International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 09 Issue: 04 | April - 2025 SJIF Rating: 8.586 ISSN: 2582-3930

An Android App and Device for EV Charging

[1] Akhil Anjikar
[1]Pranay Lohakare ,[2]Shrawan Narware,[3]Piyush Yadav ,[4]Nidhi Gurbaxani,
[5]Sayama Alishah,[6]Shamal Koche
[1] Asst. Prof. and Scholar, Dept of CSE
[1,6] Jhulelal Institute of Technology, Nagpur

Abstract:
The paper discusses the lack of adequate EV charging infrastructure in India, which hinders the widespread adoption of electric vehicles despite government incentives. While public-private partnerships have improved charging station availability, challenges such as high costs, land acquisition, and uneven distribution persist. The proposed solution is an IoT-enabled smart charging system that optimizes resource utilization, allows real-time monitoring, and integrates renewable energy sources.
The system enhances user experience by providing an Android app that helps locate, book, and pay for charging stations while also offering predictive maintenance for improved efficiency. By leveraging IoT, the project aims to build a scalable and efficient charging ecosystem , supporting India's transition to clean mobility.

KEYWORDS: IoT-enabled smart charging, scalable charging ecosystem, smart monitoring systems, mobile application, IoT-based monitoring

1.Introduction:

The growing adoption of electric vehicles (EVs) marks a significant shift towards sustainable transportation. However, one of the critical challenges hindering widespread EV adoption is the lack of sufficient charging infrastructure. This issue not only affects the convenience and feasibility of owning an EV but also contributes to range anxiety—concerns about the vehicle's ability to travel long distances without running out of charge. Addressing the shortage of EV charging stations is essential to support the transition to a greener future and to encourage more people to choose electric vehicles as a viable alternative to traditional internal combustion engine vehicles
The proposed system integrates an energy meter, a charging device, and an Android app to monitor and control EV charging. The app enables users to track their energy consumption, receive notifications, and optimize the
charging schedules. The device, equipped with an energy meter, measures the electrical energy consumed during charging and transmits the data to the app. This integrated system promotes efficient energy management, reduces costs, and enhances the overall EV ownership experience.

2.Literature survey:

Reviewed various EV charging technologies, standards, architectures, and case studies. Studied existing apps and IoT-based solutions for monitoring and booking.
The literature survey in the document provides an overview of various research papers related to EV charging systems, which were used to develop the proposed IoT-enabled EV charging system. Below are the key research papers reviewed:

1.Charge Point: Streamlining EV Charging Discovery, Booking, and Payment (2024)

- Authors: Md. Rshan Shaikh, Rohit Udamale, Dakshata Thakare, Prof. Sagar Yeshwanto
- Summary: This paper discusses the development of an app to help EV users locate, book, and pay for

charging stations. It utilizes Flutter, Firebase, and Google Maps API.

- Use in the project: The user interface design and key app features were referenced.
- Use in the project: Helped in direct monitoring of power consumption on a display.

5.Review of Electric Vehicle Charging Technologies, Standards, and Architectures (2023)

- Authors: Sithara Acharige, Md. Eamul Haque, Mohamad Taufiqul Arif, Nasser Hosenzadh

2.Electric Two-Wheeler Vehicle Charging Station (2021)

- Authors: Aashish Joshi, K.M Vishall Somaiya, Arni Tharakarm, Hariram Mubashir Hussain
- Summary: Proposes an EVCS using solar and grid power with Arduino, GPS, and Bluetooth for efficient and eco-friendly charging.
- Use in the project: Assisted in designing a digital energy meter and determining operational voltage requirements.

3.Electric Vehicle Charging Station Case Study (2020).

- Authors: Avinash V. Shrivasav, Sajidhusin S. Khan, Rahul K. Gupta, Prajkta R. Shinge
- Summary: Analyzes EV charging station infrastructure in India, highlighting optimal locations like schools and malls.
- Use in the project: Helped in determining charging efficiency (miles per charge per hour).

4.An In-Depth Analysis of EV Charging Infrastructure and Policy Implications (2019)

- Authors: Muhamad Shahid Mastoia, Shenxian Zhuanga, Hafiz Mudassir Munirb, Malik Harisc

3. Charging Station Allocation: The management system assigns an availle charging station to the user.
4. Real-time Monitoring: The system continuously monitors the charging process, tracking parameters like energy consumption and charging time.
5. Smart Grid Integration: The system communicates with the smart grid to optimize energy distribution and reduce peak demand.
6. User Notification: The user receives updates on the charging status and any issues that may arise

- Summary: Explores EV charging methods (AC/DC), international standards (IEC, SAE), and smart.

6.Electric Vehicle Charger (2022)

- Author: Niloy Mondal
- Summary: Discusses the design of an EVCS-Charge point with booking and payment features using Flutter, Google Maps, and Razorpay.
- Use in the project: Helped in selecting sensors like the MPT101B voltage sensor for current measurement

3. Existing work &Technologies:

The document describes a mini-project titled "An Android App & Device for EV Charging" from a group of students at Jhulelal Institute of Technology, Nagpur. It presents a smart IoT-enabled EV charging system that integrates a hardware device and an Android app to locate, book, and pay for charging stations.

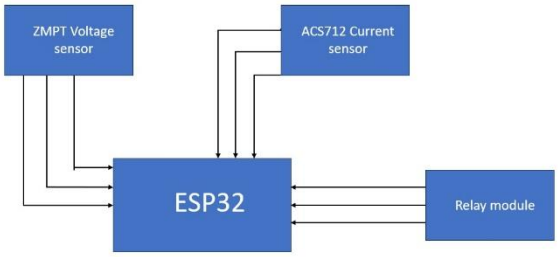

Fig no. 1 EV charging system artitecture

1. Charging Request: An EV owner sends a charging request to the management system.
2. Request Processing: The management system checks the availability of charging stations and the user's account status.

To improve the functionality of the **Parking Space Finder** system, it is crucial to analyze previous research on smart parking solutions. Several studies have explored different approaches to optimize parking management. The following comparative analysis highlights key findings from relevant studies and their applicability to our project.

4.Methodology for the Project:

1. Frontend (User Interface & Experience)

Developed using Android Studio with Kotlin/Java for a responsive and user-friendly interface Integrated Google Maps API for locating nearby charging stations.

2. Backend (Business Logic & API)

- Built using Node.js with Express.js or Django (Python) for handling requests efficiently.
- Communicates with the IoT-based charging device using MQTT/WebSockets for real-time updates.
- Integrated with Razorpay/Stripe for secure online payments.

3. Database (Data Storage & Management)

- Firebase Firestore or MySQL/PostgreSQL used for user data, transactions, and charging station details.
- Redis implemented for caching real-time EV charging status updates.
- Google Firebase Authentication for secure login and user authentication.

5.Implementation:

If someone wants to offer their vacant property for We are using QR codes for entry and exit. If someone has booked a parking slot, they need to scan the QR code at the time of entry to confirm their booking. When they exit, they will scan the QR code again, and the slot will automatically be marked as available for the next user.

We'll develop a mobile app that makes it easy for EV owners to find available charging stations.

- ch stations are available.
- Directions to the nearest station.
- Estimated wait times and pricing info.
- The ability to reserve a spot and make payments remotely.

5.4. Cloud-Based Monitoring System

A cloud platform will be set up to manage and analyze data from all the charging stations.

Implemented QR code scanning for seamless station authentication and payment processing.

The goal is to create an affordable and accessible EV charging network, and this will happen in several stages, including setting up hardware, integrating software, and monitoring everything in real-time.

5.1. Prototype Development

We'll start by setting up a small-scale prototype charging station in a controlled environment.

This station will include either Level 2 or fast-charging options, depending on the available power supply. We'll also integrate renewable energy sources like solar panels to help reduce ongoing operating costs.

5.2. Smart Charging Station Setup

The charging stations will be equipped with IoT sensors to track real-time usage .Smart meters will measure energy consumption, ensuring the power distribution is optimized. To make the stations secure and easy to use, RFID/NFC authentication systems will be put in place for user access.

5.3. Mobile App Development

The app will include features like:

- Real-time updates on whi

This system will gather and process data to optimize energy usage across all stations. We'll also use predictive analytics for demand forecasting and dynamic pricing adjustments.

5.5. Energy Management System

We'll implement an AI-powered system to manage peak demand and keep everything running smoothly.

This system will balance energy use across multiple stations to prevent power outages and dynamically allocate power based on real-time demand and availability.

5.6. Testing and Optimization

The prototype will go through thorough testing to ensure everything works as expected.

We'll gather feedback from users to make improvements and fine-tune the system. The charging algorithms will also be optimized to reduce charging time and improve overall efficiency.

5.7. Scaling Up the Infrastructure

Once the prototype is tested and working well, we'll expand to multiple locations.

We'll partner with both government and private sector players to deploy the infrastructure on a larger scale. We'll keep updating and improving the system based on real-world data and user experience.

6.Future Scope

Hardware: Power measurement sensorsIoT integration, QR codes.
Software: Android app with GPS, real-time data sync, secure payments.
Integration: IoT-based monitoring, predictive maintenance, seamless
communication.

The scope of this project encompasses the development of an IoT-enabled EV charging solution that integrates a smart device and an Android application to provide a seamless, efficient, and user-friendly charging experience. The key aspects of the project's scope include .
1) Hardware Development • Design and implementation of a smart device capable of measuring electricity harging stations, check availability, and book charging slots. • Implementation of secure digital payment mechanisms, allowing users to pay based on electricity consumption or session duration. • Development of features for real-time monitoring of charging status and electricity usage.
3) System Integration • Seamless communication between the hardware (charging device) and software (mobile app) using IoT protocols. • Real-time data synchronization to ensure accurate monitoring, billing, and user notifications. • Support for predictive maintenance using IoT sensors to enhance system reliability and minimize downtime.

consumption through a power socket. • Integration of IoT technology to enable real-time communication between the device and the mobile app. • Incorporation of QR codes on devices for secure booking and identification of charging points.
2) Software Development • Creation of an Android app that allows users to locate nearby c

7.Key achievements include:

- Real-time station availability tracking using Google Maps.
- Efficient IoT-based communication between the app and charging stations.
- Secure payment and authentication systems for hassle-free transactions.

8.Conclusion:

The development of an Android app and device for EV charging successfully bridges the gap between electric vehicle users and charging infrastructure. By integrating a user-friendly mobile interface, a robust backend, and a secure database, the system ensures seamless EV charging management.
This project contributes to the growing EV ecosystem by enhancing accessibility, convenience, and efficiency in charging infrastructure. Future improvements could include AI-based charging recommendations, solar-powered stations, and blockchain-based secure transactions to further optimize the system.

References:

[1]Abraham, D.S., Chandraseka B.Narayanamoorthi, R., Vishnuram, P., Ramakrishnan, V., Bajaj, M., Piecha,M., Blaˇzek, V., Prokop, L., 2023. Fuzzy-based efficient control of dc microgrid configuration for PV-energized EV charging station, 2753–2753 Energies 16. https://doi.org/10.3390/en16062753.

[2]Ahmad, F., Alam, M.S., Asaad, M., 2017a. Developments in xEVs charging infrastructure and energy management system for smart microgrids including xEVs. Sustain. Cities Soc. 35, 552–564. https://doi.org/10.1016/j.scs.2017.09.008. Alam, M.S., Ahmad, A., Khan, Z.A., Rafat, Y., Chabaan, R.C., Khan, I., Bharadwaj, A., Al- Shariff, S.M., 2018. A bibliographical review of electrical vehicles (xEVs) standards. SAE Int. J. Altern. Power 7, 63–98. https://doi.org/10.4271/08-07-01-0005.

[3] Alrubaie, A.J., Salem, M., Yahya, K., Mohamed, M., Kamarol, M., 2023. A comprehensive review of electric vehicle charging stations with solar photovoltaic system considering market, technical requirements, network implications, and future challenges. Sustainability 15. https://doi.org/10.3390/su15108122.

[4] Aljanad, A., Mohamed, A., Shareef, H., Khatib, T., 2018. A novel method for optimal placement of vehicle-to-grid charging stations in distribution power system using a quantum binary lightning search algorithm. Sustain. Cities Soc. 38, 174–183. https://doi.org/10.1016/j.scs.2017.12.035.

[5]Carrilero, I., Gonz´ alez, M., Anse´ an, D., Viera, J.C., Chac´on, J., Pereirinha, P.G., 2018. Redesigning European public transport: impact of new battery technologies in the design of electric bus fleets. Transp. Res. Procedia 33, 195–202. https://doi.org/10.1016/j.trpro.2018.10.092.

[6] Chen, Y., Wei, W., Zhang, F., Liu, C., Meng, C., 2017. Design of PV hybrid DC/AC microgrid for electric vehicle charging station. IEEE Transportation Electrification Conference and Expo, Asia-Pacific (ITEC Asia-Pacific). IEEE, Harbin, China. https://doi.org/10.1109/itec-ap.2017.8081027.

[7] Chen, Z., He, F., Yin, Y., 2016. Optimal deployment of charging lanes for electric vehicles in transportation networks. Transp. Res. Part B: Methodol. 91, 344–365. https://doi. org/10.1016/j.trb.2016.05.018.

[8] Chowdhury, S., Bin, T., Md Ehsanul, Haque, Yilmaz, Sozer, 2023. A three-phase overlapping winding–based wireless charging system for transportation applications. IEEE Trans. Power Electron. 38, 16245–16255. https://doi.org/10.1109/tpel.2023.3309496.

[9] Deb, S., Kalita, K., Mahanta, P., 2017. Review of impact of electric vehicle charging station on the power grid. 2017 International Conference on Technological Advancements in Power and Energy (TAP Energy). IEEE, Kollam, India, pp. 1–6. https://doi.org/10.1109/TAPENERGY.2017.8397215.

[10]Deb, S., Tammi, K., Kalita, K., Mahanta, P., 2018a. Impact of electric vehicle charging station load on distribution network. Energies 11, 178. https://doi.org/10.3390/ en11010178.

[11] Deb, S., Gao, X.-Z., Tammi, K., Kalita, K., Mahanta, P., 2019. Nature-inspired optimization algorithms applied for solving charging station placement problem: overview and comparison. Arch. Comput. Methods Eng. 28, 91–106. https://doi.org/10.1007/s11831-019-09374-4.

[12] Goli, P., Shireen, W., 2014. PV integrated smart charging of PHEVs Based on DC link voltage sensing. IEEE Trans. Smart Grid 5, 1421–1428. https://doi.org/10.1109/ tsg.2013.2286745.