Real-Time Android Based Electric Charging Station And Slot Booking.

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ABSTRACT

In the past decade, electric vehicle [EV] technology has made remarkable progress, offering enhanced power delivery and improved efficiency through innovations like regenerative braking. However, EV users still face challenges when it comes to finding charging stations, which are not as ubiquitous as traditional fueling stations. To address this need, we introduce an EV Charging Station app developed with Flutter. This app empowers EV drivers to locate nearby charging stations, reserve slots for charging, and efficiently plan their journeys by generating a roadmap with charging station waypoints based on the source and destination. This solution bridges a critical gap in the EV infrastructure, enhancing the convenience and accessibility of electric mobility

Keywords

Electric Vehicle, Mobile Application, Feedback, Vehicle Identification Number.

1. INTRODUCTION

One of the most significant challenges associated with electric vehicles [EVs] revolves around the charging process. The primary objective is to provide users with real-time information regarding the availability of charging slots at specific charging stations. Currently, many EV drivers are unaware of how many charging stations are along their journey route. As a result, they may find themselves in a situation where they have a low battery percentage and cannot reach their destination. This forces them to seek a charging station and inquire about slot availability. However, if drivers had prior knowledge of the charging station locations along their route, they could plan their journey more efficiently. In our project, we aim to address this issue by developing a system that

fulfills the need for real-time information about charging station availability. This system will significantly reduce the inconvenience experienced by EV users and save them valuable time. When a user plans a journey and knows in advance that there are charging stations available along the route, they can confidently travel and choose a charging station with available slots. This prevents situations where users arrive at a station only to find that there are no slots available, avoiding the need to backtrack to another station Moreover, our system goes beyond just indicating slot availability. It also provides users with information about the estimated time left for charging if a vehicle is already connected to a particular charging slot. This additional feature enhances convenience and planning for EV

2. Methodology

As we know from the past few years EV vehicle industry is booming so we have conceived the idea of creating an Electric Vehicle Charging Station Finder App that promises a seamless and user-friendly experience with its innovative features. This application, built using the Flutter framework, has been developed to assist EV drivers in locating nearby charging stations easily. It goes beyond mere location services by enabling users to manage all their electric vehicles within the app and even reserve charging slots in advance at the stations they choose. The primary aim of this EV Charging Station App is to empower users to find and secure available charging stations effortlessly. By providing features like vehicle management and booking options, it simplifies the EV charging

process, making it more convenient and efficient for electric vehicle owners.

3. Background

3.1 Flutter

Google created flutter as an open source and cross-platform UI development kit. It is used to build, test and deploy mobile, web, desktop and embedded apps from a single codebase. It uses a hot reload feature which allows the programmer to see all the changes applied almost instantly without losing the current application state. It is built directly into the Machine code so that it can eliminate any performance bugs of the interpretation process. Dart is the language used to write Flutter apps, utilizing the advanced features of other programming languages and it is designed to be used for the development of web and mobile apps for the clients. This language has a C style syntax and is object-oriented.

3.2 Google Maps API

This API (Application Program Interface) provided by Google, helps integrate Google Maps, which is a real-time mapping service providing satellite imagery, location information, street maps etc., into our mobile application. It has the provision of customization of the maps in accordance with the application and also reverses coding the location coordinates in latitude and longitude to a human- readable format

4. Related Work

In the paper [1] Hari Krishna S M, proposes a mobile application that allows users to pre-book a charging port at any available charging station for their electric vehicles, reducing waiting time and clustering of vehicles.The application allows users to locate EV charging stations, check the availability and working conditions of charging ports, and book time slots for charging. It also provides information on the types of chargers available and user reviews. The application utilizes technologies such as Flutter,Firebase, and Google Maps API. The goal is to provide a convenient and efficient solution for EV users and further improvements can be made based on user feedback.

In the paper [2], Mr. Arunkumar P proposed a method for an Internet of Things(IoT) based smart grid that has been developed to monitor the status of batteries in smart grid systems. The IoT which is developed here uses a cloud platform and Android Apps for communication purposes. The car user can easily check the health of his car battery and he can easily make a decision whether to take power from grid or to sell power to grid. The data stored in the Adafruit IO lasts for 30 days. For future work, handling of multiple users could be implemented so as to compare the status of different users.

In [3], Mr. Suresh Chavan described next generation communication based online EVs charging slot booking architecture. The model proposed utilizes a basic version of a GA, to manage the charge request/reply in real-time. Road Side Units serve as a communication point between the EV and the GA. Immediate Proximity Mobile Units or IPMUs are introduced as smart devices registered with the EV, typically in the form of a smartphone or smart tablet which can work parallel to or substitute for RSUs in the case when RSUs are unavailable.

In the paper [4] author stated the main purpose of the project is to develop a useful product for the EV users which will be very convenient for them.This app will not only provide service to the user, but it will also be used by the vendor (Electric station owners) as an interactive system .It can also generate more data of user which owns the electric vehicles and also the vendors which have charging station. By using this one can used to find as well as to navigate to stations.

In , [5] Er. Ashwini Deokate stated that project is created for users and vendors, with the help of this app. Vendors can make regular customer and give them good facilities with increasing the business of the vendors and it will be easier to handle the customer. Today's riders who are driving EVs. Users can save time by booking charging through this app. With the help of this app, users can stay updated with station in their area. The user can book the station by phone and charge the vehicle at the right time and user can do other works. Along with this,

the user can travel long distances by using this app. Users can enjoy EVs in a better way.

5. System Architecture

The block diagram in Fig. 5.1 gives an overview of the approach towards building a basic version of the intended features for EV charging station locator. The workflow for EV charging station locator works in following manner –

1. Client Application - The client application, also known as the mobile app, is the user-facing interface of the system. It is responsible for providing users with a seamless experience in locating charging stations, checking availability, and reserving charging slots. The client application can be developed for various mobile platforms, such as Android and iOS, and should be designed for user-friendliness and intuitive navigation.

2. Application Server - The application server acts as the central hub of the system, responsible for managing user requests, processing data, and communicating with various backend services. It handles user authentication, slot booking, payment processing, and data storage. The application server should be scalable and robust to handle a growing user base and ensure high availability.

3. Database - The database stores all the critical data related to the system, including user information, charging station details, slot availabillity, and payment records. It should be reliable and secure to protect sensitive user data and ensure data integrity.

4. Mapping Service - The mapping service provides real-time location data and mapping functionalities to enable users to locate nearby charging stations. It should be integrated with the client application to display charging stations on a map and provide route planning capabilities.

5. Payment Gateway – The payment gateway facilitates secure online transactions for slot bookings and charging sessions. It integrates with the application server to handle payment processing and ensure the protection of financial information.

6. Charging Station Management System - The charging station management system is a separate system maintained by charging station operators. It provides real-time charging slot availability data to the application server via an API integration. This enables the application server to display accurate availability information to users.

7. Communication Infrastructure - The system relies on reliable communication infrastructure to facilitate data exchange between the various components. This includes secure network protocols, firewalls, and load balancers to ensure efficient and secure data transfer.
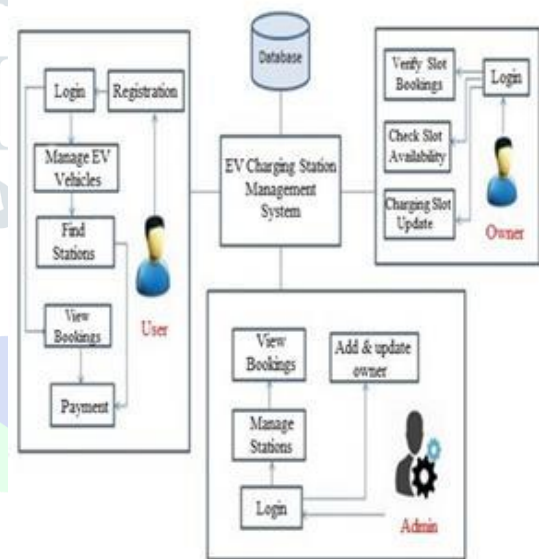

Fig 5.1 System Architecture

6. RESULTS AND TESTING

The results of the application developed are shown in this section. This section also shows the screenshots of the different pages with the justification.. After creating their profile user logs in to his/her account by providing their email and password as shown in figure 1. Application will allow the user
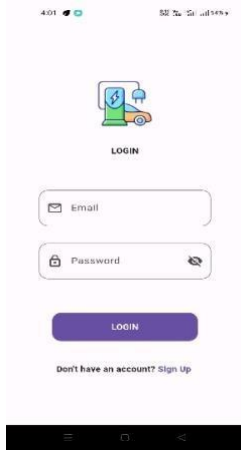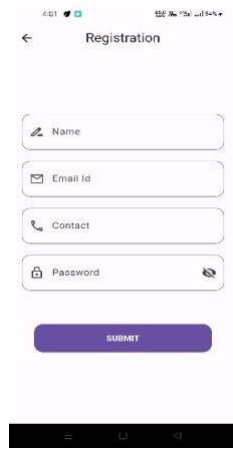
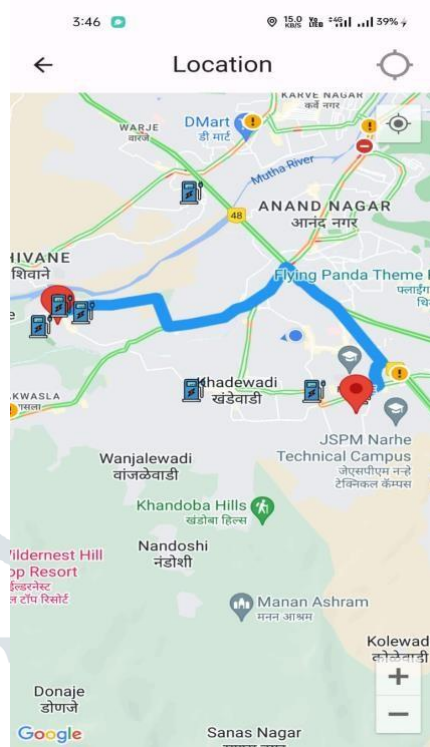Fig 6.1 Registration Page   Fig 6.2 Login Page

Fig 6.3 Slot Booking   Fig 6.4 Station Information

Fig 6.5 Booked Slot Receipt
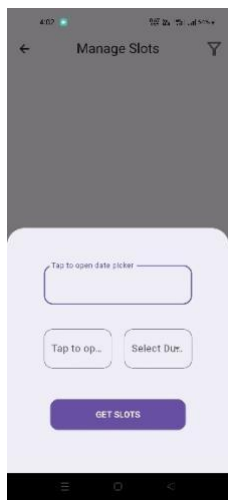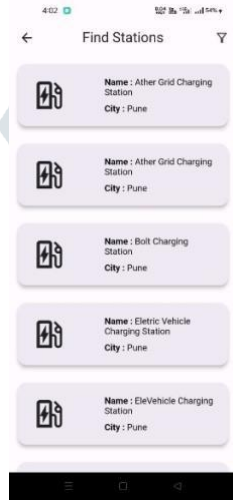

Fig 6.5 Roadmap to station

to create a new password if he/she forgot their old password. All the users have their own profile page with a unique ID where they can update their personal information and can also view their current and previous slot booking details. User can search the required stations as per their need as shown in figure 4. There will be a description page for each charging station with the working condition (based on user feedback), availability .The slot booking page allows the user to view the slots available and choose from it and after confirming the slot chosen the user can pay for the booked slot . After the successful payment the user can review the booking details.
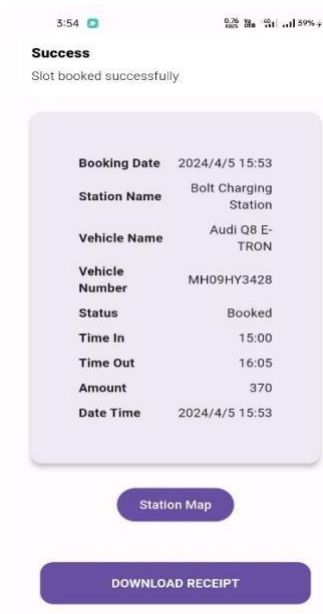
7. Conclusion

our project endeavors to tackle the pressing challenge of electric vehicle (EV) charging station availability. The lack of real-time information on charging slot availability has been a major inconvenience for EV users, leading to unforeseen delays and disruptions. Our system aims to empower EV drivers by providing comprehensive information about charging stations along their route, enabling them to plan their journeys more efficiently and

confidently. Our primary goal is to eliminate the uncertainty associated with charging station accessibility. By offering users real-time insights into charging slot availability, we seek to enable informed decision-making, preventing situations where users arrive at a station only to find all slots occupied. This not only saves time but also contributes to a smoother and more reliable electric vehicle infrastructure.

6. ACKNOWLEDGMENTS

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