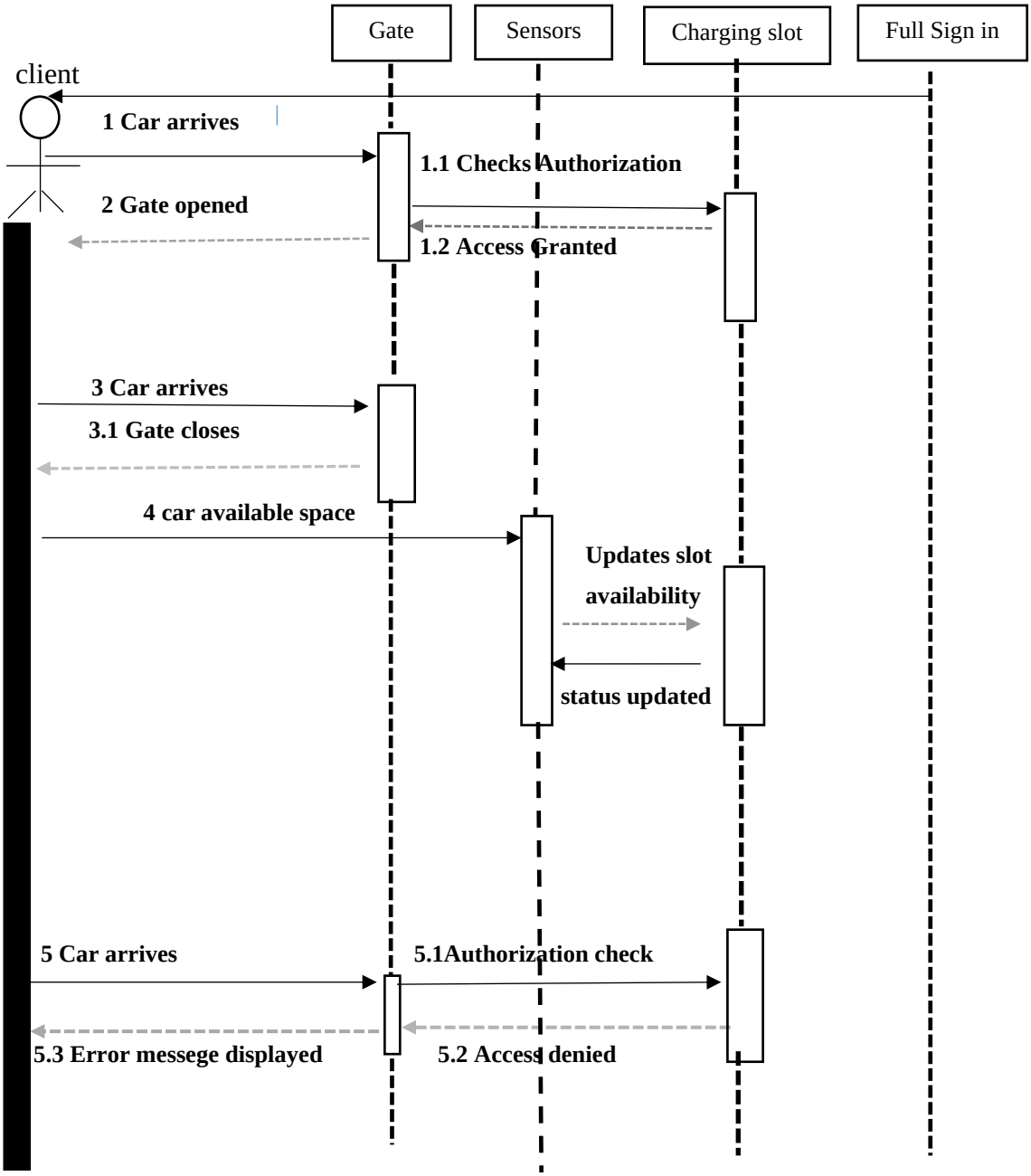
Activity diagram is a UML behavioural diagram representing the movement of the control or the flow of the object, with an emphasis on the sequence and the flow conditions. Coordinated behaviour by activity templates may be triggered by performing certain tasks, through accessing objects and data or any external events



The Figure 5.2 shows the flow control of the information of slot availability

Sequence Diagram

Sequence diagram is a type of interaction diagram that depicts objects as lifelines running down a screen, and their experiences over time are depicted as messages drawn from the source lifeline to the target lifeline. Sequence diagrams are useful for showing which objects interact with some other objects, and which messages cause such interactions as seen in Fig 5.4



The Figure 5.3 Sequence Diagram

Functional Modelling

Functional Modelling gives the process perspective of the object-oriented analysis model and an overview of what the system is supposed to do. It defines the function of the internal processes in the system with the aid of Data Flow Diagrams (DFD).

Data Flow Diagram (DFD)

A data-flow diagram (DFD) is a way of representing a flow of a data of a process or a system (usually an information system). The DFD also provides information about the outputs and inputs of each entity and the process itself.

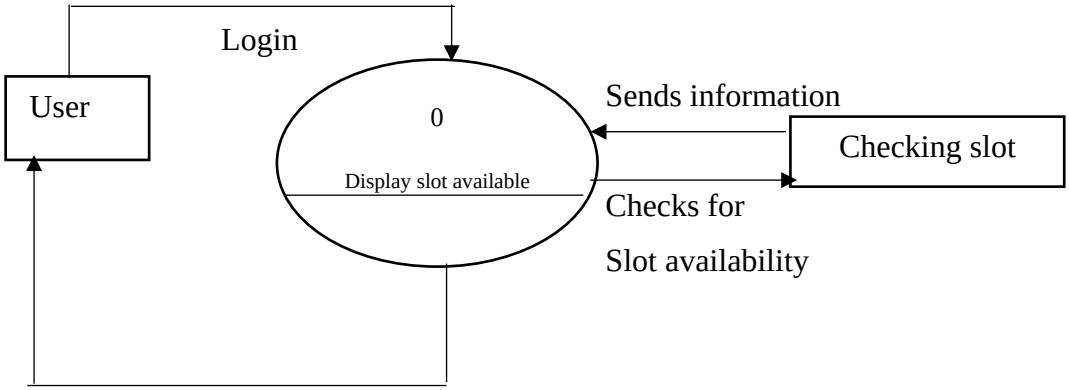


Figure 5.4 Level 0 DFD

Figure 5.5 displays the data structure as a whole and the process and interaction between the individuals.

Figure 5.6 is the first level of the data flow diagram displaying the data in a more detailed manner. The Figure 5.5 is a summary and overall phase of the project and the below diagram is detailed process where the main phase is divided into sub processes

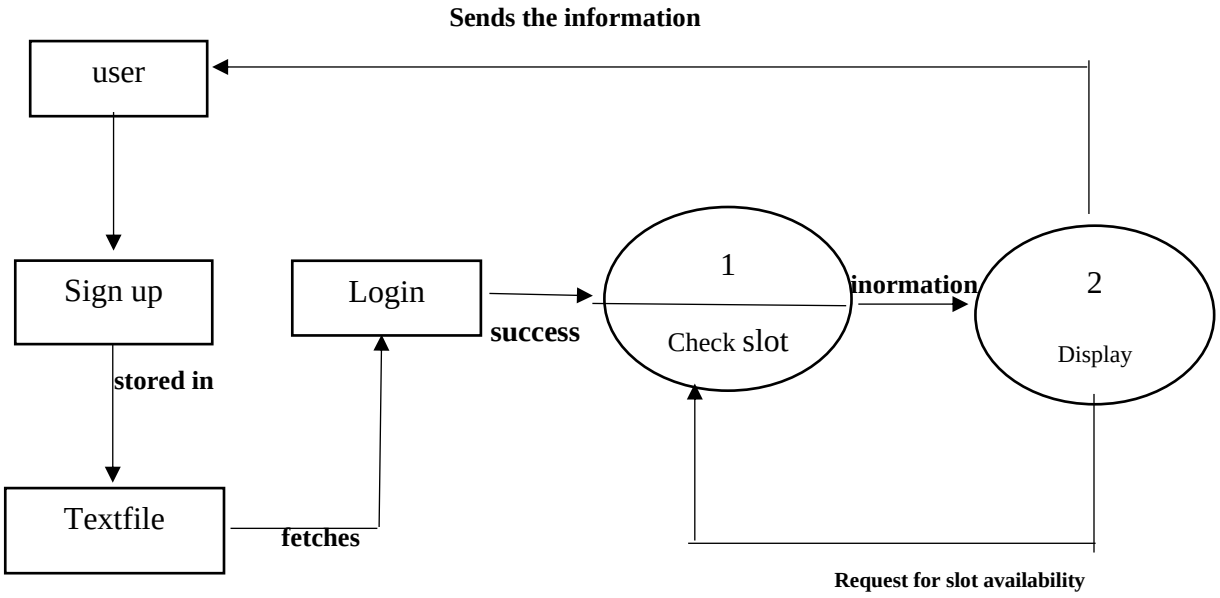


Figure 5.5 Level 1 DFD

5.2Detailed Design

The Design choices intertwine confirmation of information structure and the framework that has been utilized to build up the undertaking. The structure choices were made warily in the wake of conveying different contemplations and the results that will have on the framework's execution. The Design choices made concerning the technique is a straight-forward where the issue is understood in a straight strategy with the use of string thought. The Agile perspective is utilized in stirring up the task as it urges us to build up the undertaking rapidly and enough. By utilizing the composed system, the specialist will no doubt uncover concealed issues and additionally decrease the danger of new issues growing later on

CHAPTER 6

Implementation

Data.py

```
import csv
import re
import serial
import threading
import streamlit as st
from PIL import Image
import serial
import time


def set_interval(f, t):
    e = threading.Event()
    while not e.wait(t):
        f()


def arduino_data():
    arduino = serial.Serial('COM3', 9600)
    arduino.close()
    arduino.open()
    while True:
        data = arduino.readline()
        data = data.split()
        print("sesor1",data[0].decode())
        print("sensor2",data[1].decode())
        if int(data[0]) <= 15 and int(data[1]) <= 15:
            st.write("Slot are full")
            break
        elif int(data[0]) > 16 and int(data[1]) <= 15:
            st.write("Slot 1 is open")
            break
        elif int(data[0]) <= 15 and int(data[1]) > 16:
            st.write("Slot 2 is open")
            break
        else:
            st.write("SLot are open")
            break


# img1 = Image.open('C:/Users/Sachet/Desktop/ultrsonic/img1.jpg')
# st.image(img1, use_column_width=True)
st.header("Car Charging Station")
# sidebar components
x = st.sidebar.radio("Select", ('login','signup'))
if x == 'login':
    r = re.compile(r'[a-zA-Z0-9]{5,15}')
    st.sidebar.header("Login")
    user = st.sidebar.text_input("Enter Username")
    password = st.sidebar.text_input("Enter Password",
type='password')
    if st.sidebar.button("Login"):
        if user == "" and password == "":
            st.sidebar.error("Empty Fields")
        elif user != "" and password == "":
```

```
            st.sidebar.error("Enter a password")
        elif user == "" and password != "":
            st.sidebar.error("Enter Username")
        elif len(password) < 8:
            st.sidebar.error("Password is too short")
        elif not r.match(user):
            st.sidebar.error("Please Enter a proper Username")
        else:
            with open("user_details.txt", "r") as f:
                file = csv.reader(f)
                for i in file:
                    if user == i[0] and password == i[1]:
                        st.sidebar.success("Welcome "+user)
                        break


elif x == 'signup':
    st.sidebar.header('Sign-Up')
    u = st.sidebar.text_input('Userrname')
    p = st.sidebar.text_input('Password')

    if st.sidebar.button('Register'):
        if u == "" and p == "":
            st.sidebar.error("Empty Fields")
        elif u != "" and p == "":
            st.sidebar.error("Enter a password")
        elif u == "" and p != "":
            st.sidebar.error("Enter Username")
        elif len(p) < 8:
            st.sidebar.error("Password is too short")
        elif u != '' and p != '':
            try:
                f = open("user_details.txt", "a+")
                f.write(u+","+p)
                f.write("\n")
                f.close()
                st.sidebar.success("Registered")
            except Exception:
                st.sidebar.error("User Not registered")
        else:
            st.sidebar.error()
```

ultra_in.ino

```
int red = 11;//sensor1
int green = 10;//sensor1
int red1= 2;//sensor2
int green1=3;//sensor2
int trigPin = 9;
int echoPin = 8;
int trigPin1 = 12;
int echoPin1 = 13;
```

```
int red2=4;
int green2=5;
int duration1, distance1;
int duration, distance;




void setup() {
  Serial.begin (9600);
  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);
  pinMode(trigPin1, OUTPUT);
  pinMode(echoPin1, INPUT);
  /*#pinMode(trigPin3, OUTPUT);
  #pinMode(echoPin3, INPUT);*/
  pinMode(red, OUTPUT);
  pinMode(green, OUTPUT);
  pinMode(red1, OUTPUT);
  pinMode(green1,OUTPUT);
  pinMode(red2,OUTPUT);
  pinMode(green2,OUTPUT);

}

void loop() {
  int duration, distance;
  //First Sensor
  digitalWrite (trigPin, HIGH);
  delayMicroseconds (10);
  digitalWrite (trigPin, LOW);
  duration = pulseIn (echoPin, HIGH);
  distance = (duration/2) / 29.1;
  Serial.print(distance);
  Serial.print("\t");

//Second sensor
```

```
  digitalWrite (trigPin1, HIGH);
  delayMicroseconds (10);
  digitalWrite (trigPin1, LOW);
  duration1 = pulseIn (echoPin1, HIGH);
  distance1 = (duration1/2) / 29.1;

  Serial.print(distance1);
  Serial.print("\n");

    if (distance <=15 && distance1 > 15) {  // Change the number for
long or short distances.
      digitalWrite (red, HIGH);
      digitalWrite(green,LOW);
      digitalWrite (red1, LOW);
      digitalWrite(green1,HIGH);
      digitalWrite (red2, LOW);
      digitalWrite(green2, HIGH);
    }
    else if (distance > 15 && distance1 <= 15) {  // Change the
number for long or short distances.
      digitalWrite (red, LOW);
      digitalWrite(green,HIGH);
      digitalWrite (red1, HIGH);
      digitalWrite(green1,LOW);
      digitalWrite (red2, LOW);
      digitalWrite(green2,HIGH);
    }
    else if(distance <= 15 && distance1 <= 15)
    {
      digitalWrite (red, HIGH);
      digitalWrite(green,LOW);
      digitalWrite (red1, HIGH);
      digitalWrite(green1,LOW);
      digitalWrite (red2, HIGH);
      digitalWrite(green2,LOW);
    }
    else
```

```
    {
     digitalWrite (red, LOW);
     digitalWrite(green,HIGH);
     digitalWrite (red1, LOW);
     digitalWrite(green1,HIGH);
     digitalWrite (red2, LOW);
     digitalWrite(green2,HIGH);
    }
}
```

6.1 Screenshots

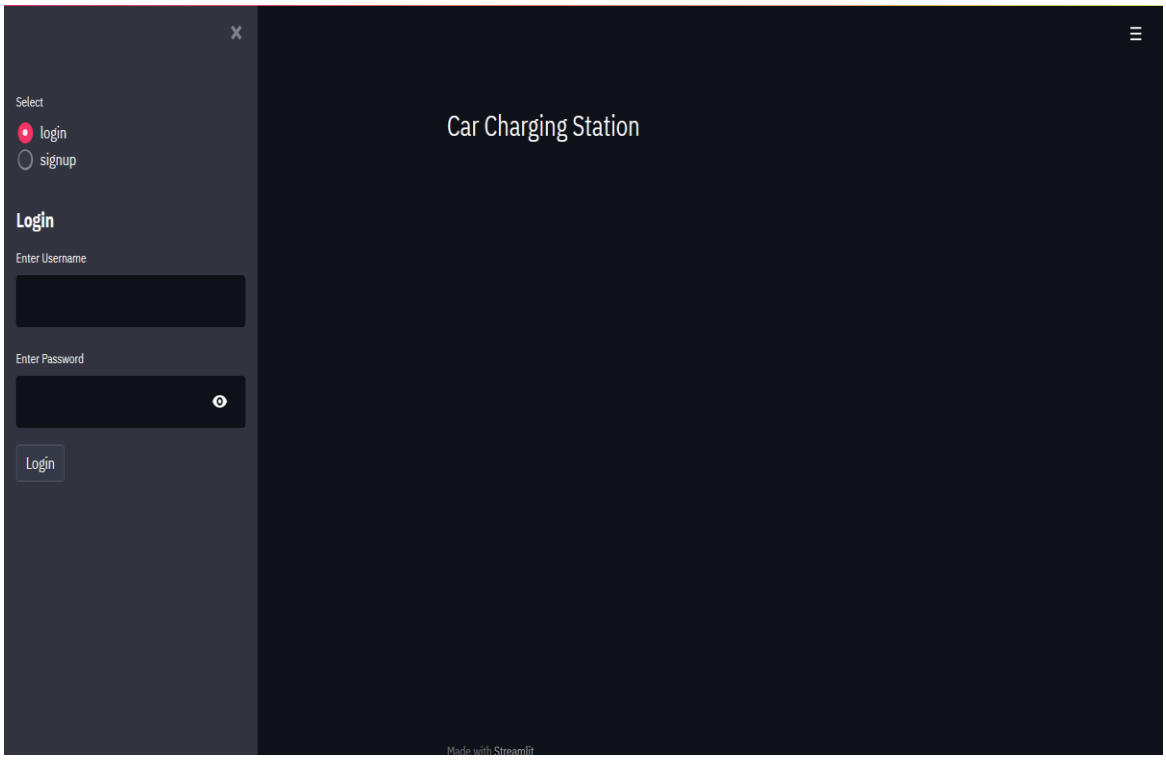


Figure 6.1 Web page

The Figure 6.1 gives input fields for username and password ,provides select option for login,signup

Figure 6.2 Registration for user

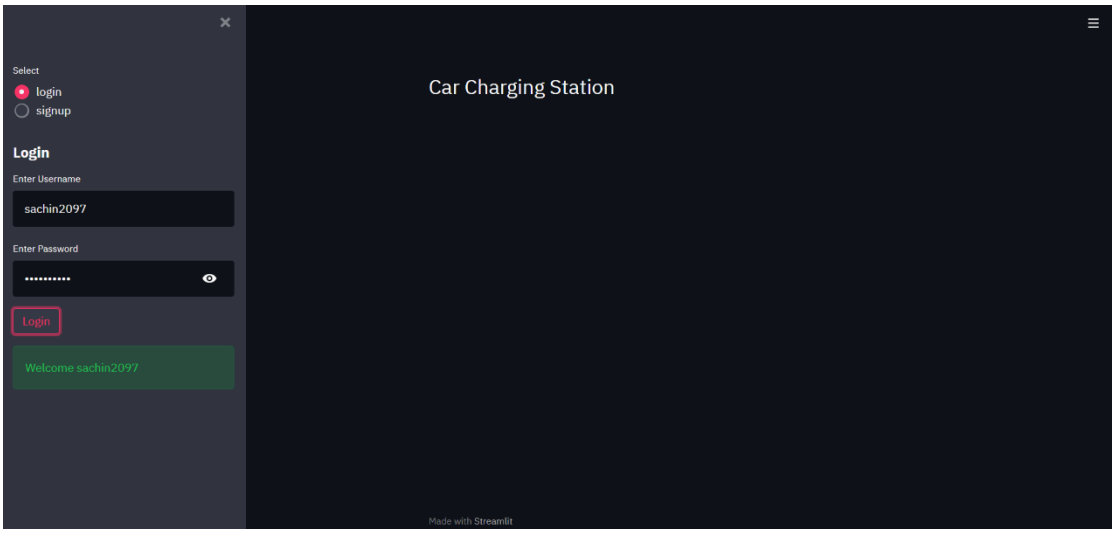


Figure 6.3 Sign in for user

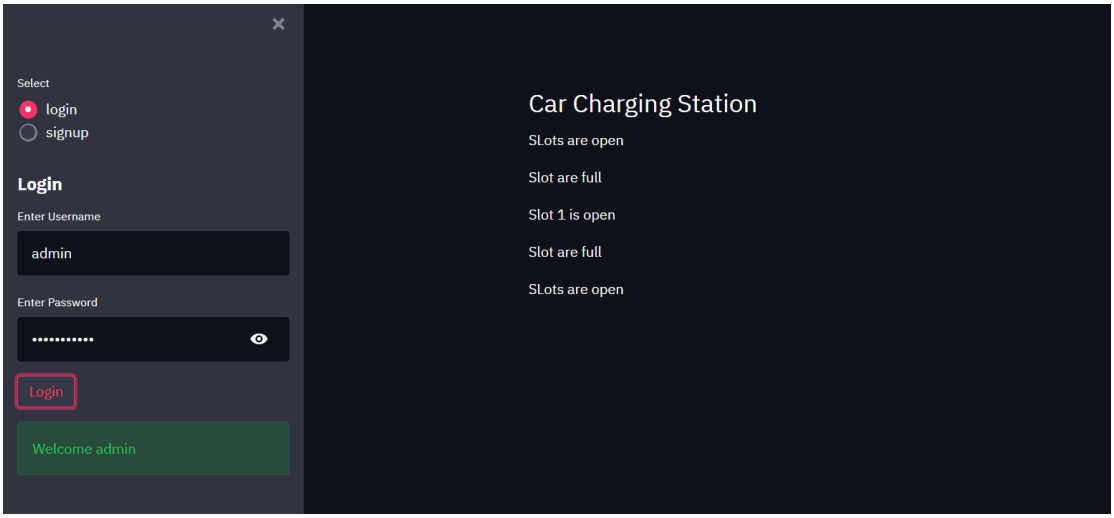


Figure 6.3 slot availability Information

Chapter 7

Software Testing

Software testing is described as a process of validating and verifying the application or software is free of bugs, fulfils the technical specifications as directed by its
development and design, and meets the requirements of the user effectively and efficiently in managing all extraordinary and boundary situations.

Software testing can be categorised following steps:

- **Verification**: Refers to the collection of tasks to ensure that a given feature is properly executed by the program.
- **Validation**: Reference is made to a distinct series of objectives that ensure that the software that has been built is identifiable to customer's needs.

7.1 Test Cases

Table 7.1 Test Cases for User Sign Up

Test Case ID	Test Description	Input	Expected Output	Actual output	Remark
USER_SIGNUP_01	To check wheather username and password empty	Username= Password =	Empty fields	Empty Fields	Pass
USER_SIGNUP_02	To check wheater password empty	Username= Sachin2097 Password =	Enter Password	Enter password	Pass
USER_SIGNUP_03	To check wheater password empty	Username= Password =sachin2097	Enter username	Enter username	Pass
USER_SIGNUP_04	To check user Registered	Username=sachin2097 Password =sachin2097	Registered	Registred	Pass

USER_SIGNUP_05	To check User Registered	Username= Sachin2097 Password= sach	Registered	Password Too Short	Fail

Table 7.2 Test Cases for User Sign In

Test Case ID	Test Description	Input	Expected Output	Actual output	Remark
USER_LOGIN_01	Both field empty	Username= sachin2097	Empty Field	Empty Field	Pass
USER_LOGIN_02	Login Fields Should not be Blank	Only Password= 123456	Enter username	Enter username	Pass
USER_LOGIN_03	To check for user login	Username= Sachin2097 Password= 123456	Welcome Sachin2097	Welcome Sachin2097	Pass
USER_LOGIN_04	To check for user login if user not Registred	Username= Sagar123 Password= 123456	Invalid username And password	Invalid Username and password	Pass

Table 7.3 Test Cases for Data Fetching

Test Case ID	Test Description	Input	Expected Output	Actual output	Remark
Data Fetching Slot 1	To check whether slot 1 available	Slot2 Distance <=15	Slot 1 open	Slot 1 open	Pass
Data Fetching Slot 2	To check whether slot 2 available	Slot1 Distance <=15	Slot 2 open	Slot 2 open	Pass
Data Fetching Slot 1 and slot 2	To check whether both slots are open	Slot 1>16 Slot 2>16	Slots are open	Slots are open	Pass
Data Fetching Slot 1 and Slot 2	To check whether both slots are full	Slot 1<15 Slot 2<15	Slots are full	Slots are full	Pass

7.2 Testing and Validation

The following are the Testing and Validation phase screenshot against the modules of the system.

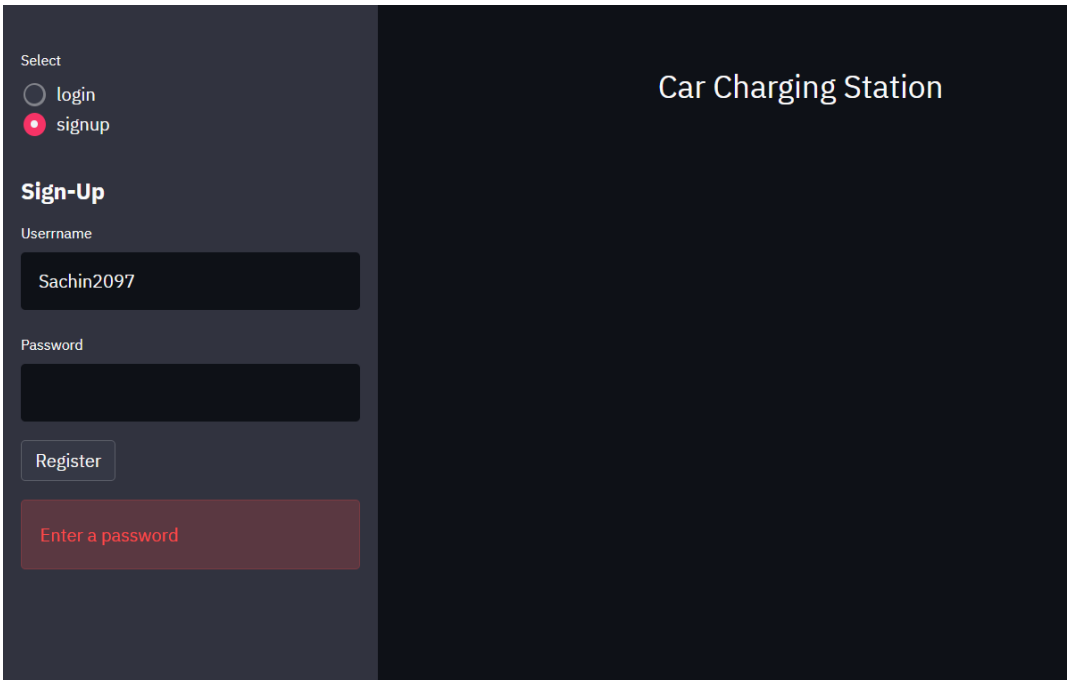


Figure 7.1 Testing for userpassword

Figure 7.1 shows the if the user has not entered password it will show Enter password

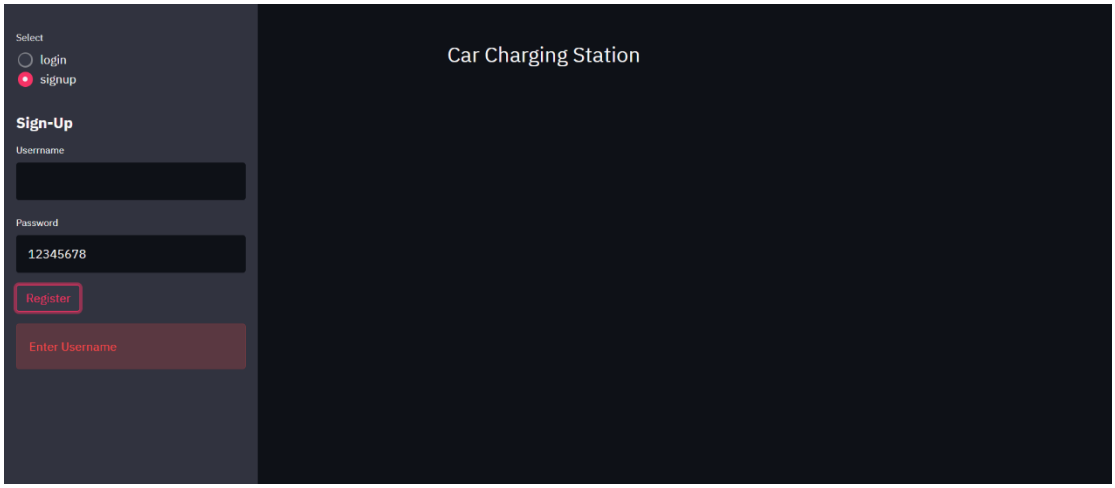


Figure 7.2 Testing for username

Figure 7.2 shows the if the user has not entered Username it will show Enter password

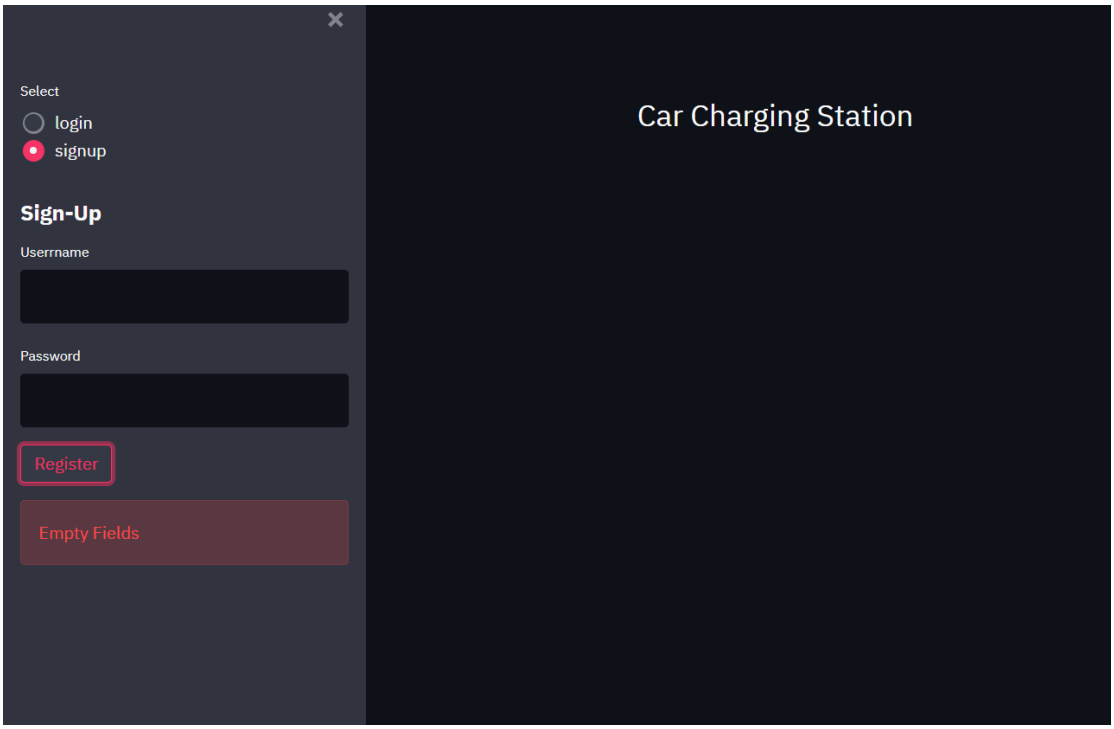


Figure 7.3 Testing for Both field Empty

Figure 7.3 shows the if the user has not entered password it will show Enter password

Chapter 8

Conclusion

The challenges facing EV deployment have become more tractable in recent years, but they are still considerable. Of far more consequence for sustainably scaling EV ownership is the cost-effective, efficient deployment of charging infrastructure. Standalone economic analysis of different charging options suggests that residential Level 2 charging, where available, can be the best option for most of an EV owner's charging needs, and that ToU rates (mostly for overnight charging) can bring down the average cost of electricity to below the equivalent fuel cost for an ICE.

Unprecedented levels of investment and product development planned by almost all major OEMs clearly indicates that a much larger EV market is forthcoming. The debate over utility ownership of EV infrastructure is ongoing. The criteria for deciding whether public ownership and rate-basing the cost of charging infrastructure is the appropriate tool for developing this market, or whether charging infrastructure should be left entirely to the private sector, are unresolved. There are differences of opinion on the rate at which this transition will occur, but there is clear technological and economic traction towards much greater reliance on electric vehicles. New rate designs, better smart metering and charging equipment technologies, and a charging infrastructure that is convenient and price competitive will need to be developed and implemented. These are difficult but achievable tasks.

Chapter 9

Future Enhancement

- Avoiding Congestion at the charging pool fee system would allow people to travel without cash. It provides drivers with Also, as it would reduce the waiting time, long queues, increase the efficiency of the Charging pool station.
- An android application can be developed with charging slot reservation system using the charging slots availability real-time information.
- Online booking of cahrging slots can be facilitated
- It could be scalable for more number of charging stations

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