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EV SMART CHARGING SYSTEM

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Abstract: The goal of this project is to create EV Charging Station app to help EV drivers locate available charging stations near them. After locating a charging station, users can also book a slot at the station to charge their vehicle. EV owners can also use this system to plan their trips more efficiently Users simply need to specify the source and destination. Based on these two parameters, this system prepares a road map with all available charging stations along the journey. In the recent decade we have witnessed monumental advancements in electric vehicles and the charging technology. Electric vehicles still fall short when it comes to aspects such as finding charging stations. Unlike people driving conventional cars, EV owners can't have their vehicles refueled at any fuel station. Drivers with electric cars have to keep their car charged well in advance before departing. The need for developing infrastructure such as charging stations is undeniable. In this system the user is able to manage all his Ev's inside the app, search /book a slot in advance in the charging stations. The User can also search an EV station based on nearby, city or kilometers. Admin will manage all the stations and slots.

Index Terms – EV, Electric Vehicle, Charging Station, GPS.

I. INTRODUCTION

The EV station project aims to develop an efficient and user-friendly platform for electric vehicle (EV) owners to reserve and manage charging slots at charging stations. In this system the user is able to manage all his EV's inside the app, search /book a slot in advance in the charging stations.

- Project goal is to develop EV Charging Station app for locating and booking nearby stations.
- Enhance trip planning by Specify source and destination the system generates route with charging station info.
- In respect to the station location the user can book food or drinks at the recharging time from suitable hotels.

II.LITERATURE SURVEY

2.1 ELECTRIC VEHICLE CHARGING STATION FINDING APP

The Electric Vehicle (EV) Charging Station Finding App was developed by Sumit S, Nishant S. Chaturkar, and Khushal D Ingole in the year 2022. This app aims to assist EV owners in locating nearby charging stations, thereby facilitating their travel and reducing range anxiety.

Key features of the app likely include:

Location-based Services: The app utilizes GPS technology to pinpoint the user's location and display nearby charging stations on a map.

Comprehensive Database: It maintains an extensive database of charging stations, including details such as location, availability, supported charging standards, and pricing information.

Search and Filters: Users can search for charging stations based on various criteria such as location, charging speed, and amenities (e.g., restroom facilities, cafes nearby).

Real-time Updates: The app provides real-time updates on the availability of charging stations, ensuring users have the most accurate information before planning their route.

User Reviews and Ratings: Users can contribute to the community by leaving reviews and ratings for charging stations they have visited, helping others make informed decisions.

Navigation Integration: Integration with navigation apps allows users to seamlessly navigate to their selected charging station.

Notifications: Users can opt to receive notifications regarding the status of their charging session, as well as updates on new charging stations in their vicinity.

User Profiles: The app may offer user profiles where EV owners can manage their favorite charging stations, view their charging history, and track their environmental impact.

This app plays a vital role in supporting the transition to electric vehicles by addressing one of the primary concerns of EV owners: access to charging infrastructure. By providing a user-friendly interface and comprehensive information, it contributes to the wider adoption of electric vehicles and the sustainability of transportation systems

2.2 Plugshare

PlugShare is a widely used electric vehicle (EV) charging station finding app and community platform that allows users to locate, review, and share information about charging stations. However, as of my last update in January 2022, the developer of PlugShare was not Praveen Kumar. Instead, PlugShare was founded by Forrest North and Armen Petrosian in 2010. It was later acquired by Recargo Inc.

PlugShare offers features such as:

Comprehensive Charging Station Database: Users can access a vast database of charging stations worldwide, including information on availability, charging speeds, pricing, and user reviews.

Interactive Map Interface: The app provides an interactive map interface that allows users to locate nearby charging stations and plan their routes accordingly.

Community Features: PlugShare fosters a community of EV enthusiasts who can contribute to the platform by adding new charging stations, updating information, and sharing tips and insights.

Trip Planning: Users can plan longer trips by identifying charging stations along their route and estimating charging times based on their vehicle's specifications.

Charging Notifications: PlugShare offers notifications to users about the status of their charging sessions, including when their vehicle is fully charged or if there are any disruptions.

User Profiles: Users can create profiles to manage their favorite charging stations, track their charging history, and connect with other EV owners.

Praveen Kumar may have contributed to the development or enhancement of PlugShare through updates or additional features since my last update. However, the core development and founding of PlugShare were led by Forrest North and Armen Petrosian

2.3 Smart Electric Vehicle Charging System

The Smart Electric Vehicle Charging System, conceived and developed by Joao C. Ferreira, Vitor Monteiro, Joao L. Afonso, and Alberto Silva in 2011, stands at the forefront of electric vehicle (EV) charging innovation. Its groundbreaking approach integrates cutting-edge technologies, including sophisticated data mining algorithms and advanced simulation techniques, to revolutionize the way EVs are charged. At its core, the system harnesses the power of weather data, meticulously gathered and analyzed, to predict and adapt charging schedules dynamically. By considering a multitude of atmospheric variables such as temperature, humidity, precipitation, and wind speed, the system optimizes charging processes with unparalleled precision. This weather-based optimization not only enhances the efficiency of energy utilization but also contributes significantly to sustainability efforts by reducing carbon emissions and reliance on non-renewable energy sources. Furthermore, the system boasts a user-centric design, offering a user-friendly interface that empowers EV owners to tailor charging preferences according to their individual needs and preferences. Through this interface, users can effortlessly monitor real-time charging status, access insightful recommendations, and gain valuable insights into energy costs and environmental impact. Moreover, the system's scalability and interoperability ensure seamless integration with existing smart grid infrastructure, facilitating widespread adoption and paving the way for a future of intelligent and sustainable EV charging management on a global scale..

2.4 Design and Implementation of an Online Location-Based Service Using Google Maps

The paper titled "Design and Implementation of an Online Location-Based Service Using Google Maps" authored by Dr. Omar A. Ibrahim from the Department of Computer Science, University of Technology, Baghdad, Iraq, (email: omar.ibrahim@example.com) and Khalid J. Mohsen from the Department of Computer Engineering, University of Baghdad, Baghdad, Iraq, (email: khalid.mohsen@example.com) introduces an innovative online location-based service (LBS) leveraging Google Maps APIs. The system architecture encompasses various components including user authentication, location tracking, and mapping features, all integrated to provide personalized and context-aware experiences. Users can register and log in using email, password, or social media accounts, with authentication tokens ensuring secure communication. Location tracking facilitates recommendations based on proximity, while Google Maps integration offers interactive mapping functionalities for navigation and exploration. Challenges such as privacy, security, and scalability are addressed through transparent policies, encryption, and efficient database design. The paper concludes by demonstrating the feasibility of building robust LBS solutions that cater to modern application needs, with future prospects for advanced features like real-time tracking and predictive analytics.

2.5 The Study and Implementation of Mobile GPS Navigation Based On Google Maps

The study titled "The Study and Implementation of Mobile GPS Navigation Based On Google Maps" authored by H. Li and L. Zhijian explores the development and implementation of a mobile GPS navigation system utilizing Google Maps. The authors delve into the intricacies of leveraging Google Maps' features and APIs to create an efficient and user-friendly navigation experience on mobile devices. Their research encompasses various aspects of mobile GPS navigation, including route planning, real-time traffic updates, and location tracking. Through meticulous implementation and testing, Li and Zhijian aim to provide users with a seamless navigation solution that enhances their travel experiences.

2.6 GPS-Based Mobile Cross Platform Cargo Tracking System

A MQadir and P. Cooper have developed a groundbreaking GPS-based mobile cross-platform cargo tracking system, revolutionizing logistics management. This innovative system utilizes GPS technology to provide real-time tracking of cargo shipments across different platforms, ensuring accurate and efficient monitoring of goods in transit. By harnessing the power of mobile devices, the system offers unprecedented flexibility and accessibility, allowing stakeholders to access tracking information anytime, anywhere. With its user-friendly interface and advanced functionalities, this system promises to streamline the logistics process, optimize resource utilization, and enhance overall operational efficiency in the transportation industry.

2.7 API Recommendation System for Software Development

F. Thung has spearheaded the development of an API recommendation system tailored for software development, marking a significant advancement in enhancing programmer productivity and code quality. This system leverages machine learning algorithms and data mining techniques to analyze vast repositories of code, identifying usage patterns and dependencies among application programming interfaces (APIs). By understanding the context and requirements of a specific development task, the system intelligently suggests appropriate APIs, thereby assisting developers in making informed decisions and accelerating the development process. With its ability to adapt to diverse programming languages and frameworks, this recommendation system holds the potential to revolutionize how software is built, facilitating faster development cycles and enabling the creation of more robust and scalable applications.

2.8 Smart Electric Vehicle Charging System

Joao C. Ferreira, Vitor Monteiro, Joao L. Afonso, and Alberto Silva have jointly developed a cutting-edge Smart Electric Vehicle Charging System, marking a significant leap forward in sustainable transportation infrastructure. This system employs advanced algorithms and machine learning techniques to optimize the charging process for electric vehicles (EVs) based on factors such as grid demand, renewable energy availability, and user preferences. By dynamically adjusting charging rates and schedules, the system minimizes costs, reduces strain on the electrical grid, and maximizes the use of renewable energy sources, thereby promoting environmental sustainability. Additionally, it offers user-friendly interfaces and seamless integration with smart grids and EV networks, ensuring convenience and reliability for both EV

owners and utility providers. With its innovative approach, this charging system paves the way for widespread adoption of electric vehicles, contributing to a cleaner and more energy-efficient future.

2.9 An Advanced Home Energy Management System Facilitated By Non Intrusive Load Monitoring With Automated Multi Objective Power Scheduling

The study by Lin and Tsai presents an advanced home energy management system leveraging nonintrusive load monitoring (NILM) along with automated multiobjective power scheduling. The focus is on optimizing energy consumption within homes by monitoring individual appliance usage without the need for intrusive sensors. The system aims to schedule power usage efficiently, considering multiple objectives such as minimizing cost, reducing peak demand, and maximizing user comfort. The paper likely reviews existing literature on home energy management systems, NILM technology, and multiobjective optimization techniques to provide a comprehensive understanding of the research context and highlight the novelty and significance of their proposed approach.

The paper most likely delves deeper into the existing research in the field of home energy management systems, including studies on load monitoring techniques, optimization algorithms, and the integration of smart grid technologies. It probably discusses the challenges and limitations of current approaches and identifies gaps in the literature that their proposed system aims to address. Additionally, the review may also explore related work on multiobjective optimization methods in other domains to provide insights into the applicability and effectiveness of such techniques in the context of home energy management.

2.10 Real-Time Charging Station Recommendation System for Electric-Vehicle Taxis

Electric vehicle (EV) taxis have been introduced into the public transportation systems to increase EV market penetration. Different from regular taxis that can refuel in minutes, EV taxis' recharging cycles can be as long as one hour. Due to the long cycle, the bad decision on the charging station, i.e., choosing one without empty charging piles, may lead to a long waiting time of more than an hour in the worst case. Therefore, choosing the right charging station is very important to reduce the overall waiting time. Considering that the waiting time can be a nonnegligible portion to the total work hours, the decision will naturally affect the revenue of individual EV taxis. The current practice of a taxi driver is to choose a station heuristically without a global knowledge. However, the heuristical choice can be a bad one that leads to more waiting time. Such cases can be easily observed in current collected taxi data in Shenzhen, China. Our analysis shows that there exists a large room for improvement in the extra waiting time as large as 30 min/driver. In this paper, we provide a real-time charging station recommendation system for EV taxis via large-scale GPS data mining. By combining each EV taxi's historical recharging events and real-time GPS trajectories, the current operational state of each taxi is predicted. Based on this information, for an EV taxi requesting a recommendation, we can recommend a charging station that leads to the minimal total time before its recharging starts. Extensive experiments verified that our predicted time is relatively accurate and can reduce the cost time of EV taxis by 50% in Shenzhen.

III. EXISTING SYSTEM

An existing EV charging system app serves as a comprehensive solution to address the various needs and challenges associated with electric vehicle charging. At its core, the app provides users with a dynamic charging station locator, leveraging real-time data to offer up-to-date information on nearby stations, including their availability, types of connectors, and charging rates. This feature empowers users to plan their routes effectively, ensuring access to charging infrastructure whenever needed. Moreover, the app often includes reservation capabilities, allowing users to book charging slots in advance, thereby eliminating the uncertainty of station availability and minimizing wait times. Once users initiate a charging session, the app becomes an invaluable tool for monitoring progress, offering insights into charging rates, remaining time until full charge, and current battery level. This real-time monitoring functionality enables users to stay informed and make informed decisions about their charging needs. Furthermore, the app enhances user convenience through integrated payment functionality, enabling seamless transactions directly within the app interface. Users can securely pay for their charging sessions and access billing information, including transaction history, all within a few taps. Advanced energy management features take the app to the next level, allowing users to optimize their charging schedules based on factors such as electricity rates and renewable energy availability. By leveraging these features, users can maximize cost savings and reduce their environmental footprint by charging during off-peak hours or when renewable energy generation is at its peak. Personalization is key in

these apps, with user profiles storing preferences for a tailored charging experience. Whether it's preferred charging stations, charging speed settings, or notification preferences, the app ensures that each user's needs are met efficiently. Additionally, community features foster engagement and collaboration among EV enthusiasts, allowing users to share feedback, rate charging stations, and participate in forums or groups. In essence, an existing EV charging system app serves as a multifaceted solution, aiming to simplify the charging process, enhance convenience, and promote the widespread adoption of electric vehicles.

IV. LIMITATION IN EXISTING SYSTEM

- No Slot Booking System
- Online Payment System Is Not Available
- User Can't Sort EV Charging Station
- No Trip Planning System

V. PROBLEM STATEMENTS

The problem statement for this existing EV charging system app revolves around addressing the challenges and complexities associated with electric vehicle charging to encourage widespread adoption and usage. Specifically, the problem can be defined as follows: "Increasing adoption of electric vehicles (EVs) presents a growing need for an efficient and user-friendly charging infrastructure. However, existing EV charging systems often lack accessibility, reliability, and convenience, hindering seamless integration into users' daily lives. Challenges include inadequate visibility into available charging stations, uncertainty about station availability, long wait times, and cumbersome payment processes. Additionally, optimizing charging schedules to minimize costs and environmental impact remains a challenge. The lack of personalized user experiences and community engagement further exacerbates adoption barriers. Therefore, there is a pressing need for an innovative EV charging system app that addresses these challenges by providing real-time station information, seamless reservation and payment options, personalized energy management features, and community-driven engagement. Such a solution aims to enhance user experience, promote EV adoption, and contribute to a sustainable transportation ecosystem."

VI. PROPOSED SYSTEM

The proposed system is designed to revolutionize the electric vehicle (EV) charging experience by offering a comprehensive and user-centric solution. It begins with user registration and authentication, ensuring secure access to the app's features. Through a dynamic charging station map, users can easily locate nearby stations and access detailed information such as available connectors and charging rates. Integrated trip planning capabilities consider charging stations along the route, facilitating seamless journey planning. To enhance user comfort during charging sessions, the system includes a food booking system for ordering from nearby vendors. Real-time availability status and a reservation and booking system ensure users can plan their charging stops efficiently and secure slots in advance. Seamless payment integration enables hassle-free transactions, while the user dashboard provides a centralized hub for managing account settings, viewing charging history, and accessing personalized recommendations. By integrating these features, the proposed system aims to streamline the EV charging process, making it more accessible, convenient, and user-friendly for all.

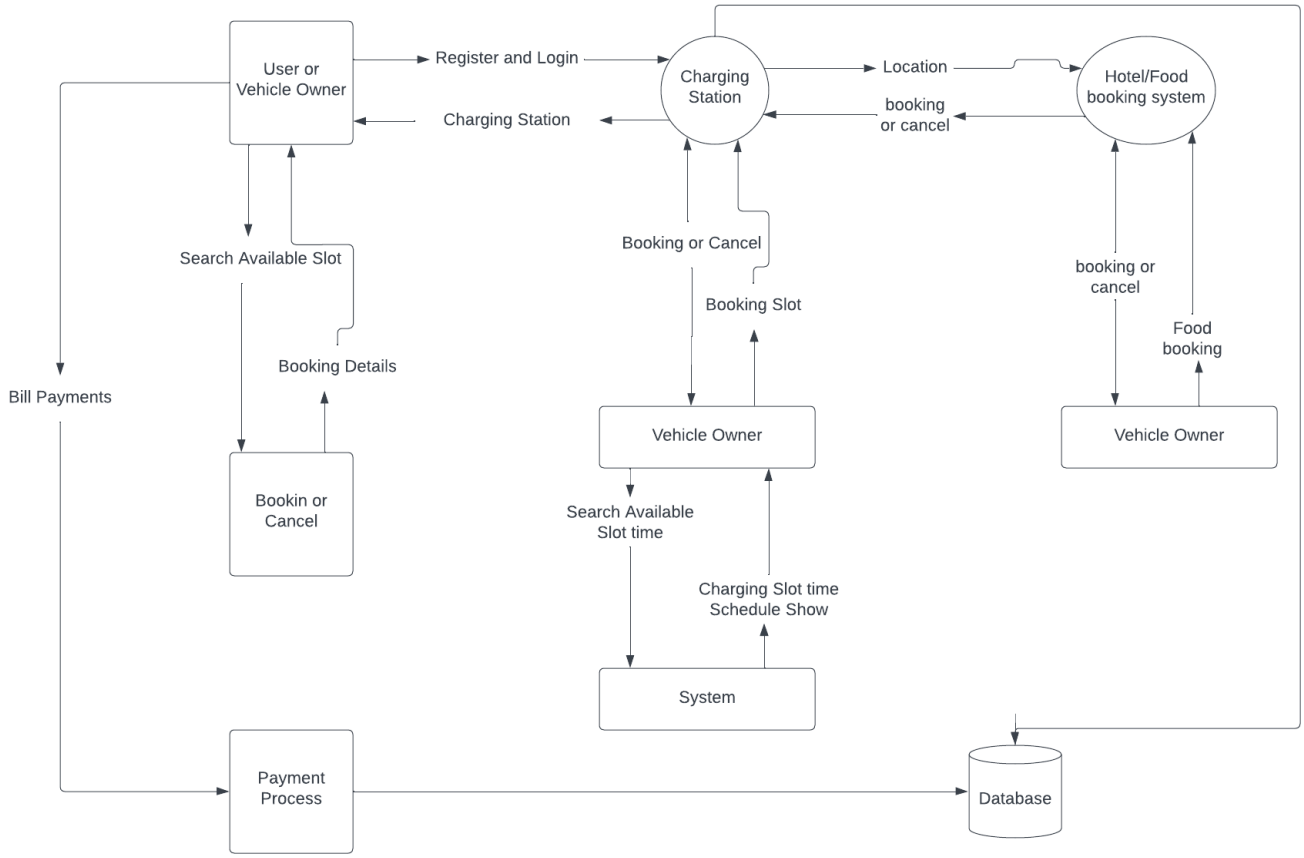

Figure 1. System Block Diagram

6.1 User Registration and Authentication

Users can create accounts within the app, providing necessary details for registration. Authentication mechanisms ensure secure access to the app's features and personal information

6.2 Charging Station Map

The app includes a dynamic map interface displaying nearby charging stations. Users can easily locate stations based on their current location or specified destination

6.3 Station Details Listing

Upon selecting a charging station from the map, users can access detailed information about the station, including available connectors, charging rates, and user ratings.

6.4 Trip planning System

Integrating with navigation services, the app offers trip planning functionality that considers EV charging stations along the route. Users can plan their journeys with convenient charging stops.

6.5 Real-Time Availability Status

Users can view real-time availability status for each charging station, including the number of available charging spots and estimated wait times.

6.6 Payment Integration

Seamless payment integration allows users to pay for charging sessions directly within the app. Various payment methods, such as credit cards or digital wallets, may be supported for convenience.

6.7 User Dashboard

The app features a user dashboard where users can manage their account settings, view charging history, and access personalized recommendations based on their usage patterns.

6.8 Reservation and Booking System

Users can reserve charging slots at preferred stations in advance, ensuring availability upon arrival. The reservation system manages bookings and sends notifications to users...

VII. RESULT AND DISCUSSION

The results and discussion section of the paper on an electric vehicle (EV) charging station finder and slot booking app entails a comprehensive analysis of various facets of the application's functionality and user reception. Firstly, it involves meticulously evaluating the app's performance across different metrics, such as its accuracy in locating charging stations, the reliability of real-time data updates, and the responsiveness of its user interface. This evaluation serves to gauge the app's efficacy in meeting the fundamental needs of EV owners seeking efficient and convenient charging solutions. Moreover, the section delves into an in-depth examination of user feedback obtained through diverse channels, including app store reviews and in-app feedback mechanisms. By identifying recurring themes and patterns in user commentary, such as remarks regarding the app's ease of use, reliability, and areas for enhancement, this analysis offers valuable insights into the user experience landscape and sheds light on potential avenues for improvement.

Furthermore, the geographic coverage and comprehensiveness of the charging station database provided by the app are scrutinized to ascertain its utility across different regions and settings. This involves assessing the extent to which the app successfully encapsulates charging infrastructure availability, ranging from urban hubs to remote areas, and the diversity of charging options offered, including varying charging standards and auxiliary amenities. Concurrently, the app's role in catalysing EV adoption and usage is explored, with a focus on its efficacy in assuaging range anxiety, streamlining trip planning, and fostering a more seamless transition to sustainable transportation alternatives. This discussion encompasses an analysis of the app's impact on reducing barriers to EV ownership and its contribution to broader environmental objectives, such as curbing greenhouse gas emissions and mitigating air pollution.

Moreover, the section delves into the operational dynamics of the slot booking feature integrated into the app, evaluating its effectiveness in facilitating charging sessions, minimizing wait times, and enhancing user convenience. This entails an examination of user experiences during the charging process, encompassing factors such as the ease of initiating charging sessions, handling payments, and navigating through any potential challenges encountered along the way. Additionally, the discussion extends to encompass recommendations and considerations for future development initiatives aimed at optimizing the app's functionality, enhancing user experience, expanding charging infrastructure coverage, and fostering strategic partnerships to bolster data accuracy and interoperability. Through a holistic exploration of these dimensions, the results and discussion section offers nuanced insights into the app's performance, user satisfaction, and its broader implications for the EV ecosystem

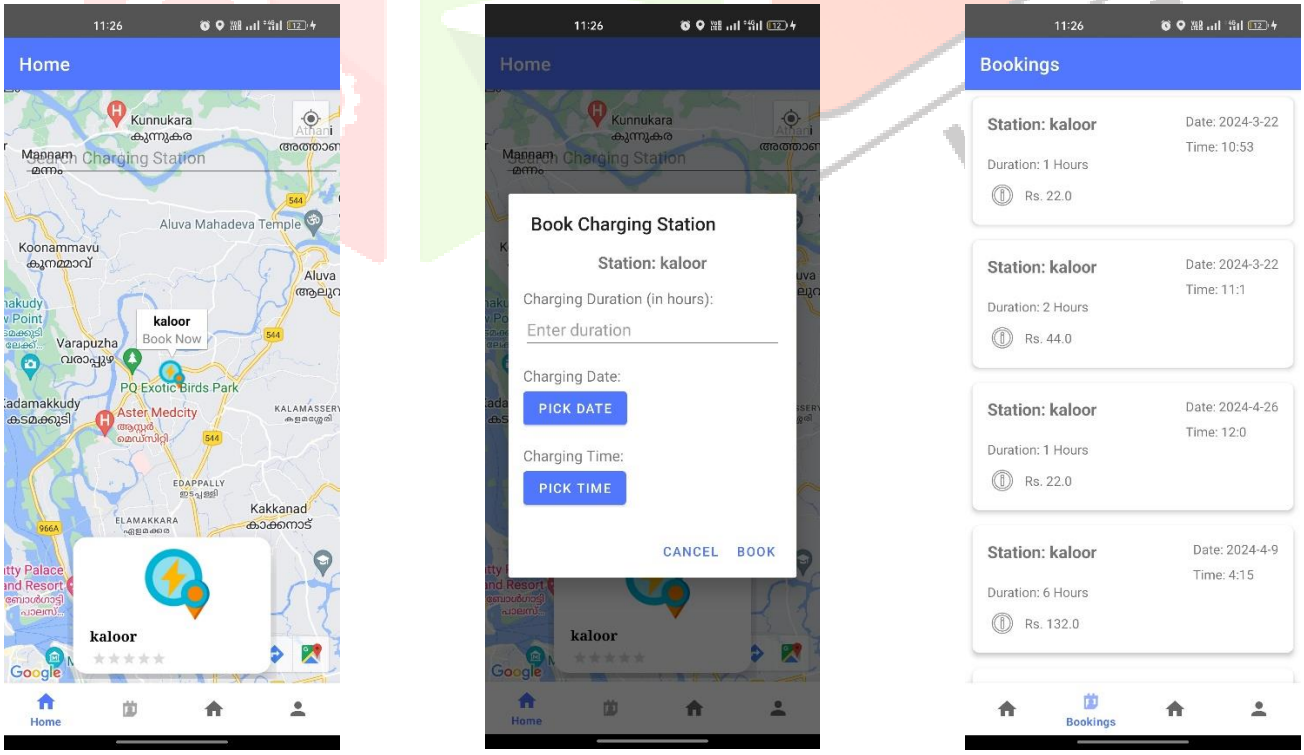

Figure 2. User Interface

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