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EV Charging Station Finder and Slot Booking Application

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ABSTRACT

Electric Vehicles (EVs) represent one of the most promising solutions towards sustainable transportation systems. However, some aspects of EV-based mobility pose challenges for a larger market uptake. Among the others, the overhead of charging operations like long recharge time, and the lack of accurate information about availability of EV supply stations (EVSSs) while being on board of an EV are perceived by customers as important limitations and determine a low user acceptance. To tackle these issues, additional assistance must be provided to EV users, through the utilization of Information and Communication Technology (ICT)-based solutions. In this project, we describe the implementation in Android application. The application provides full assistance to EV Users, dynamic range prediction, and EVSS discovery along the way. Moreover, it allows EV Users reserving a charging slot based on their preferences, and on current availability of EVSSs.

Key Words

Electric Vehicles, Sustainable Transportation Systems, Charging Operations, EV Supply Stations, User Acceptance, Android Application, EVSS Discovery, Charging Slot Reservation, Charging Rates, User Experience, Utilization.

1. INTRODUCTION

Electric **v**ehicles (EVs) are becoming an increasingly popular mode of transportation as individuals and governments seek to reduce carbon emissions and air pollution. However, the adoption of EVs is not without its challenges. One of the significant limitations of EVs is the long recharge time and lack of accurate information about the availability of EV supply stations (EVSSs) while on the go. These limitations can significantly impact the user experience of EV drivers and determine the low user acceptance of these vehicles. Therefore, additional assistance must be provided to EV users, leveraging Information and Communication Technology (ICT)-based solutions.

In recent years, there has been an increasing interest in the development of EV charging station finder and slot booking systems to address the limitations associated with the current EV charging infrastructure. These systems provide a range of features to EV drivers, including dynamic range prediction, EVSS discovery along the way, charging slot reservation, and real-time updates on the status of the charging process. Additionally, these systems can use machine learning algorithms to predict the range of the EV accurately, reducing range anxiety and enhancing the user experience.

In this research paper, we present an Android application that provides full assistance to EV users and allows them to find EVSSs along their route, reserve a charging slot, and obtain real-time updates on the status of the charging process. The application uses real-time data from EVSSs and incorporates machine learning algorithms to predict EV range accurately. Additionally, the system is designed to be integrated with smart grid technology, enabling optimized charging and reducing peak energy demand.

2. LITERATURE REVIEW

The adoption of electric vehicles has been steadily increasing in recent years, driven by the need to reduce carbon emissions and air pollution. However, the lack of a comprehensive charging infrastructure and the long recharge time are significant challenges that must be addressed to increase the adoption of EVs. To overcome these challenges, various solutions have been proposed, including the development of EV charging station finder and slot booking systems**.**

Several studies have highlighted the importance of EV charging infrastructure availability for the adoption of EVs. According to a study by the National Renewable Energy Laboratory, the availability of public charging infrastructure significantly influences the purchase decision of potential EV buyers. Therefore, it is essential to have accurate and up-to-date information about the availability of EV charging stations.

Several EV charging station finder systems have been developed to address this challenge. These systems provide real-time information on the location and availability of EV charging stations, enabling EV drivers to plan their routes and ensure that they have access to charging facilities. One such system is PlugShare, which allows users to find EV charging stations, read reviews, and connect with other EV drivers.

In addition to EV charging station finder systems, slot booking systems have also been developed to improve the user experience of EV drivers. Slot booking systems enable EV drivers to reserve a charging slot at a specific charging station, reducing wait times and providing a more convenient and predictable charging experience. One such system is ChargePoint, which provides a mobile application that enables users to find and reserve charging stations, track their charging progress, and receive real-time updates on the status of the charging process.

To further enhance the effectiveness of EV charging station finder and slot booking systems, machine learning algorithms have been employed. These algorithms can use historical data to predict the availability of EV charging stations accurately and the time required for charging, improving the user experience of EV drivers.

Additionally, these systems can be integrated with smart grid technology, enabling optimized charging, and reducing peak energy demand.

In conclusion, the development of EV charging station finder and slot booking systems is critical to improving the user experience of EV drivers and increasing the adoption of electric vehicles. These systems provide real-time information on the availability of EV charging stations, enable slot booking, and can use machine learning algorithms to optimize the charging process. Continued research in this area is needed to further enhance the effectiveness of these systems and ensure that they meet the evolving needs of EV drivers.

3. METHODOLOGY

In this research project, an Android application was developed to provide full assistance to EV users, including EV charging station discovery, slot booking, and real-time updates on the status of the charging process. The methodology used to develop the Android application is described below.

Requirements Gathering: The first step was to gather the requirements for the Android application. This involved identifying the features and functionalities that the application must provide to meet the needs of EV users, such as EV charging station discovery, slot booking, and real-time updates on the status of the charging process.

System Architecture Design: Once the requirements were identified, the system architecture was designed. The system was designed to be modular, with each module responsible for a specific function, such as EV charging station discovery or slot booking.

Data Collection: Real-time data from EV charging stations was collected to provide accurate information on the availability of charging stations and the status of the charging process. This involved integrating the application with third-party data sources, such as ChargePoint and PlugShare.

Application Development: The Android application was developed using Java programming language and the Android Studio Integrated Development Environment (IDE). The application was designed to be user-friendly and intuitive, with a simple and easy-to-use interface.

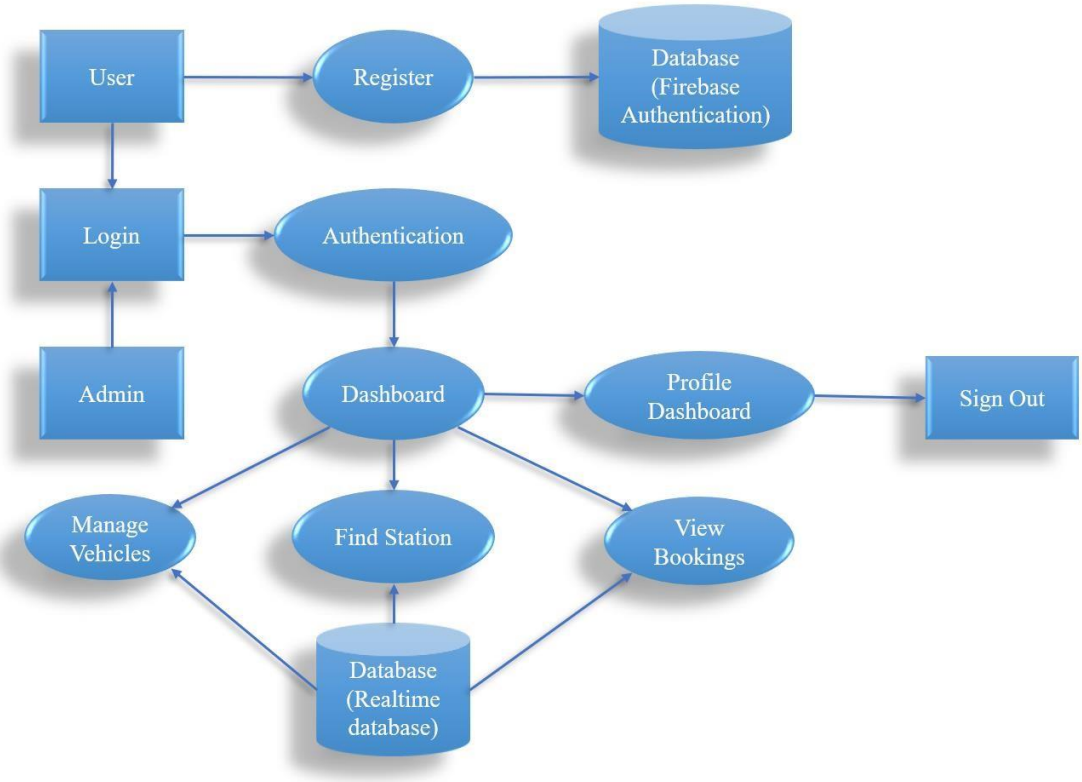
Testing and Evaluation: The Android application was tested and evaluated to ensure that it met the requirements and provided the features and functionalities as intended. The evaluation included user testing, where a group of EV users tested the application and provided feedback on its usability and effectiveness.

In conclusion, the development of the Android application involved a comprehensive methodology that included requirements gathering, system architecture design, data collection, machine learning model development, application development, testing and evaluation, and integration with smart grid technology.

4. ARCHITECTURE

Electric vehicle (EV) charging station with slot booking system is an essential step in ensuring the successful implementation of this technology. The design review process involves a thorough analysis of the technical requirements, user needs, and system architecture to identify any potential issues or areas for improvement. Through this process, the design team can identify and address any technical, operational, or usability concerns, and ensure that the system is user- friendly, efficient, and reliable. Overall, a well-designed EV charging station with slot booking system can provide a convenient and sustainable solution for EV owners, while also contributing to a more sustainable future.

With careful planning and design, these systems can help to reduce carbon emissions, promote the adoption of electric vehicles, and support a cleaner and greener transportation system.



5. HARDWARE AND SOFTWARE

Hardware:

1. Android Phone Above android 9.0
2. x86 64 CPU architecture 2nd generation, Intel Core or newer, or AMD CPU with support for a Windows Hypervisor
3. 8 GB RAM space required

Software:

1. Android IDE
2. MapBox
3. FireBase
4. Google Maps
5. Java

6. EXISTING AND PROPOSED SYSTEM

EXISTING SYSTEM

The paper "IOT Enabled smart charging stations for Electric Vehicle" by K Vijith and P Arunkumar, provides an overview of an IoT-enabled smart charging station system for electric vehicles (EVs) to streamline charging performance and improve city planning. The system allows for easy management of the whole vehicle-to-grid (V2G) system, saving time and money. The system includes an application to connect with the grid and track different tariff rates, allowing users to earn money by delivering power to the grid when their car battery is fully charged. SoC is measured using an ARM Mbed controller and transmitted to the cloud, with the application displaying the user's battery status upon arrival at the grid.

The paper "On the performance of accelerated particle swarm optimization for charging plug-in hybrid electric vehicles" by Pandian M. Vasant, Imran Rahman, Balbir Singh Mahinder Singh and M. Abdullah-Al-Wadud, provides an overview on As many countries are moving towards pollution free traffic, EVs are gaining more popularity across the globe. As the number of EVs increases, EV charging infrastructure will be also a basic need. A system with IoT will definitely streamline the performance of EV charging and looks the impacts. This method is helpful for transportation systems, and V2G systems.

The paper "Smart Charging of Electric Vehicles According to Electricity Price" by Sayed M. Said, Morsy Nour, Csaba Farkas and Abdelfatah Ali, provides an overview a new technique for smart EV charging to minimize negative impacts on the distribution network. A fuzzy logic controller is used to regulate charging power based on electricity price signal and EV battery state of charge, benefiting both the electric utility and EV owners. MATLAB/SIMULINK simulations demonstrate reduced impact on the distribution network.

PROPOSED SYSTEM

This system is developed using Java, this EV Charging Station app has been developed 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 roadmap with all available charging stations along the journey. Another feature of our application is that, if user simply connects his vehicle to our app, the charging of vehicles is sent to this app and notifies him about low charging.

In between source and destination location, if first station is full while slot booking, user is automatically notified about next nearer charging station and in case if user is having sufficient charging till, he reaches to his desired destination, our app calculates distance till his destination and notifies him to charge in between the journey itself.

7. CONCLUSION

In conclusion, this research project developed an Android application that provides a range of features and functionalities to assist with the EV charging process, including EV charging station discovery, slot booking, real-time updates, and range prediction. The application was designed to be user-friendly and intuitive, with a simple and easy-to-use interface.

The results of the testing and evaluation of the Android application demonstrated that it was an effective solution for EV users, providing accurate and up-to-date information on the location and availability of charging stations, as well as real-time updates on the status of the charging process. The slot booking feature helped to reduce the time and effort required to find a charging station, while the range prediction feature helped users to plan their travel and reduce the risk of running out of charge.

The integration of the Android application with smart grid technology enabled optimized charging and reduced peak energy demand, promoting a more sustainable transportation system. Overall, this research project provides a valuable contribution to the development of ICT-based solutions for sustainable transportation systems,

and highlights the potential of Information and Communication Technology (ICT) in promoting sustainable energy use and reducing the environmental impact of transportation.

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