Real-Time EV Charging Station Management with Slot Booking and Occupancy

P. S. Sajjanshetti[1], Om Kurkut[2], Sairaj Pawar[3], Sanchet Kuchanwar[4]
[1]*Asst. Professor, Dept. of Computer Engineering, NBN Sinhgad Technical Institute Campus, Pune, India*
[2,3,4] *Student, Dept. of Computer Engineering, NBN Sinhgad Technical Institute Campus, Pune, India*

Abstract *- In view of the acute need to put an end to environmental degradation and reduction of dependence on oil, shift is going on toward Electric Vehicles. Our project-Complete Electric Vehicle Station Management System (EVSMS)-will support the shift. It is based on the design and implementation of our EVSMS, critical to supporting the transition toward using electric vehicles instead of similar oil-petroleum-powered ones. Our EVSMS includes user registration, owner dashboards, and an admin panel, which makes it user-friendly for car owners as well as station operators. What gives a user-friendliness touch to our system is through integration with the Google Maps API in locating nearby charging stations, but what really makes our system stand out is its real-time station occupancy information. This function not only assists users to identify available charging slots but also nudges them towards opting for alternative stations if their preferred ones happen to be occupied. Besides better user convenience, our system further enhances the slot booking alongside initial payment that accompanies charging. Besides all of the above features, it keeps the users aware of station availability and promotion, thereby strengthening merits of using EVs. Our project is essentially in pursuit of concentration on EVs as the environment-friendly alternative of the conventional fuel-based automobiles. An easily accessible, technologically advanced EVSMS will accordingly help achieve the ultimate goal of carbon emission minimization and checking the unfavourable impact on the environment, thereby increasing the appeal of EVs. This survey gives us all the desired information regarding our system design and consistency with the global shift toward sustainable, eco-friendly mobility.*

Keywords *Electric Vehicles (EVs), Electric Vehicle Station Management System (EVSMS), Slot Booking, Map, chatbot.*

INTRODUCTION

During recent years, these problems of global warming and fossil fuel exhaustion through extensive consumption of energy resources have been increasingly recognized as global challenges[1]. Renewable energy systems that work independently of fossil fuels are a viable solution to these problems. This paper focuses on issues concerning Japan, where the government has long introduced Feed-in Tariffs (FiT), because the rate at which photovoltaic systems are being installed has increased dramatically since their introduction in this country [2]. However, the developed power by the increased number of photovoltaic systems is quite high and tends to create a negative effect on the system frequency and distribution voltage. Thus, the Japanese government has begun thinking again over the Fit system. Adding to that problem is the cost of installation of PV, which is reducing every year. Thus, in the near future, the price of PV power is expected to reduce very much. Proposed is an aggregator that appears as an EV charging station which purchases power from near-exclusively smart houses, PV systems and sells power to electric vehicles and smart houses. The EV charging station needs a fixed battery for electricity trading [5].

 We know EV Automobiles going to be the future of the world yet these machines need charging stations for charging.

 Project work will provide the system with an open platform for booking charging slots to available charging stations anytime customers need.

 In this system, the user would get facilities such as an AI chatbot to book the station through vocal commands, Maps feature for sensing the direction, Digital payment option, Notifications, Mails and SMS of each activity.

MOTIVATION

- A system should be designed with which all electric vehicle charging stations are brought together at one point.
- Our system does a station identifying according to the user's preference; thus, it helps the

enthusiastic travelers who would like to travel long distances with their electric vehicles. This function is very easy and allows traveling persons to reach their destination in time.

- It will cost nothing, and due to that fact, your reservation for that time slot will be confirmed.
- Our system must allow users to create demand for new schedules. As a perquisite in the confirmation of their reservations, it is essential that users have to pay partially online. Our system will also provide a small map indicating the way to the station concerned.
- Apart from slot timing control, the system will provide an interface to charging stations that allows examining all the free slots, in addition to lists of reserved slots.

  • Android-based system: The app must be only on an Android. During development, we'll use the time-slot allocation strategies along with Google Maps API to allow the system to avail itself of directional sensing.

LITERATURE SURVEY

For smart cities, the developed Smart Electric Vehicle Charging Management system focuses on optimization in the allocation of slots for charging more efficiently through a [1] Scheduling Algorithm. The principal parameters for optimization are Output Power and Price per kilowatt-hour (kWh). It is run on a central server that aims at reducing waiting time to ensure optimal distribution of allocations for charging and finally boosts the satisfaction of the user with EV. Dubbed the SecCharge system, it collaborates quite effectively with CSOs to offer charging services for electrical vehicle service operators; hence, it contributes to the development of intelligent urban infrastructure more inclusively. The CHATBOT design and building integrate a [2] rule-based algorithm coupled with NLP techniques with the principal purpose of fine-tuning the overall design of the chatbot.

The choice of the evaluation metric depends on the intent variants, which check out whether the chatbot has the right understanding and responds appropriately to user intents. The design focuses on attaining productive conversational flow. This method of evaluation involves testing the chatbot as if it were interacting with people, thereby confirming that its conversation abilities meet the set criteria. The proposed application is relevant to several companies, customer service centers and other sectors. It witnesses the fact that the chatbot application exists in other realms. Considering the optimization of the search for the shortest path within dynamic locales, the algorithm chosen [3] Bellman Ford end provides strong attention towards the minimization of memory usage in routing computations without being overweighted by left unoptimized. Dynamic location features encompass various node dynamics.

For significant factors of evaluation, these will include the amount of used memory, optimality, and the network topology. For the evaluation method, this shall be based on a comparison between other algorithms such as Dijkstra, A*, and Ant Colony, based on their effectiveness within the confines of dynamic location and geographic data. This optimization is aimed at improving online transport services and geographic information systems through a more resource-efficient and optimal solution for planning routes in changing environments.

PROPOSED SYSTEM

Identify the following user intent related to the EV station management system, for example, queries such as whether stations are available, prices to charge at the station, methods of payment accepted, or status.

Prepare a sample corpus of user queries with their matching intension, and then use this as training data for the NLP model.

Tokenize the query entered by every user and perform all appropriate text preprocessing, including removing stop words and stemming or lemmatization.

Design an intent recognition model which, through possibly a supervised algorithm, could be implemented by a machine learning implementation, perhaps with a support vector machine or even a deep learning structure such as a recurrent neural network.

The designed model should consume the user's query and produce the intended output.

That is where named entity recognition (NER) comes in; NER identifies station names, locations, or time in user queries thereby enabling extraction of particular information from user inputs.

Develop a system that treats the context in the dialogue. This would allow the chatbot to understand questions in the light of the current interaction.

Integrate the chatbot to get updated data from the database or API of the electric vehicle station management system regarding availability, pricing, and other important details about the stations.

With a stated intent and specified entities, furnish fitting responses. Suitable responses might be about station availability, charging rate, and even how to make a reservation.

Design a rating mechanism by which users can comment on the adequacy of answers that this chatbot gives. Feedback of this kind will keep the natural language processing model-and the chatbot in general-evolving toward perfection.

CONCLUSION

This was meant to be an Internet-based platform that is aimed at overcoming the waiting time problem faced at Electric Vehicle (EV) charging stations by providing an advance reservation system for EVs. Conducting our methodology would include in-depth review of the related literature, comparative study of the major EV charging applications in the Indian market, and critical analysis of feedback from customers.

This has opened up some common weaknesses of current EV charging platforms that are comprised of unclear and complicated interfaces to users; no information given on availability of charging ports in real time; not capable of checking the real-time status of operation for charging ports; limited ways to pay for charging; and lacking reviews. We were basically to build an intuitive, user-friendly website that is worthwhile for EV owners, specifically solving these common reservation problems. Our system is designed flexible enough to be updated swiftly to ensure a smooth interface. We could boast of soliciting effective responses to the identified issues from our users. Depending upon the manner in which we design our web-based EV charging station network platform, the proper features and functionalities must be there in meeting the aspirations of the user. It is also envisioned that improvement in our website will integrate new features with valuable recommendations for the users of EV so that they can take proper decisions while booking slots at the charging stations using information which is complete and current.

REFERENCES

[1] L. Saranya, 2R. Kavya Sree, 3D. Janani, P. Loga Sheneha, 4A. Priyadharshini, “Smart Electric Vehicle Charging Station”, Department of Electronics and Communication Engineering, Karpagam College of Engineering, Coimbatore, Tamil Nadu, India,2023.

[2] A. Hassoune M. Khafallah A. Mesbahi and T. Bouragba "Smart topology of evs in a ev-grid system based charging station" 2017 International Conference on Electrical and Information Technologies (ICEIT) pp. 1-6 Nov 2017.

[3] M. Ahmadi N. Mithulananthan and R. Sharma "A review on topologies for fast charging stations for electric vehicles" 2016 IEEE International Conference on Power System Technology (POWERCON) pp. 1-6 Sep. 2016.

[4] H. Zhu D. Zhang Q. Liu and Z. Zhou "Three-port dc/dc converter with all ports current ripple cancellation using integrated magnetic technique" IEEE Trans. on Power Electronics vol. 31 no. 3 pp. 2174-2186 March 2016.

[5] H. Zhu D. Zhang B. Zhang and Z. Zhou "A non-isolated three-port dc converter and three-domain control method for Ev- battery power systems" IEEE Trans. on Industrial Electronics vol. 62 no. 8 pp. 4937-4947 Aug 2015.

[6] J. C. Mukherjee and A. Gupta "A review of charge scheduling of electric vehicles in smart grid" IEEE Systems Journal vol. 9 no. 4 pp. 1541-1553 Dec 2015.

[7] S. Bai D. Yu and S. Lukic "Optimum design of an ev/phev charging station with dc bus and storage system" 2010 IEEE Energy Conversion Congress and Exposition pp. 1178-1184 Sep. 2010.