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Web Based EV Charging Station Finder and Slot Booking Flutter

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ABSTRACT: In the face of depleting fossil fuel resources, global attention has shifted towards sustainable and efficient green energy solutions. The rapid advancement of Electric Vehicle (EV) technology, coupled with decreasing component costs, is contributing to the increasing popularity of EVs as a more environmentally friendly alternative to conventional vehicles. This study introduces a novel approach where the State of Charge (SoC) of EV batteries is continuously displayed, and the nearest charging stations are readily accessible on the vehicle's screen. The proposed system takes a step further by guiding the EV driver to a slot booking website from a curated list of nearby charging stations, streamlining the process of reserving a charging slot. As the commercial viability of EVs continues to rise, the demand for an effective slot booking system becomes imperative to alleviate the time-consuming nature of the charging process and accommodate the growing need for more charging stations. The presented model for the booking system aims to not only enhance efficiency but also establish a cost-effective solution, addressing the evolving requirements of the expanding electric vehicle ecosystem.

KEYWORDS: SoC, EV Station, Slot Booking

I.INTRODUCTION

New industries are emerging, like Electric Vehicles (EVs). In India, Electric vehicles Sales are increasing. As mentioned in a below chartAs of now electric charging stations are limited in India and people cannot find the right charging station which will save them time and money. The problem is not only finding the charging station but also charging it quickly because of the time required to charge the EVs. This leads to the inconvenience of EV users as requires a lot of time, so slot booking is required to charge EVs. As the electric vehicle industry is growing in India and fewer charging stations are available in India and new registrations of the charging station are growing so there is no availability of this growing charging station on virtual Maps.



This leads to the inconvenience of the user in finding a charging station virtually. An electric vehicle (EV) charging station app is a mobile application designed for EV owners to locate and manage charging station services. The app provides information about the availability and location of charging stations, their charging speeds, and costs, and helps users to navigate to the nearest charging station. It also allows users to pay for charging services directly through the app, eliminating the need for cash or card payments at the station. Additionally, the app may track the charging history of the user's vehicle, allowing them to monitor their usage and spending. The main goal of an EV charging station app is to make the charging process as convenient and efficient as possible for EV owners. An electric vehicle (EV) charging station app is a mobile application designed for EV owners to locate and manage charging station services. The app provides information about the availability and location of charging stations, their charging speeds, and costs, and helps users to navigate to the nearest charging station. It also allows users to pay for charging

services directly through the app, eliminating the need for cash or card payments at the station. In this article, we will primarily focus on the basic idea of our project which we are going to develop. To give you our project's basic idea we have organized this paper into chapters; the second chapter is a literature survey which includes several documents, manuals, and analysis papers that are associated with our plan for the project, third chapter focus on the method which we will go to follow during the implementation of our project, and a fourth chapter is technology stack, which focuses on technologies we will be using during our project, fifth chapter is discussion, in which we will discuss in what manner we will be working on this project. Finally, we have to focus on future work and conclude the statement on how we are going to make this project ready for public use. In this project, we will design and develop an app that will find nearby charging stations of the user locality. The app will show all nearby electric vehicle charging stations. The user can directly navigate to these charging stations. This app will provide a facility for booking slots for charging the Electric vehicle of the users based on the type and charging

II. RELATED WORK

Abhinav Kumar, The deployment of renewable energy sources and the proliferation of electric vehicles are crucial steps towards reaching a more sustainable energy future. The idea behind integrating green renewable distributed generation (GRDG)-based EV charging stations into unbalanced distribution networks is to use locally generated renewable energy to power electric vehicles. The dynamics of uneven distribution networks, the erratic nature of renewable energy sources, and the fluctuating energy requirements of EV charging stations make integration an intrinsically complex process. The imbalanced nature of distribution networks, which can result in voltage fluctuations, power imbalances, and other operational concerns, is one of the main challenges in this context. Sustaining the stability and dependability of the distribution network as a whole primarily depends on the deployment of intelligent grid management algorithms. A crucial first step in creating a resilient and sustainable energy infrastructure is the integration of renewable distributed generation (DG)-based EV charging stations in imbalanced distribution networks. In this study unbalanced Modified IEEE 85 bus system considered as test system to integrate EV fast charging station as well as green renewable DG to improve the performance of distribution network parameters.

Hari Krishna S M, The growing number of Electric Vehicles (EV) in the transportation sector has brought with it challenges associated with charging of the vehicle at the charging stations, like clustering of vehicles at a particular station, leading to longer waiting hours due to low number of charging outlets available. This has led to loss in time and energy of the EV owners and a frustrating experience in locating a nearby charging station. The paper entrails a solution to tackle these issues, by proposing a mobile application to pre book or reserve a charging port ahead of time at any available charging station for charging the EV, thus ensuring effective service to the users, reducing the clustering of vehicles at the charging stations and thereby less waiting time. The proposed system provides the user with details such as the location of a charging station, number and type of chargers present at a charging station and availability of slots during a specific period. It also allows users to book an available slot with a secured payment gateway and maintains user feedback.

Sarika P. R.; Sivraj P., A workflow is proposed for the detection of unauthorized persons in an ATM. Certain assumptions, including the context of identification are made by training their features and storing the datasets. However, not every individual will be a suspect. Suspicious activity on ATMs that are located in remote areas and to reduce the risk of fraudulent transactions. such as using another person's card to withdraw money etc., Various video survey and image processing have been discussed in relation to surveillance methods. It discusses the various processes, preprocessing, classification, feature extraction and the corresponding video processing methods.

Sarika P. R.; Sivraj P. With an increase in Electric Vehicles (EV) that have unique charging requirements, finding suitable Electric Vehicle Supply Equipment (EVSE) for charging EVs is becoming a difficult and challenging task. This paper focuses on developing a cloud-based and customer-oriented EV charging station recommender, which suggests EV charging stations for users based on their location and requirements. The recommender will take the location of the vehicle and other user needs such as type of connector, accessibility, access time, parking lot, station category etc. as inputs to recommend the most convenient charging stations in increasing order of distance from the user's location and facilitate slot booking. From the charging station dataset, the Random Forest Algorithm (RFA) is applied for finding stations that are near the vehicle location; Linear Search Algorithm (LSA) for filtering stations that satisfy the user requirements; and the Haversine formula for calculating distance. Streamlit is used for developing an end-user cloud application that is deployed in Streamlit Cloud. Additional features, such as charging request scheduling, and using live locations to update the station list, can be integrated to the system in the future.

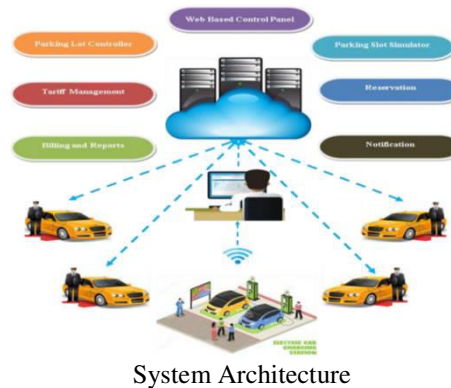
Suresh Chavhan Owing to the increased worldwide awareness regarding pollution caused by the consumption of fossil fuels, Battery-powered vehicles are bound to take over the conventional Internal Combustion Engine. Keeping the difficulties faced by the economy of the city and the populace of adapting to an entirely grid-run charging infrastructure in mind, a framework incorporating electric vehicles to everything (EV2X) communication and Charge Slot booking based on data got from a survey conducted has been developed in this literature. The conclusions drawn from the survey develop key insights into developing statisticorating the use of LTE to support the conventional OCPP and promote user controlal models that are further explored in this context. Algorithms and strategies to implement next-generation efficient EV2X communications have been implemented and developed for the city. Further, we have established a priority order for slot booking and incorp over charge-cycles. Introducing IPMUs using an LTE connection to act as a supplement to the conventional OCPP is explored in this context. Besides that, we have built the M/M/m queuing model of EVs in the charging station and its optimisation. We have done the exhaustive evaluation of the robustness of the proposed system in a fairly large-scale network in a discrete-time event simulator. The proposed system's results (simulation, analytical, and comparison) show the reduction of waiting time, good accuracy, and having of charging time and costs. These performances measures improve shows the real-time applicability of the proposed system.

III. EXISTING METHODOLOGY

Finding electric vehicle (EV) charging stations presents several challenges for both EV owners and operators. One primary issue revolves around inadequate infrastructure and accessibility. Despite the growing popularity of electric vehicles, the availability of charging stations remains limited in many regions, particularly in rural areas or less densely populated regions. This scarcity often leads to "range anxiety" among EV drivers, as they may be uncertain about finding a charging station within a reasonable distance, especially during long journeys or in unfamiliar locations. Additionally, even in areas where charging stations exist, inconsistencies in charging standards, connector types, and charging speeds pose significant hurdles for EV owners. This lack of standardization complicates the charging process and may require drivers to navigate through various charging networks, potentially leading to confusion and inconvenience.

IV. PROPOSED METHODOLOGY

Amidst the global shift towards sustainable energy solutions in the face of dwindling fossil fuel resources, the prominence of Electric Vehicles (EVs) has risen steadily, driven by technological advancements and declining component costs. Recognized as a greener alternative to traditional vehicles, EVs are gaining traction for their environmental benefits. This study proposes a pioneering approach wherein the State of Charge (SoC) of EV batteries is continuously monitored and prominently displayed on the vehicle's screen, facilitating real-time awareness of battery status for drivers. Moreover, the system integrates seamless access to nearby charging stations directly from the vehicle's interface. Going a step further, it offers guidance to a curated list of charging stations with a built-in slot booking functionality, streamlining the process of reserving charging slots. With the increasing commercial viability of EVs, there arises a pressing need for an efficient slot booking system to alleviate the time-consuming nature of charging and cater to the growing demand for charging infrastructure. The proposed model not only aims to enhance operational efficiency but also strives to establish a cost-effective solution, meeting the evolving needs of the expanding electric vehicle ecosystem while facilitating smoother transitions towards sustainable transportation alternatives.



IV. RESULT AND DISCUSSION

- **Admin Dashboard Module**

This module offers an intuitive administrative interface designed to oversee EV (Electric Vehicle) charging infrastructure efficiently. It enables administrators to handle charging stations, slots, and user bookings seamlessly. With this tool, admins can perform various tasks such as adding, editing, or deleting charging stations, managing slot availability to ensure optimal usage, accessing detailed booking information, and generating comprehensive reports for insightful analysis. Overall, it streamlines the management of EV charging facilities, enhancing operational control and user experience.

- **EV Charging Station Map Module**

The integration of mapping APIs within this module significantly enhances user experience and accessibility to EV charging infrastructure. By leveraging mapping technology, users gain access to a dynamic map interface that visualizes the geographical distribution of EV charging stations. This map interface serves as a central hub for users seeking charging solutions, offering a comprehensive overview of available stations in their vicinity. Through intuitive search functionalities, users can easily locate nearby charging stations based on their current location or desired destination.

Furthermore, the map interface provides detailed information about each charging station, empowering users to make informed decisions regarding their charging needs. Users can access essential details such as station availability, including the number of available slots and real-time status updates. Additionally, information on charging rates and supported connectors is readily available, enabling users to assess the cost and compatibility of each station.

One of the key features of this integration is the ability to obtain directions to the selected charging station directly from the map interface. By seamlessly integrating with mapping APIs, users can generate step-by-step navigation instructions tailored to their preferred mode of transportation, whether it be driving an electric vehicle or walking. This functionality streamlines the process of locating and navigating to charging stations, eliminating the need for users to switch between multiple applications or platforms.

Moreover, the mapping integration enhances the overall usability of the module by providing a visually engaging and intuitive interface. Users can interact with the map through familiar gestures such as pinch-to-zoom and drag-to-pan, facilitating effortless exploration of charging station locations. The integration also supports additional features such as filtering options, allowing users to refine their search based on specific criteria such as station type, charging speed, or amenities.

- **User Authentication Module**

The user authentication system embedded within this module serves as a cornerstone for ensuring secure access and personalized experiences for users interacting with EV charging infrastructure. Through robust authentication mechanisms, users can confidently register, login, and manage their accounts, fostering trust and reliability in the platform.

One of the primary functionalities of this authentication system is user registration, which enables individuals to create accounts tailored to their specific needs and preferences. During the registration process, users are prompted to provide essential information such as their email address, username, and password. To enhance security and prevent unauthorized access, the module incorporates email verification, requiring users to confirm their email addresses before

gaining full access to their accounts. This validation step helps mitigate the risk of fraudulent registrations and ensures that users have control over their accounts from the outset.

Upon successful registration, users can leverage the login functionality to access their accounts securely. The login process employs industry-standard encryption protocols to safeguard user credentials during transmission, minimizing the risk of interception or unauthorized access. Additionally, the system may incorporate advanced security measures such as multi-factor authentication (MFA) to further fortify account protection and thwart potential cyber threats.

In the event of forgotten passwords or account lockouts, the module offers password recovery functionality to facilitate seamless account access restoration. Users can initiate the password recovery process by providing their registered email address, triggering a secure password reset mechanism. This process may involve sending a unique verification code to the user's email or implementing additional verification steps to verify the user's identity before allowing password modification. By offering streamlined password recovery options, the module enhances user convenience while maintaining stringent security standards.

• Slot Booking Module

The booking functionality embedded within this module represents a pivotal advancement in facilitating seamless access to EV charging infrastructure for users. By enabling users to reserve charging slots at their preferred stations, the module enhances convenience, flexibility, and efficiency in managing charging needs. At the core of this functionality is the intuitive booking interface, which empowers users to select their desired EV charging station, date, and time slot for charging. Leveraging a user-friendly interface, individuals can effortlessly browse available stations based on location, charging speed, amenities, and other relevant criteria. Upon identifying a suitable station, users can proceed to select a convenient date and time slot for their charging session, aligning with their schedule and preferences.

The module seamlessly integrates with the underlying infrastructure to handle slot availability in real-time, ensuring that users have access to accurate and up-to-date information when making booking decisions. By dynamically updating slot availability based on current reservations and operational constraints, the system optimizes resource utilization and minimizes the likelihood of overbooking or scheduling conflicts.

Upon confirming their booking, users receive instant confirmation notifications, providing reassurance and peace of mind regarding their reservation. This confirmation typically includes essential details such as the booking reference number, station location, selected date and time slot, and any additional instructions or requirements. By delivering clear and concise booking confirmations, the module enhances user satisfaction and reduces ambiguity surrounding the reservation process.

In the event of unforeseen circumstances or changes in plans, the module facilitates seamless booking modifications or cancellations, allowing users to adjust their reservations as needed. Whether rescheduling to accommodate a revised itinerary or canceling due to unforeseen conflicts, users can easily manage their bookings through the intuitive interface. This flexibility not only enhances user convenience but also promotes efficient resource allocation and utilization within the charging infrastructure ecosystem.

• Payment Gateway Integration Module

The integration of payment gateways within this module plays a pivotal role in facilitating seamless and secure online transactions for EV charging slot bookings. By seamlessly connecting with trusted payment processing systems, users are provided with a convenient and reliable means to complete their bookings, enhancing accessibility and user experience.

At its core, the integration with payment gateways enables users to choose from a variety of payment methods to settle their bookings, including credit/debit cards, digital wallets, and other supported payment options. This flexibility ensures that users can utilize their preferred payment method, catering to their individual preferences and convenience. Whether users opt for the familiarity of traditional card payments or the convenience of digital wallets, the module accommodates a diverse range of preferences, fostering inclusivity and user satisfaction.

In addition to offering a variety of payment methods, the module prioritizes security to safeguard users' sensitive financial information and protect against potential threats or unauthorized access. By adhering to industry-standard encryption protocols and compliance regulations, the platform ensures that payment transactions are conducted securely and with the utmost confidentiality. Robust security measures, such as tokenization and secure authentication mechanisms, further fortify the payment process, reducing the risk of fraud and enhancing user trust.

The payment process itself is designed to be intuitive and user-friendly, guiding users through a seamless transaction flow from start to finish. Upon selecting their preferred payment method and confirming their booking details, users are seamlessly redirected to the secure payment gateway interface. Here, they can securely input their

payment information, such as card details or digital wallet credentials, and authorize the transaction with confidence. The module may also incorporate additional features, such as one-click payments or saved payment methods, to streamline the checkout process and enhance user convenience.

Upon successful completion of the payment transaction, users receive instant confirmation notifications, providing reassurance and transparency regarding the outcome of their booking. These notifications typically include essential details such as the transaction reference number, booking details, and payment amount, ensuring clarity and accountability throughout the process. By providing users with timely and informative feedback, the platform enhances trust and confidence in the booking and payment process.

In the event of payment failures or issues, the module is equipped with robust error handling mechanisms to assist users in resolving any challenges promptly. Whether addressing declined transactions, expired cards, or other payment-related issues, the platform guides users through troubleshooting steps and offers support to ensure a seamless payment experience. By prioritizing user support and assistance, the platform minimizes disruptions and fosters user satisfaction even in the face of unexpected challenges.

VI.CONCLUSION

The development of a web-based EV charging station finder and slot booking system marks a significant step forward in advancing accessibility, convenience, and sustainability within the electric vehicle ecosystem. By leveraging cutting-edge technologies and robust functionalities, this platform empowers users to seamlessly locate nearby charging stations, assess availability, and book slots with ease. Through intuitive mapping interfaces, users gain visibility into the geographic distribution of charging infrastructure, while integrated search and filtering features enable tailored station discovery based on individual preferences and requirements. Moreover, the integration of user authentication and payment gateways enhances security and reliability, ensuring that transactions are conducted securely and transparently. Users can register, log in, and manage their accounts securely, while flexible payment options accommodate diverse preferences and streamline the booking process. Real-time slot availability updates and instant booking confirmations provide users with peace of mind and assurance regarding their charging sessions. From an administrative standpoint, the platform offers valuable insights into usage patterns, revenue generation, and infrastructure performance, enabling administrators to optimize operations and enhance user satisfaction. By leveraging data analytics and reporting functionalities, administrators can identify opportunities for expansion, address bottlenecks, and refine service offerings to meet evolving user needs effectively.

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