PLUG PARADISE - EV CHARGING STATION WITH TRAFFIC DETECTION

A MINI-PROJECT REPORT

Submitted by

HEMALATHA R 221701020

THOSHIKAARANI S T 221701061

in partial fulfilment for the course

CD19651 Mini Project

for the degree of

BACHELOR OF ENGINEERING

in

COMPUTER SCIENCE AND DESIGN

RAJALAKSHMI ENGINEERING COLLEGE

RAJALAKSHMI NAGAR

THANDALAM

CHENNAI -602 105

APRIL 2025

RAJALAKSHMI ENGINEERING COLLEGE

CHENNAI – 602105

BONAFIDE CERTIFICATE

Certified that this project report **"PLUG PARADISE – REAL CHARGING STATION LOCATOR WEBSITE"** is the bonafide work of **HEMALATHA R (221701020)** and **THOSHIKAARANI S T (221701061)**, who carried out the project work for the subject CD19651 – Mini Project under my supervision.

SIGNATURE	**SIGNATURE**
Prof. Uma Maheshwar Rao	**Mr. S. Pradeep kumar**
Head of the Department	**Supervisor**
Computer Science and Design	Computer Science and Design
Rajalakshmi Engineering College	Rajalakshmi Engineering College
Chennai - 602105	Chennai - 602105

Submitted to Project and Viva Voce Examination for the subject

CD19651 – Mini Project held on_____.

Internal Examiner External Examiner

ABSTRACT

Plug Paradise is an advanced EV charging station locator that enhances the driving experience by integrating real-time traffic detection, route optimization, and charging station discovery. With live traffic monitoring, users receive real-time congestion updates, enabling them to select the fastest and most efficient route to their destination. The intelligent route-planning feature dynamically adjusts navigation based on road conditions, minimizing travel time and ensuring optimal charging stops along the way. Additionally, Plug Paradise provides detailed station information, including pricing (if applicable), supported vehicle types, and user-generated ratings and reviews. The platform fosters community engagement by allowing users to contribute by adding new stations, reporting charger issues, and sharing real-world charging experiences. By integrating traffic data, smart route planning, and charging station tracking into a single, intuitive interface, Plug Paradise helps reduce range anxiety, optimize energy efficiency, and support the growing adoption of electric vehicles.

ACKNOWLEDGEMENT

Initially we thank the Almighty for being with us through every walk of our life and showering his blessings through the endeavour to put forth this report. Our sincere thanks to our Chairman **Mr. S. Meganathan, B.E, F.I.E.,** our Vice Chairman **Mr. Abhay Shankar Meganathan,B.E.,M.S.,** and our respected Chairperson **Dr. (Mrs.) Thangam Meganathan, Ph.D.,** for providing us with the requisite infrastructure and sincere endeavouring in educating us in their premier institution.

Our sincere thanks to **Dr. S. N. Murugesan, M.E., Ph.D.,** our beloved Principal for his kind support and facilities provided to complete our work in time. We express our sincere thanks to our **Prof. Uma Maheshwar Rao** Associate Professor and Head of the Department of Computer Science and Design for his guidance and encouragement throughout the project work. We convey our sincere thanks to our internal guide and Project Coordinator, **Mr. S. Pradeep Kumar** Department of Computer Science and Design, Rajalakshmi Engineering College for his valuable guidance throughout the course of the project.

HEMALATHA R 221701020

THOSHIKAARANI S T 221701061

TABLE OF CONTENT

LIST OF FIGURE

CHAPTER 1

INTRODUCTION

Electric Vehicle (EV) Charging Stations are rapidly gaining prominence as the demand for electric vehicles continues to rise. Efficient and accessible charging infrastructure is crucial for the widespread adoption of EVs. However, many drivers face challenges in locating nearby charging stations, checking availability, and ensuring a smooth charging experience. Our EV Charging Station platform aims to address these issues by providing real-time information on the location, availability, and operational status of charging stations. With an intuitive and user-friendly interface, users can effortlessly navigate to the nearest charging stations and monitor charging status updates. We utilize a user-centered design approach, incorporating feedback from surveys, interviews, and usability tests to enhance the platform's functionality. By improving navigation, optimizing performance, and refining the interface, our goal is to create a seamless and engaging experience for EV users.

CHAPTER 2

LITERATURE REVIEW

2.1. UI/UX Design and Usability Evaluation of an EV Charging Station Locator Website: A Case Study

This study examines UI/UX challenges in EV charging station locator websites, emphasizing the need for clear navigation, accurate station location information, easy accessibility, and real-time availability updates. Usability testing with 50 participants showed that user satisfaction depends on these factors, highlighting the need for improved visual design and better user guidance to reduce frustration.

2.2. User Experience and Interface Design for EV Charging Station Locator

This study examines website interfaces for EV charging station locators, focusing on improving user experience, especially for first-time EV users. Key findings highlight the need for clear station availability mapping, predictive features, and user-friendly filters for better guidance. The research suggests simplifying search and selection processes through an intuitive interface to enhance user adoption and satisfaction.

2.3. Enhancing User Experience for Electric Vehicle Charging Station Locator Websites Through UI/UX Design

This study highlights key UI/UX issues in EV charging station locator websites, including unclear station availability, inaccurate geolocation, and complex filtering options. It proposes solutions such as streamlined navigation, improved search filters, real-time status updates, and educational features to help users understand station capabilities, pricing, and availability.

CHAPTER 3

SOFTWARE USED

Farm Hub is developed using a combination of modern technologies to ensure a seamless and efficient user experience. The core technologies include Figma for UI/UX design, Flutter for frontend development, and Firebase for backend services.

3.1. TOOL SELECTION

In the initial phase of the EV Charging Station Locator website redesign project, our team thoroughly assessed various UI/UX design tools to determine the best fit for our project's requirements. Figma was selected as the primary tool due to its powerful collaborative features and web-based accessibility. The ability for multiple designers and stakeholders to work simultaneously on the same files in real time greatly streamlined our design process. Figma's extensive library of plugins and integrations also provided us with the necessary tools and resources to enhance our creativity and productivity, ensuring that we could meet the specific demands of the EV charging station locator website's user interface.

3.2. DESIGN IMPLEMENTATION WITH FIGMA

Using Figma, our team focused on enhancing both the user experience and the overall aesthetics of the EV Charging Station Locator website. Figma's vector tools allowed for precise and detailed design work**,** ensuring high-quality, scalable visuals across various screen sizes and devices. The component system played a pivotal role in maintaining consistency throughout the website by enabling us to create reusable UI elements. This not only ensured a cohesive design language but also accelerated the design process by eliminating redundant tasks and enhancing overall efficiency.

3.3. PROTOTYPING AND FEEDBACK

Prototyping and iterative testing were crucial in refining the website's design, and Figma's interactive prototyping features were indispensable in this phase. We were able to link design frames and apply transitions and animations to simulate real-world website interactions. This interactive prototype allowed stakeholders to experience the website's functionality firsthand and provide immediate feedback. The ease of incorporating these insights into the design ensured that the user interface was continuously refined, improving the overall experience for users of the EV Charging Station Locator website.

3.4. COLLABORATION AND REAL-TIME UPDATES:

Figma's collaborative nature enabled seamless communication between our project team members and stakeholders. The ability to view real-time updates and leave comments directly on the design files reduced the need for frequent meetings and email exchanges. Additionally, Figma's cloud-based platform ensured that all team members, regardless of location, had access to the latest design versions, keeping everyone aligned and fostering a unified vision for the website's interface.

3.5.OUTCOME AND IMPACT

The use of Figma significantly contributed to the success of the EV Charging Station Locator website redesign. Post-launch feedback and analytics showed notable improvements in user satisfaction and engagement, confirming the effectiveness of the updated design. The project not only achieved its initial goals but also provided a solid foundation for future updates, offering a scalable and user-friendly design framework that can adapt to the evolving needs of EV users and the expanding charging infrastructure.

CHAPTER 4

PRESENT TECHNOLOGY

The current state of technology in the EV Charging Station Locator website encompasses several key components that are critical to providing a seamless experience for users searching for charging stations. This section outlines the existing technologies used by the website, focusing on software architecture, data handling, user interface design, and security measures.

4.1. SOFTWARE ARCHITECTURE

The EV Charging Station Locator website utilizes a modern, scalable architecture designed to manage high volumes of user interactions and real-time data. The architecture typically includes:

a. **Front End**

The user interface is developed using **HTML**, **CSS**, and **JavaScript**, ensuring a responsive and interactive experience across various devices and browsers. JavaScript enhances the website's interactivity, facilitating dynamic content updates and user engagement.

b. **Back End**

The project employs **Node.js** for server-side operations, enabling efficient handling of asynchronous events and real-time data processing. This setup allows the application to manage user requests effectively and provide timely information on charging station availability.

4.2. USER INTERFACE AND EXPERIENCE

The user interface (UI) of the EV Charging Station Locator website aims to provide a functional yet user-friendly experience. However, several challenges still exist, particularly in improving search efficiency and ensuring accessibility. Currently, the website includes:

a. **Responsive Design:** The website features a responsive layout that adapts to different screen sizes and orientations, ensuring a smooth experience on desktop.

b. **Accessibility Features:** Basic accessibility features are included, such as high-contrast themes and keyboard navigation. However, there is significant potential to enhance accessibility further, particularly by incorporating features like voice search, screen reader compatibility, and customizable font sizes.

The present technology supporting the EV Charging Station Locator website Is well-suited for providing users with critical information about charging stations. However, improvements in user interface design and user experience are essential to enhance overall usability and ensure smoother interactions. Future technology upgrades should focus on optimizing performance, enhancing security measures, and creating a more intuitive, accessible experience for users as the adoption of electric vehicles continues to grow.

4.3. LIMITATIONS

4.3.1.LIMITATIONS OF THE CURRENT EV CHARGING STATION APP TECHNOLOGY

While the EV Charging Station Locator website is equipped with essential technologies to manage real-time charging station data and user interactions, several limitations still affect its performance, usability, and overall user satisfaction. Identifying these limitations is crucial for guiding future improvements and redesign efforts. Below are some of the primary limitations currently faced by the EV Charging Station Locator website:

4.3.2.USER INTERFACE AND USER EXPERIENCE (UI/UX)

a. **Complex Navigation:** Users often report that navigating through the website is not intuitive, making it difficult to locate nearby charging stations, check availability, or access additional station details.
b. **Outdated Design:** The website's design lacks modern UI elements seen in newer, well-optimized applications. Improvements in layout, visual aesthetics, and interactive features are needed to enhance user engagement .

4.3.3.ACCESSIBILITY

a. **Limited Accessibility Features:** The website does not fully support users with disabilities. Features such as voice search, screen reader compatibility, and customizable font sizes are either limited or absent.
b. **Inadequate Contrast and Font Sizes:** The website's contrast is insufficient for users with visual impairments, and the text size customization options are limited, making it harder for some users to read essential information.

CHAPTER 5

PROPOSED DESIGN

In the proposed redesign of the EV Charging Station Locator Website, the primary objective is to enhance user experience by making the interface more intuitive, visually appealing, and efficient. The redesign will focus on simplifying navigation, improving accessibility, and ensuring seamless interactions across different devices. A cleaner layout with a streamlined menu structure will help reduce clutter and improve the visibility of key features such as searching for charging stations, checking availability, and managing user accounts.

A major change in the redesign involves restructuring the homepage to prioritize real-time updates on charging station status, waiting times, and pricing details. The process of searching for and booking charging stations will be optimized to minimize the number of steps required, integrating predictive search and autofill features to accelerate user interactions while reducing errors. Enhancements in accessibility will include high-contrast visuals, larger clickable areas for better usability, multilingual support, and voice navigation to ensure inclusivity for all users.

A personalized dashboard will be introduced, enabling users to conveniently view their charging history, upcoming bookings, and preferred charging stations in one place. Additionally, real-time notifications about charging session status and station availability will be incorporated into the booking page, ensuring a smooth and informed experience.

The current system faces several usability challenges that will be addressed in the redesign. One critical issue is frequent session timeouts, which require users to repeatedly log back in, disrupting their experience. The new design will incorporate an improved session management system to maintain user authentication without unnecessary interruptions. Another limitation is the lack of a feature to charge multiple

vehicles in a single booking session. The redesign will introduce a multi-vehicle selection option, allowing users to complete bookings for multiple EVs without restarting the process for each one.

The payment process also requires significant improvements, as the current design is cluttered and lacks user-friendliness. The payment page will be reorganized to provide a smoother, more intuitive experience while integrating a variety of digital and physical payment options. This will make it easier for all users, including senior citizens, to complete transactions comfortably. Additionally, many users visit the website solely to book charging stations, without engaging with other useful services. The redesigned platform will explore better integration of features such as trip planning, charging cost estimation, and loyalty rewards to enrich the overall user experience.

By leveraging modern UI/UX tools and real-time prototyping, the EV Charging Station Locator Website will be transformed into a seamless, user-friendly, and accessible platform. The improvements will not only enhance user satisfaction and engagement but also attract a broader audience, ensuring a more efficient and enjoyable charging experience for EV users.

5.1 USE CASE DIAGRAM

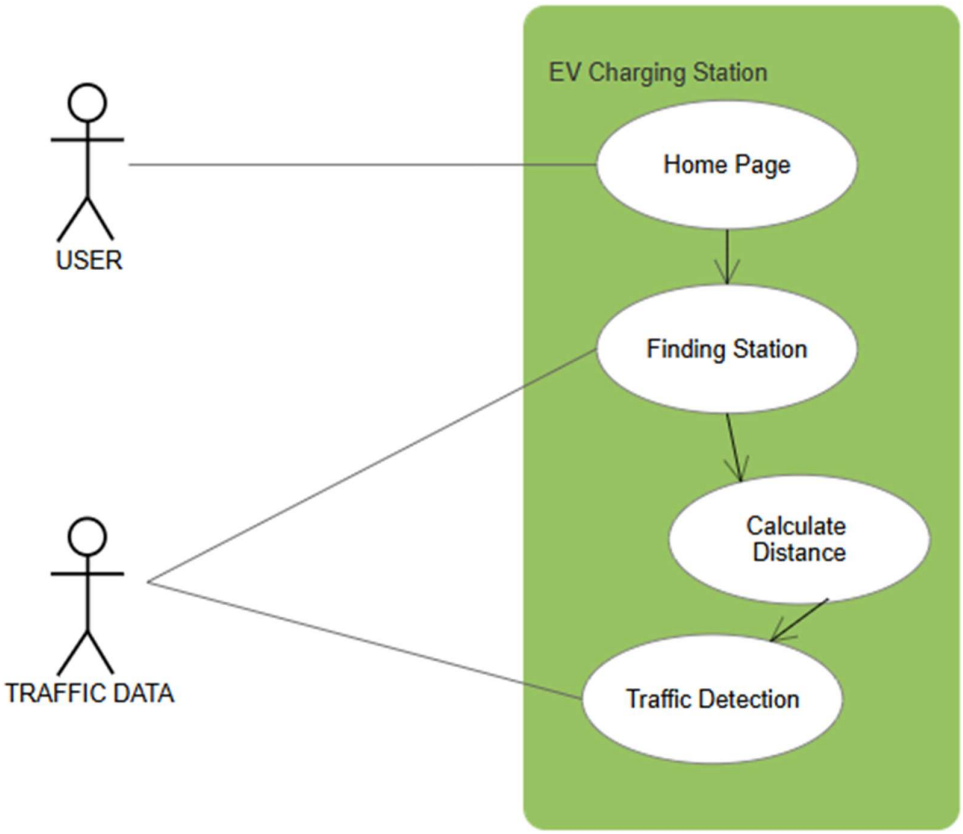

Fig1.Use case diagram

5.2 ADVANTAGES

a. **Advantages of Redesigning the EV Charging Station Locator Website:** A comprehensive redesign of the EV Charging Station Locator Website could bring numerous benefits, ranging from improved user experience to increased operational efficiency and security. Here are the key advantages that a redesign could offer:

b. **Enhanced User Experience (UX):**

   i. **Improved Usability**: By simplifying the website's interface and making navigation more intuitive, users can find information and complete tasks such as locating charging stations or checking their availability more easily and quickly.

   ii. **Modern Design:** Updating the visual design to align with contemporary aesthetics will make the website more appealing and enjoyable to use, increasing user satisfaction and retention.

   iii. **Personalized Experience:** Integrating advanced data analytics to offer personalized charging station suggestions, alerts, and promotions can enhance user engagement and make the website more relevant to individual needs.

c. **Integration and Scalability:**

   i. **Seamless Integration with Other Services:** Improving integration with navigation services and payment platforms can offer a more holistic travel and charging planning tool, making the EV charging station locator website a one-stop solution for EV users.

   ii. **Scalable Infrastructure:** Building a scalable digital infrastructure ensures that the website can handle future increases in user numbers and search queries without performance degradation.

CHAPTER 6

OUTPUT

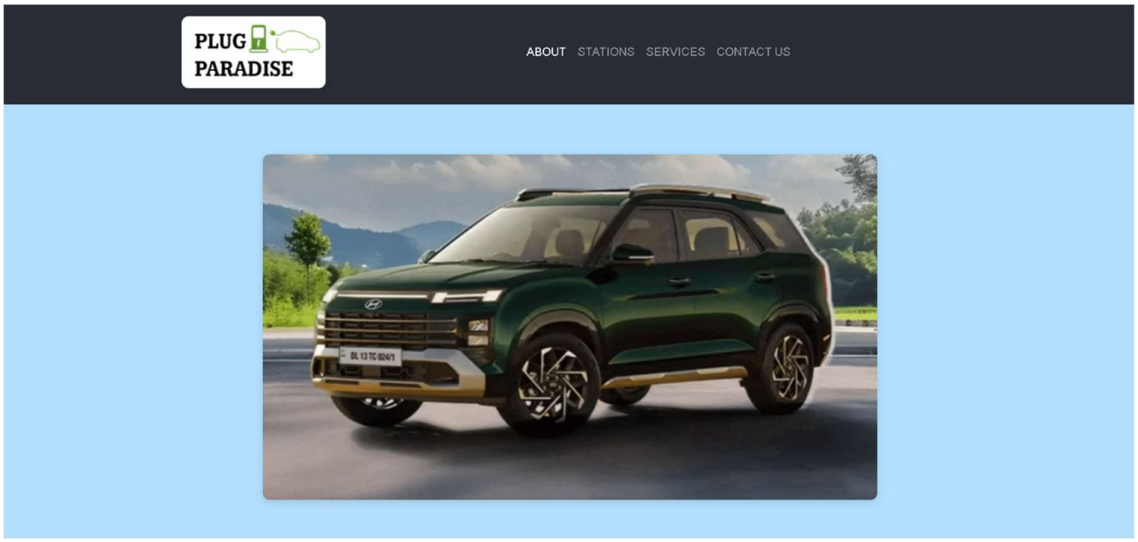

Fig2.Home Page of Plug Paradise

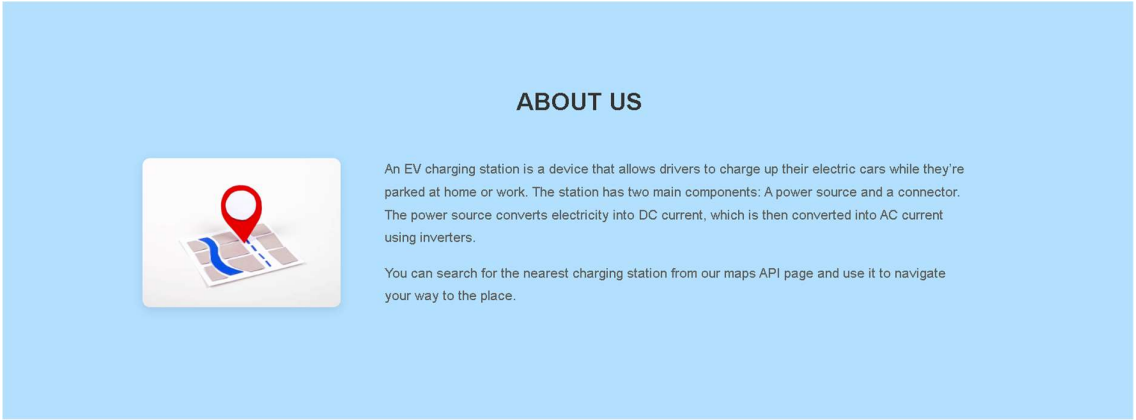

Fig3: About Us Page

Fig4: Our Stations Page

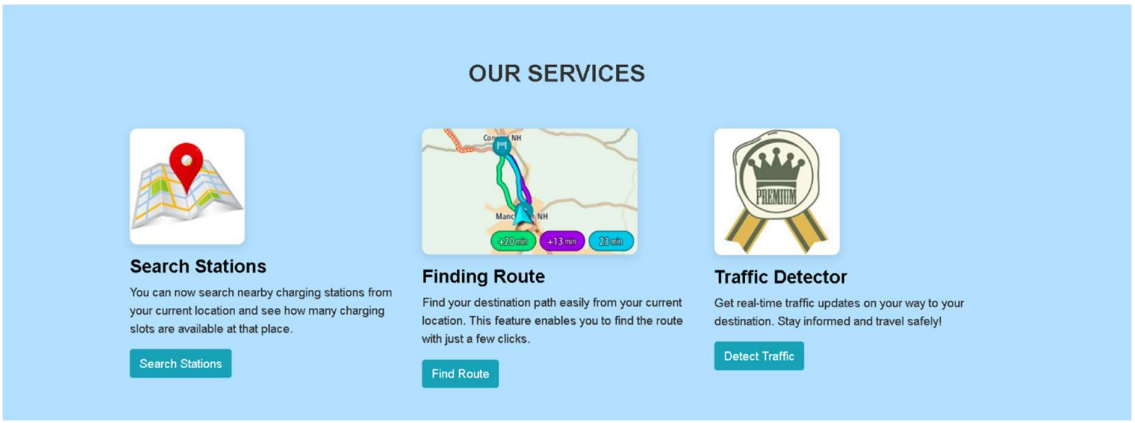

Fig5: Our Services Page

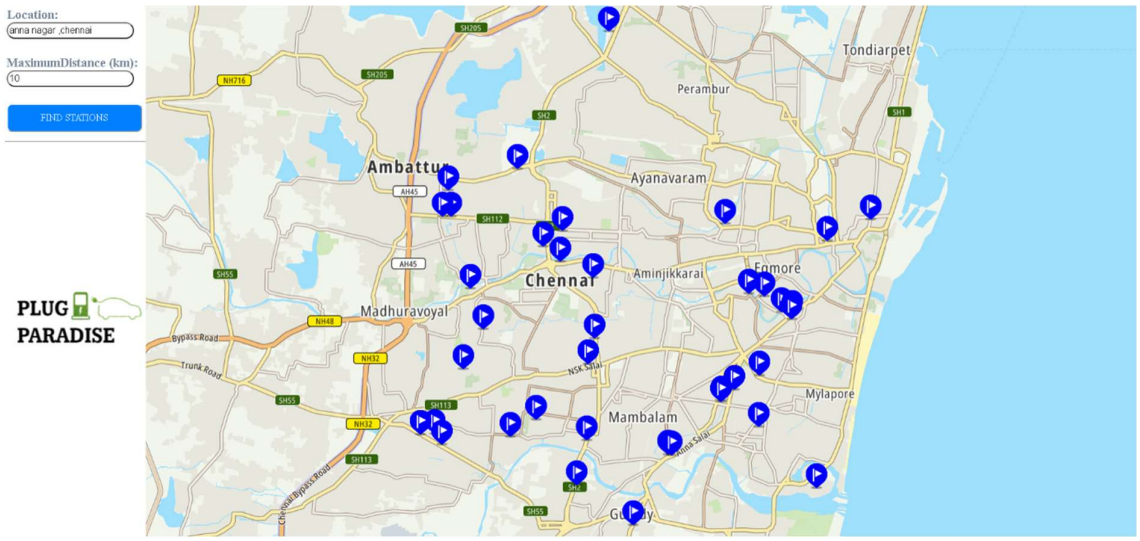

Fig6: Finding Stations Page

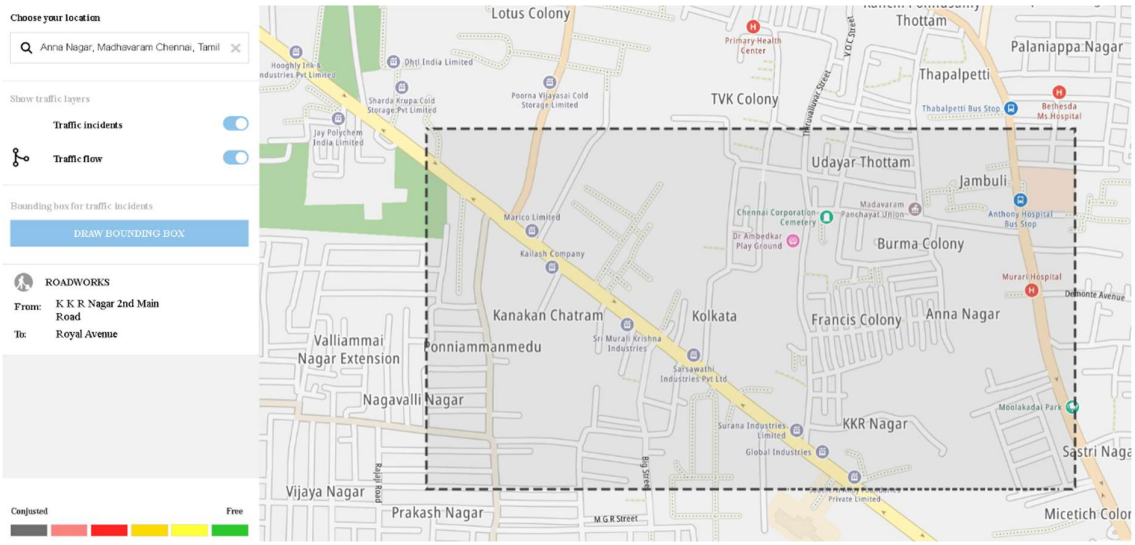

Fig7: Traffic Detection Page

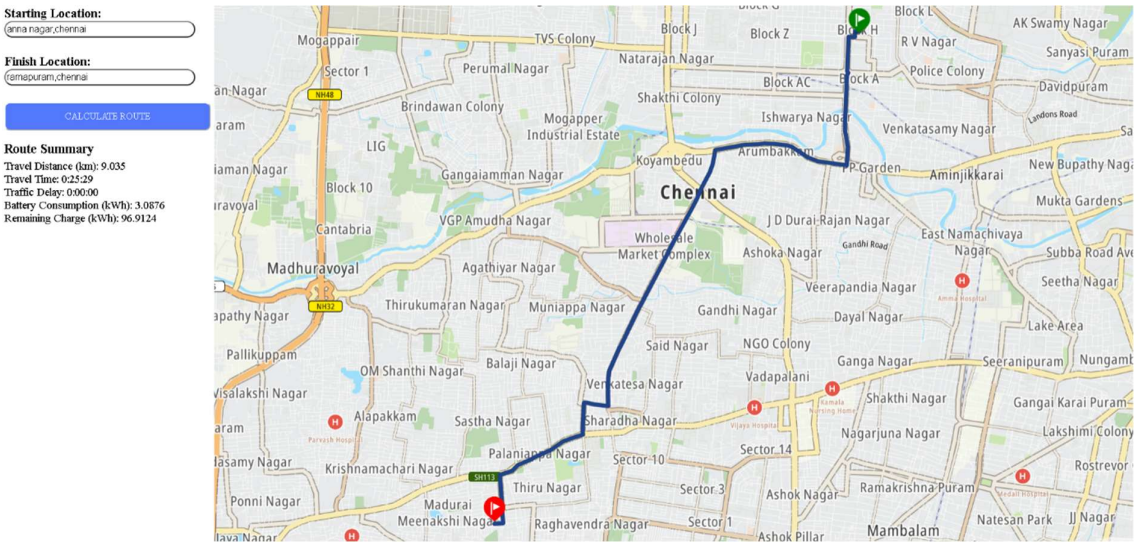

Fig8: Finding Route page

CHAPTER 7

CONCLUSION

The EV Charging Station Locator Website serves as a critical component in facilitating electric vehicle adoption, a growing sector in sustainable transportation. Despite its pivotal role, the website's current design and technological underpinnings present several limitations that hinder user experience, performance, and overall satisfaction.

The proposed redesign of the EV Charging Station Locator Website encompasses a broad spectrum of improvements, from enhancing user interface and experience, bolstering security measures, to integrating advanced data analytics for personalized services. These changes aim to transform the website into a more intuitive, secure, and efficient tool, thus significantly elevating the user journey from searching for charging stations to completing their charging sessions.

Moreover, the redesign would enable service providers to maintain their competitive edge in a market increasingly influenced by technological innovations and rising user standards. In an era where digital interactions are becoming the norm, the ability of the EV Charging Station Locator Website to provide a seamless, reliable, and enjoyable experience is crucial.

In conclusion, the redesign of the EV Charging Station Locator Website represents a strategic step forward for the electric vehicle infrastructure sector. It addresses current shortcomings while paving the way for future enhancements that could adapt to technological advancements and changing user behaviors. By committing to this redesign, service providers would ensure that the website continues to serve as an indispensable tool for EV users, promoting a more connected and accessible charging network.

REFERENCE

1. Cooper, A., Reimann, R., Cronin, D., & Noessel, C. (2014). About Face: The Essentials of Interaction Design. Wiley. https://www.wiley.com/enus/About+Face%3A+The+Essentials+of+Interaction+Design%2C+4th+Edition-p-9781118766576
2. Goodman, E., Kuniavsky, M., & Moed, A. (2012). Observing the User Experience: A Practitioner's Guide to User Research. Morgan Kaufmann.
3. Schaffer, E. (2004). Institutionalization of Usability: A Step-by-Step Guide. Addison-Wesley Professional.
4. Norman, D. A. (2013). The Design of Everyday Things: Revised and Expanded Edition. Basic Books. https://www.amazon.com/Design-Everyday-Things-Revised-Expanded/dp/0465050654
5. Krug, S. (2014). Don't Make Me Think, Revisited: A Common-Sense Approach to Web Usability. New Riders. https://www.amazon.com/Dont-Make-Think-Revisited-Usability/dp/0321965515