IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 7, May 2024

Charging Slot Prediction and Automation System for Electric Vehicle Charging Station

V. Ashwin[1] and Dr. S. Prasanna[2]
PG Student, Department of Computer Applications[1]
Professor, Department of Computer Applications[2]
Vels Institute of Science Technology & Advanced Studies, Pallavaram, Chennai, India
ashwinvijikumar@gmail.com and prasanna.scs@velsuniv.ac.in

Abstract: *Governments worldwide are prioritizing alternative energy options for transportation due to rising pollution levels and depleting oil reserves, driving the shift towards electric vehicles (EVs). With EVs gaining popularity, efficient charging infrastructure is crucial for sustaining E-Mobility services. We've developed a next-generation online EV charging slot booking system, integrating a stochastic queuing model to optimize charging parameters and minimize delays. Our cloud-based charging station management platform efficiently networks and manages multiple stations, reducing waiting times and preventing EVs from halting due to battery depletion. This initiative aims to create a cost-effective and efficient system, facilitating the widespread adoption of electric mobility and addressing environmental concerns.*

Keywords: Slot booking, geo location, payment facility, user and admin login, dynamic slot allocation, time saving

I. INTRODUCTION

Electric vehicles (EVs) are powered by rechargeable batteries, replacing internal combustion engines, offering low environmental impact, enhanced performance, and reduced operational costs. Charging occurs through electric power sources or regenerative braking, converting kinetic energy into electrical energy. EVs come in various types, including all-electric, plug-in hybrid, and hybrid vehicles. They emit zero emissions, are highly efficient, and cost-effective due to lower maintenance and operational expenses. Challenges include limited driving range and the need for widespread charging infrastructure, yet ongoing advancements in battery technology and infrastructure are overcoming these hurdles, making EVs a compelling transportation choice globally.

Objective

Challenges in EV charging includes limited infrastructure and range anxiety due to insufficient station availability. Inconsistent information across networks and lack of standardization in plug types and speeds further complicate finding compatible stations. Additionally, unreliable or outdated information can lead to frustration and wasted time for EV drivers.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 7, May 2024

System Architecture

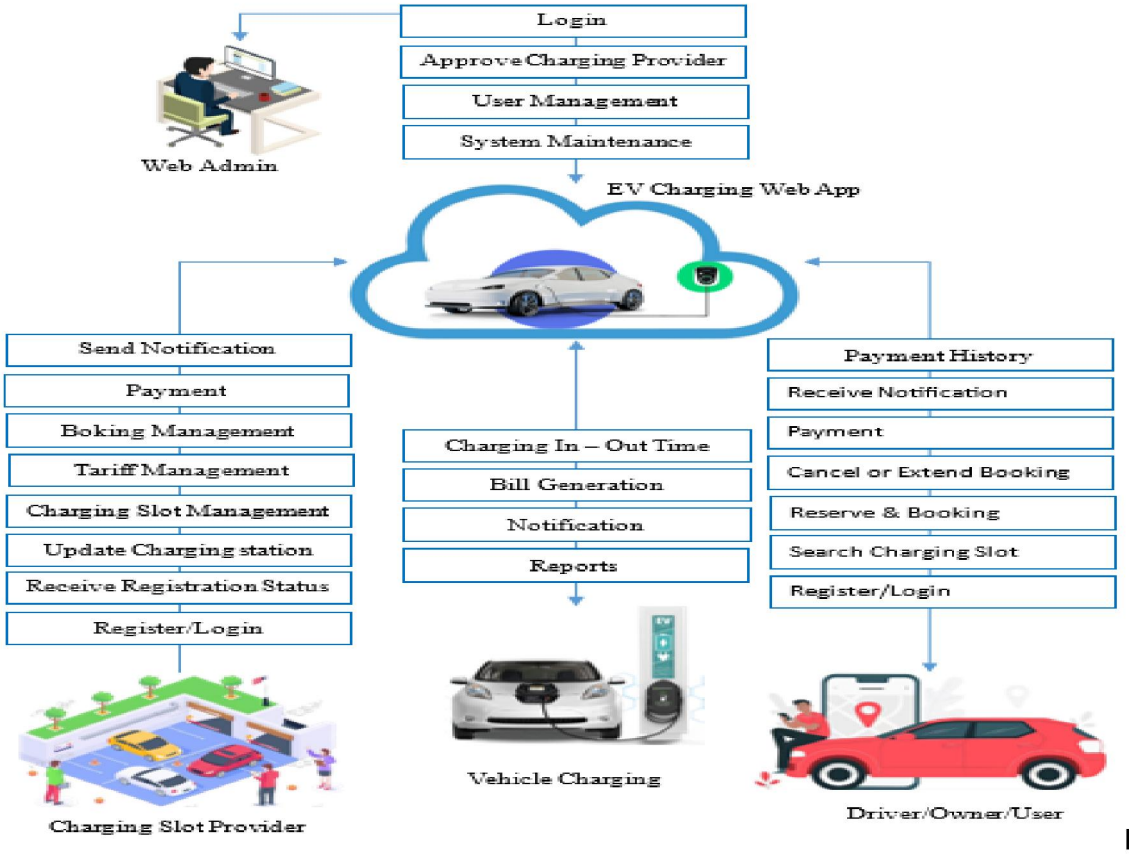

Fig.1 System Architecture

Use case diagram

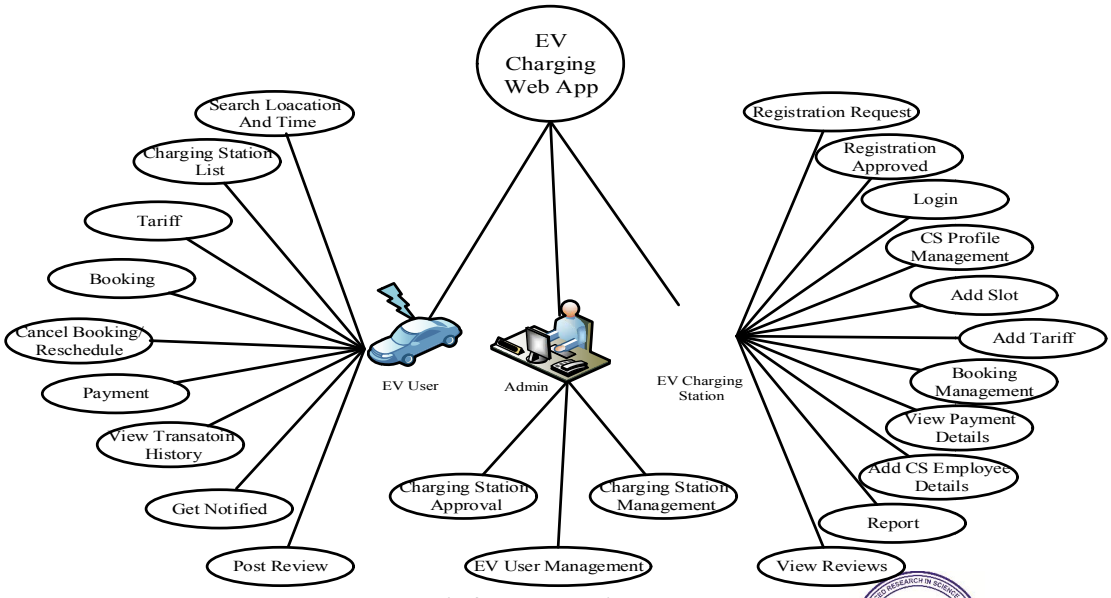

Fig 2 Use case Diagram

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 7, May 2024

II. PROPOSED SYSTEM

2.1 Stochastic Queuing Models

Stochastic Queuing Simulation (SQS) is a methodology for characterizing and simulating large-scale workloads (e.g. To evaluate new server configurations, scheduling policies, etc.). The technique builds upon analytic foundations, but adds simulation to account for cs workload properties that make closed-form solutions intractable. While pieces of these methods may be well known to queuing theorists or statisticians, they have not been presented in a cohesive manner, or widely adopted by the systems community.

A queuing model is composed of a collection of "slots" which process charge. We model each charging station as a single queuing system; this queuing system may have multiple "slots" which correspond to individual CS in a multicore CS. car arrive into the system according to an inter arrival time distribution and their size (measured in time) is distributed according to a service time distribution. A queuing discipline must be chosen to determine how queued jobs are scheduled and processed;

2.2 Forecasting in Open Car Parks with Charging Point

Web and mobile application the innovative advantages over other charging stations are the web and mobile application. When a user registers, all the functions of the system can be managed through the application. With the application, charging of EV becomes reliable, and the trip less stressful, as the application allows the user:

- Find the nearest charging station,
- Reserve charging time,
- Navigation to the location,
- Easy charging activation,
- Charging limit setup (amount of energy, amount, time),
- Flexible payment system (payment cards, PayPal system…);
- Live monitoring of charging during other activities (meeting, shopping, viewing the show...)

2.3 Web Admin

The web admin interface encompasses several essential functionalities tailored for efficient system management. One core aspect is the implementation of a robust login system, ensuring secure access for administrators through stringent authentication and authorization protocols. Administrators are empowered with the capability to review and approve registration requests from EV charging stations, ensuring only verified stations are operational within the network. Moreover, the platform facilitates seamless charging station management, granting administrators the ability to add new stations, update profiles, and oversee availability statuses. Additionally, administrators have the authority to manage user accounts, encompassing tasks such as approving registrations, deactivating accounts when necessary, and facilitating profile management. This comprehensive suite of features equips administrators with the tools needed to maintain operational excellence and user satisfaction within the EV charging ecosystem.

2.4 EV Charging Station

The charging station management system provides a comprehensive platform for station owners to efficiently manage their operations. Owners can easily submit registration requests, receiving timely notifications on approval status. Secure login functionality ensures access to station profiles, which can be updated with key details like location, contact information, and available amenities. Owners can specify slot information, including charging speed and connector types, and define tariff details, adjusting pricing models and rates as needed. A booking management system enables users to reserve slots based on availability and preferences. Owners can track payment details and transaction history, as well as add and manage employee details if required. Detailed reports offer insights into usage statistics and revenue, aiding in performance tracking and profitability analysis. Additionally, owners can engage with users through reviewing and responding to feedback, fostering customer engagement and service enhancements.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 7, May 2024

2.5 EV User

The EV user interface streamlines the charging process with a user-friendly platform. EV owners can easily register and securely log in to access the system's features. They can search for charging stations by location and preferred time, view station details including tariffs, and book slots based on availability and preferences. Flexibility is provided with options to reschedule or cancel bookings. Secure payment integration ensures hassle-free transactions, with users able to track their charging history and receive timely notifications via SMS and email. Additionally, users can contribute to community feedback by posting reviews, enhancing the overall charging experience.

III. CONCLUSION

In essence, the project revolutionizes Electric Vehicle Charging Stations (EVCS) through cutting-edge technologies like stochastic queuing algorithms, enhancing efficiency and user experiences. Web Administrators access a robust platform for seamless station management, aided by comprehensive reports for informed decision-making. Charging Station Owners benefit from dynamic management tools and optimized slot prediction, while cloud-based scalability ensures adaptability to network growth. EV Users enjoy a user-friendly interface, transparent tariff information, and efficient booking processes, supported by timely notifications and feedback mechanisms. This project pioneer's sustainable mobility solutions, addressing EV infrastructure challenges and driving widespread adoption. Its innovative design and technological prowess position it as a cornerstone in the evolution of electric mobility solutions.

IV. FUTURE SCOPE

- **Integration with Smart Grid Technologies:** Explore integration with smart grid technologies to optimize charging schedules based on grid demand and renewable energy availability. This integration could contribute to a more sustainable and grid-friendly charging ecosystem.
- **Dynamic Pricing Mechanism:** Implement a dynamic pricing mechanism that adjusts tariffs in real-time based on factors such as demand, grid load, and station utilization. This could optimize revenue for charging station owners and offer cost-effective solutions for users.
- **Vehicle-to-Grid (V2G) Integration:** Explore V2G integration capabilities to enable bidirectional energy flow between electric vehicles and the grid. This could unlock additional revenue streams for EV owners and provide grid stabilization benefits.
- **Fleet Management Solutions:** Develop fleet management features to cater to businesses and organizations with multiple electric vehicles. This could include centralized management of charging schedules, billing, and reporting for fleet operators.

REFERENCES

[1] Cao, Yue and Tao, Jiang and Kaiwartya, O. and Sun, Hongjian and Zhou, Huan andWang, Ran (2019) 'Toward preempted EV charging recommendationthrough V2V based reservation system.', IEEE transactions on systemsman, and cybernetics: systems.

[2] Throughput and Fairness Analysis of 802.11-Based Vehicle-to-Infrastructure Data Transfers Conference Paper · October 2011 DOI:10.1109/MASS.2011.30 · Source: DBLP

[3] Bayram, Islam Safak, and IoannisPapapanagiotou. "A survey on communication technologies and requirements for internet of electric vehicles."EURASIP Journal on Wireless Communications and Networking 2014, no.1 (2014): 223.

[4] Cai, Lin, Jianping Pan, Lian Zhao, and Xuemin Shen. "Networked electricvehicles for green intelligent transportation." IEEE Communications StandardsMagazine 1, no. 2 (2017): 77-83.

[5] Hatton, Chandler E., Satish K. Beella, J. C. Brezet, and YC2009 Wijnia."Charging Stations for Urban Settings the design of a product platformfor electric vehicle infrastructure in Dutch cities." World Electric VehicleJournal 3, no. 1 (2009): 134-146.

[6] del Razo, Victor, and Hans-Arno Jacobsen. "Smart charging schedules forhighway travel with electric vehicles." IEEE Transactions on TransportationElectrification 2, no. 2 (2016): 160-173.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 7, May 2024

[7] Gusrialdi, Azwirman, Zhihua Qu, and Marwan A. Simaan. "Distributedscheduling and cooperative control for charging of electric vehicles athighway service stations." IEEE Transactions on Intelligent TransportationSystems 18, no. 10 (2017): 2713-2727.