# <ECO CHARGE>

*A*

*Mini Project Report*

*Submitted in partial fulfilment of the*

*Requirements for the award of the Degree of*

**BACHELOR OF ENGINEERING**

IN

**INFORMATION TECHNOLOGY**

By

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**Department of Information Technology**

**Vasavi College of Engineering (Autonomous)**

**ACCREDITED BY NAAC WITH 'A++' GRADE**

**(Affiliated to Osmania University and Approved by AICTE)**

**Ibrahimbagh, Hyderabad-31**

**2023**

# Vasavi College of Engineering (Autonomous)

## ACCREDITED BY NAAC WITH 'A++' GRADE

## (Affiliated to Osmania University and Approved by AICTE)

## Hyderabad-500 031

## Department of Information Technology

## DECLARATION BY THE CANDIDATE

We, **Mohammed Nomaan,** Mohammed Muneeb Ur Rahman**, and Kogooru** Bhargavi**,** bearing hall ticket numbers, **1602-22-737-094, 1602-22-737-093** and **1602-22-737-071**, hereby declare that the project report entitled **Eco Charge** is submitted in partial fulfilment of the requirement for the award of the degree of **Bachelor of Engineering** in **Information Technology**

This is a record of bonafide work carried out by us and the results embodied in this project report have not been submitted to any other university or institute for the award of any other degree or diploma.

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We would also like to sincerely thank the project reviewers for their valuable inputs and suggestions.

**Abstract :**

The provided HTML template represents a page displaying information about the charging cost for an electric vehicle. It includes details such as charging station name, location, charger type, units, cost per kWh, and the total charging cost. The template also features a styled Google Maps Directions button.

Here's a simplified abstraction:

Styling:

Defines styling rules for paragraphs, spans, and a directions button.
Specifies the appearance of the container with a title.
Content:

Displays charging-related information using paragraphs and spans.
Calculates and displays the total charging cost.
Interaction:

Includes a Google Maps Directions button with a link generated based on the charging station's name and location.
This template aims to provide a visually appealing and informative representation of charging-related details, coupled with an interactive map feature.

## Table Of Contents

## Introduction:

Introduction to Eco Charge: A Flask-Powered EV Charging Station Locator

Eco Charge is a robust web application designed to simplify the user experience of finding and interacting with electric vehicle (EV) charging stations. Developed using the Flask framework, the application seamlessly integrates with an SQLite database to store crucial details about charging stations and their associated charger types. The platform offers a user-friendly interface that allows individuals to explore available charging stations, search for specific locations, and estimate charging costs based on selected charger types and units. With a focus on accessibility and convenience, Eco Charge not only provides essential information but also incorporates interactive maps and Google Maps integration for an enhanced user journey.

Key Features and Database Integration:
The backbone of Eco Charge lies in its database models—ChargingStation and ChargerType—which capture vital information about charging stations, including names, locations, and associated charger types with costs per kilowatt-hour (kWh). To ensure a seamless user experience, the application populates the database with default data upon initialization, creating a foundation for users to explore various charging options. The integration of Flask-SQLAlchemy enables efficient data management and retrieval, supporting the dynamic functionalities of the platform.

Interactive Maps and User-Friendly Interface:
Eco Charge goes beyond a conventional EV charging locator by incorporating an interactive map powered by Leaflet.js. Users can easily identify charging stations on the map and select preferred options, enhancing the overall visual experience. The application's user interface, characterized by HTML templates and CSS styles, ensures clarity and aesthetics. Additionally, Eco Charge facilitates location-based searches, allowing users to find charging stations tailored to their preferences. With a commitment to accessibility and innovation, Eco Charge strives to be a valuable tool for both EV enthusiasts and casual users seeking a reliable and intuitive charging station locator.

## Technology

Flask:

Flask is a web framework for Python that simplifies the process of building web applications. It is lightweight, modular, and provides the necessary tools to create scalable and efficient web solutions. In this code, Flask is the core framework responsible for handling HTTP requests, rendering HTML templates, and managing routes.

Flask-SQLAlchemy:

Flask-SQLAlchemy is an extension for Flask that simplifies database integration using SQLAlchemy, a popular SQL toolkit and Object-Relational Mapping (ORM) library for Python. It facilitates the creation and management of database models in an object-oriented manner. The code uses Flask-SQLAlchemy to define and interact with the database models for charging stations and charger types.

SQLite:

SQLite is a lightweight, serverless relational database management system (RDBMS). In this code, SQLite serves as the backend database to store information about charging stations and charger types. It is a convenient choice for small to medium-sized applications due to its simplicity and ease of integration.

Leaflet.js:

Leaflet.js is a JavaScript library for interactive maps. The code incorporates Leaflet.js to create an interactive map displaying the locations of charging stations. This enhances the user experience by providing a visual representation of charging station distribution.

HTML and CSS:

HTML (Hypertext Markup Language) is used for structuring the content of web pages, while CSS (Cascading Style Sheets) is employed for styling and layout. The HTML templates in the code define the structure of web pages, and CSS styles enhance the visual presentation, ensuring a clean and appealing user interface.

JavaScript:

JavaScript is a scripting language that enables dynamic interactions within web pages. The code utilizes JavaScript to implement functionalities such as fetching geolocation data and handling user interactions on the map.

Google Maps API:

Although not explicitly mentioned in the provided code, the mention of Google Maps in the 'charging_cost.html' template suggests the potential use of the Google Maps API. This API could be employed to provide additional features such as displaying directions to a selected charging station. These technologies collectively contribute to the development of a feature-rich and user-friendly EV charging station locator application.

**Implementation(Code):**

```
# app.py
from flask import Flask, render_template, request, redirect, url_for
from flask_sqlalchemy import SQLAlchemy

app = Flask(_name_)
app.config['SQLALCHEMY_DATABASE_URI'] = 'sqlite:///charging_stations.db'

with app.app_context():
   db = SQLAlchemy(app)

class ChargingStation(db.Model):
   id = db.Column(db.Integer, primary_key=True)
   name = db.Column(db.String(255), nullable=False)
   location = db.Column(db.String(255), nullable=False)
   charger_types = db.relationship('ChargerType', backref='charging_station', lazy=True)

class ChargerType(db.Model):
   id = db.Column(db.Integer, primary_key=True)
   name = db.Column(db.String(50), nullable=False)
   cost_per_kwh = db.Column(db.Float, nullable=False)
   station_id = db.Column(db.Integer, db.ForeignKey('charging_station.id'), nullable=False)

def create_default_data():
   # Check if data already exists
   if ChargingStation.query.filter_by(name='Tata Power Charging Station', location='Banjara
Hills').first() is None:
      with app.app_context():
         # Create instances and add to the database
         station1 = ChargingStation(name='Tata Power Charging Station', location='Banjara
Hills')
         charger_type1 = ChargerType(name='CCS', cost_per_kwh=18,
charging_station=station1)
         charger_type2 = ChargerType(name='AC', cost_per_kwh=6, charging_station=station1)

         station2 = ChargingStation(name='Tata Charging Station', location='Somajiguda')
         charger_type3 = ChargerType(name='CCS', cost_per_kwh=20,
charging_station=station2)
         charger_type4 = ChargerType(name='AC', cost_per_kwh=7, charging_station=station2)

         # Add instances to the session
         db.session.add(station1)
         db.session.add(charger_type1)
         db.session.add(charger_type2)

         db.session.add(station2)
```

```
        db.session.add(charger_type3)
        db.session.add(charger_type4)

        # Commit the changes
        db.session.commit()

@app.route('/')
def index():
    charging_stations = ChargingStation.query.all()
    return render_template('index_leaf.html', charging_stations=charging_stations)

@app.route('/find_charging_stations', methods=['POST'])
def find_charging_stations():
    location = request.form.get('location')

    if location:
        # Query charging stations based on the entered location
        charging_stations =
ChargingStation.query.filter(ChargingStation.location.ilike(f'%{location}%')).all()
        return render_template('index_leaf.html', charging_stations=charging_stations,
entered_location=location)
    else:
        # If no location entered, redirect back to the index page
        return redirect(url_for('index'))

@app.route('/select_charger/<int:station_id>', methods=['GET', 'POST'])
def select_charger(station_id):
    station = ChargingStation.query.get_or_404(station_id)

    if request.method == 'POST':
        charger_type_id = request.form['charger_type']
        units = request.form['units']

        charger_type = ChargerType.query.get_or_404(charger_type_id)

        # Calculate charging cost based on selected charger type, units, and cost_per_kwh
        charging_cost = float(units) * charger_type.cost_per_kwh

        return render_template('charging_cost.html', station=station, charger_type=charger_type,
units=units, charging_cost=charging_cost)

    return render_template('select_charger.html', station=station)

if _name_ == '_main_':
    with app.app_context():
        db.create_all()
        create_default_data()

    # Run the Flask application in debug mode
    app.run(debug=True)
<!-- index_leaf.html -->
<!DOCTYPE html>
```

```
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <title>Welcome to Eco Charge</title>
  <!-- Add your other head elements here -->

  <!-- Add a link to your custom CSS file if needed -->
  <link rel="stylesheet" href="styles.css">

  <style>
    body {
      font-family: 'Arial', sans-serif;
      margin: 0;
      padding: 0;
      background-color: #f4f4f4;
    }

    header {
      background-color: #333;
      color: #fff;
      padding: 20px;
      text-align: center;
    }

    #logo {
      height: 120px;
      width: 120px;
      position: absolute; /* Position the logo absolutely */
      top: 10px; /* Distance from the top */
      left: 300px; /* Distance from the left */
    }

    h1 {
      margin: 0;
    }

    form {
      margin-top: 20px;
    }

    label {
      color: #fff;
    }

    input {
      padding: 10px;
      margin-right: 10px;
    }

    button {
      padding: 10px 20px;
```

```
    background-color: #4caf50;
    color: #fff;
    border: none;
    cursor: pointer;
   }

   button:hover {
    background-color: #45a049;
   }

   #map {
    height: 400px;
    width: 100%;
   }
  </style>
</head>
<body>
  <header>

   <!-- Add a heading for the page -->
   <h1>Welcome to Eco Charge</h1>
      <!-- Add your logo here -->
      <img src="{{ url_for('static', filename='image.jpeg') }}"  id="logo">

   <!-- Search bar for finding charging stations -->
   <form id="searchForm">
    <label for="search">Find Charging Stations:</label>
    <input id="search" type="text" name="location" placeholder="Enter location">
    <button type="button" onclick="findChargingStations()">Find Charging Stations</button>
   </form>
  </header>

  <!-- Embed Leaflet.js map as before -->
  <div id="map"></div>

  <!-- Include Leaflet.js from CDN -->
  <link rel="stylesheet" href="https://unpkg.com/leaflet/dist/leaflet.css" />
  <script src="https://unpkg.com/leaflet/dist/leaflet.js"></script>

  <script>
   var map;
   var chargingStations = [
    { id: 1, name: 'Tata Power Charging Station', location: 'Banjara Hills', lat: 17.4065, lon:
78.4772 },
    { id: 2, name: 'Tata Charging Station', location: 'Somajiguda', lat: 17.4256, lon: 78.4346 },
    // Add more charging stations as needed
   ];

   document.addEventListener('DOMContentLoaded', function () {
    // Initialize the map with default center coordinates
    map = L.map('map').setView([17.4065, 78.4772], 10);
```

```
    // Use OpenStreetMap as the base layer
    L.tileLayer('https://{s}.tile.openstreetmap.org/{z}/{x}/{y}.png', {
      attribution: '&copy; OpenStreetMap contributors'
    }).addTo(map);

    // Add markers for charging stations
    for (var i = 0; i < chargingStations.length; i++) {
      var station = chargingStations[i];
      var marker = L.marker([station.lat, station.lon]).addTo(map)
        .bindPopup("<b>" + station.name + "</b><br>Click to select charger");

      // Attach click event to the marker
      marker.on('popupopen', function (e) {
        // Retrieve information about the clicked charging station
        var clickedStation = chargingStations.find(s => s.lat === e.popup._latlng.lat && s.lon ===
e.popup._latlng.lng);
        if (clickedStation) {
          // Redirect to the page for selecting a charger (modify the URL as needed)
          window.location.href = "/select_charger/" + clickedStation.id;
        }
      });
    }
  });

  function findChargingStations() {
    var locationInput = document.getElementById('search');
    var location = locationInput.value;

    // Geocode the entered location using a geocoding service (adjust the service URL as
needed)
    fetch('https://nominatim.openstreetmap.org/search?format=json&q=' + location)
      .then(response => response.json())
      .then(data => {
        if (data.length > 0) {
          var foundLocation = data[0];
          var foundLat = parseFloat(foundLocation.lat);
          var foundLon = parseFloat(foundLocation.lon);

          // Update the map view to the found location
          map.setView([foundLat, foundLon], 12);
        } else {
          alert('Location not found. Please enter a valid location.');
        }
      })
      .catch(error => {
        console.error('Error fetching geolocation data:', error);
      });
  }
 </script>
</body>
</html>
<!-- select_charger.html -->
```

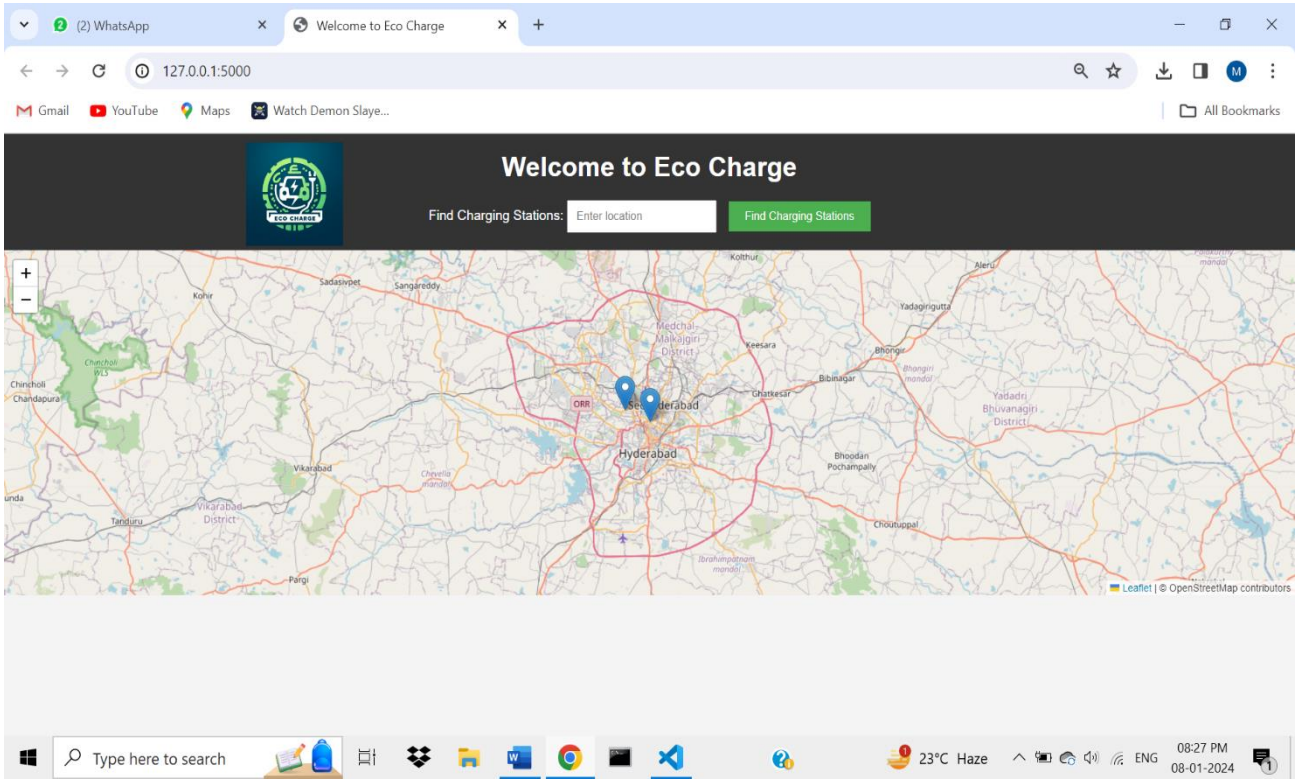
```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <title>Select Charger Type and Units</title>
  <style>
    body {
      font-family: 'Arial', sans-serif;
      background-color: #f4f4f4;
      margin: 0;
      padding: 0;
    }

    h2 {
      color: #333;
    }

    form {
      max-width: 400px;
      margin: 20px auto;
      padding: 20px;
      background-color: #fff;
      border-radius: 8px;
      box-shadow: 0 0 10px rgba(0, 0, 0, 0.1);
    }

    label {
      display: block;
      margin-bottom: 8px;
      color: #555;
    }

    select, input {
      width: 100%;
      padding: 10px;
      margin-bottom: 16px;
      box-sizing: border-box;
    }

    button {
      background-color: #4caf50;
      color: #fff;
      padding: 10px 20px;
      border: none;
      border-radius: 4px;
      cursor: pointer;
      font-size: 16px;
    }

    button:hover {
      background-color: #45a049;
```

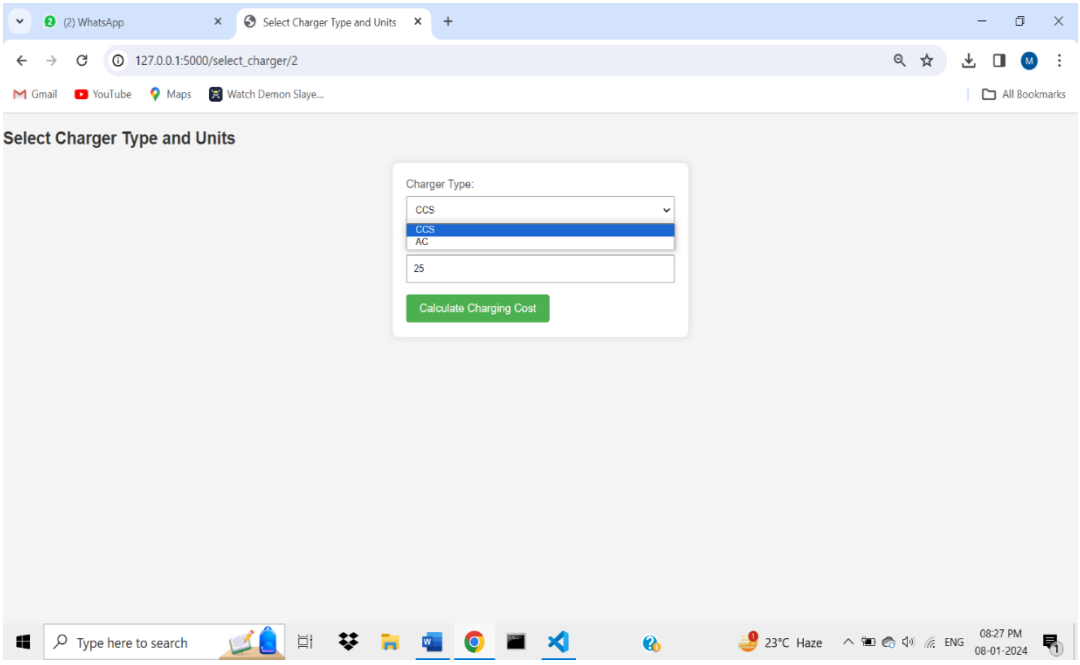
```
    }
  </style>
  <!-- ... (other head elements) ... -->
</head>
<body>
  <h2>Select Charger Type and Units</h2>
  <form action="{{ url_for('select_charger', station_id=station.id) }}" method="post">
    <label for="charger_type">Charger Type:</label>
    <select id="charger_type" name="charger_type" required>
      {% for charger_type in station.charger_types %}
        <option value="{{ charger_type.id }}">{{ charger_type.name }}</option>
      {% endfor %}
    </select>
    <br>
    <label for="units">Units:</label>
    <input type="number" id="units" name="units" required>
    <br>
    <button type="submit">Calculate Charging Cost</button>
  </form>
</body>
</html>
<!-- charging_cost.html -->
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <title>Charging Cost</title>
  <style>
    body {
      font-family: 'Arial', sans-serif;
      background-color: #f7f7f7;
      margin: 0;
      padding: 0;
      display: flex;
      align-items: center;
      justify-content: center;
      height: 100vh;
    }

    .container {
      text-align: center;
      padding: 20px;
      background-color: #fff;
      border-radius: 8px;
      box-shadow: 0 0 20px rgba(0, 0, 0, 0.1);
    }

    h2 {
      color: #333;
    }
```

```
      p {
        margin: 10px 0;
        color: #555;
      }

      p span {
        font-weight: bold;
        color: #333;
      }

      p:last-child {
        font-size: 1.4em;
        color: #4caf50;
      }

      .directions-button {
        margin-top: 20px;
        background-color: #4285f4;
        color: #fff;
        padding: 10px 20px;
        border: none;
        border-radius: 4px;
        cursor: pointer;
        text-decoration: none;
        display: inline-block;
      }

      .directions-button:hover {
        background-color: #357ae8;
      }
    </style>
    <!-- ... (other head elements) ... -->
</head>
<body>
    <div class="container">
      <h2>Charging Cost</h2>
      <p><span>Charging Station:</span> {{ station.name }}</p>
      <p><span>Location:</span> {{ station.location }}</p>
      <p><span>Charger Type:</span> {{ charger_type.name }}</p>
      <p><span>Units:</span> {{ units }}</p>
      <p><span>Cost per kWh:</span> &#x20B9; {{ charger_type.cost_per_kwh }}</p>

      {% set total_cost = units|float * charger_type.cost_per_kwh %}
      <p><span>Total Charging Cost:</span> &#x20B9; {{ total_cost }}</p>

      <!-- Google Maps Directions Button with search query -->
      <a class="directions-button"
href="https://www.google.com/maps/search/?api=1&query={{ station.name }} {{
station.location }}" target="_blank">Get Directions</a>
    </div>
</body>
</html>
```

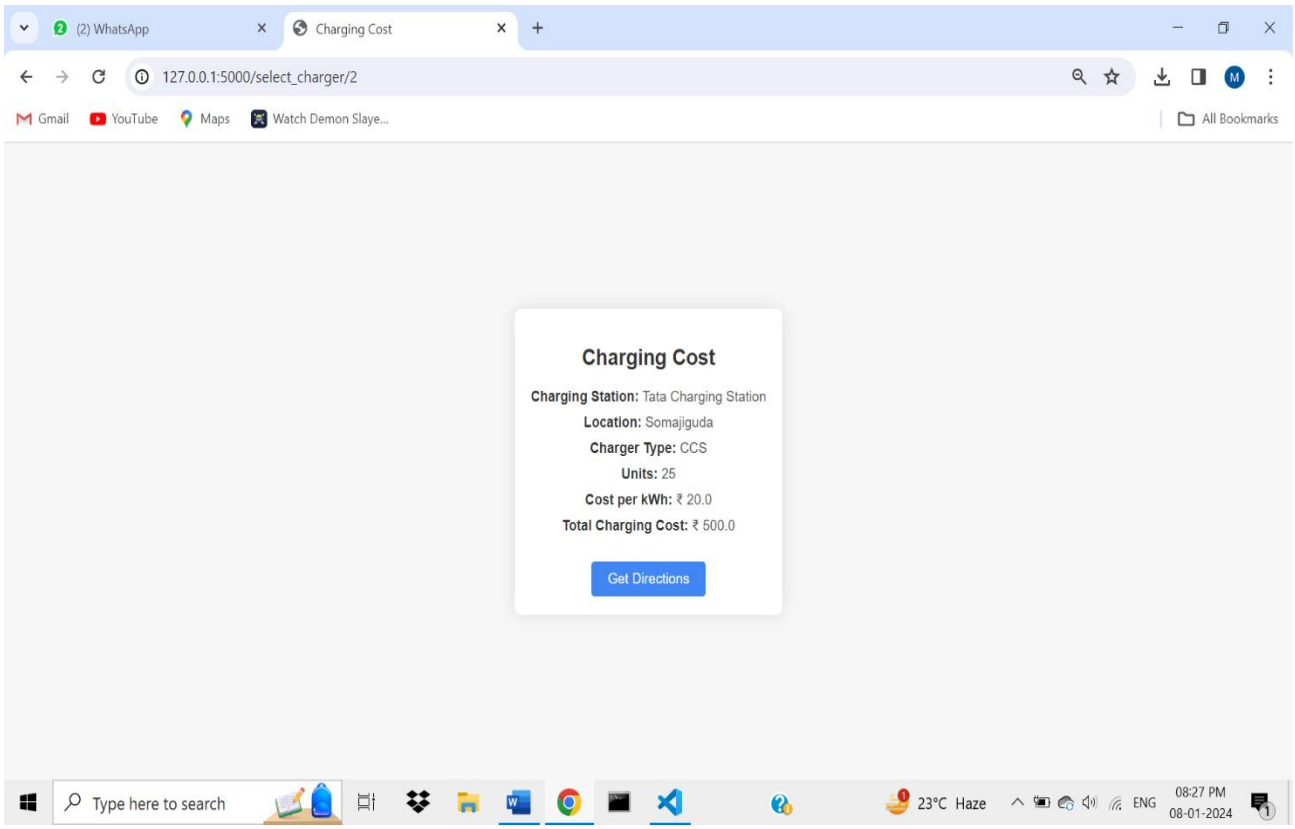
## Output:

## User Interface :



**Page showing charging cost :**



## Conclusion and Future Scope:

The Flask application, with its robust database structure and user-friendly interface, effectively manages and presents information about charging stations. The integration of Flask SQLAlchemy and Leaflet.js ensures efficient data handling and an interactive map experience.

Future Scope:
Potential enhancements include user authentication for personalized experiences, improved error handling, and input validation for security. Adding interactive map features, real-time data integration, and mobile responsiveness would enhance usability and functionality.

Overall Impact:
The application's potential contribution to the electric vehicle infrastructure can be further realized by exploring partnerships, real-time data sources, and collaboration with sustainable transportation initiatives. Continuous updates, user feedback, and a commitment to technological advancements will ensure the app remains impactful in promoting sustainable transportation.

**References :**

https://www.w3schools.com/html
https://www.w3schools.com/css/default.asp
https://www.w3schools.com/js/default.asp
**https://flask.palletsprojects.com/en/3.0.x/**