

# ChargeMate: AI Based EV Charging Locator and Schedule

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**Abstract** — The rapid global shift toward electric vehicles has created an urgent need for more intelligent and reliable charging infrastructure management. ChargeMate addresses this challenge by introducing an AI-driven platform designed to streamline the process of locating and scheduling vehicle charging. By leveraging real-time data and predictive machine learning algorithms, the system accurately forecasts station availability and identifies the most convenient locations.

**Keywords:** Electric Vehicles (EV), Artificial Intelligence (AI), Smart Scheduling, Charging Infrastructure, Range Anxiety, Real-time Data, Route Optimization, Smart Grid

## I. INTRODUCTION

One of the biggest problems right now is that too many people try to charge their cars at the same time, which leads to long lines and crowded stations. This also puts a lot of pressure on the local power grid. ChargeMate helps fix this by acting like a smart manager. It can suggest times when charging is cheaper or when the stations are quieter, which saves you money and helps the city manage its electricity better. Instead of everyone rushing to the same spot at 5:00 PM, the app helps spread things out so the whole system runs smoothly. We also designed the app to be like a helpful assistant that stays one step ahead of you. Most drivers don't want to spend their day checking maps or worrying about percentages. ChargeMate learns your routine—like when you go to work or when you head to the grocery store—and sends you a friendly notification if it sees you'll need a charge soon. It even tells you what's near the charging station, like a coffee shop or a park, so you have something to do while you wait. By making the charging process this simple, we hope to help more people feel comfortable moving away from gas cars. Many people stay away from electric vehicles because they think it's too much work to keep them charged.

## II. LITERATURE SURVEY

- 1) M. Al-Garni proposed a paper that explored the application of machine learning to enhance the management of demand complexities in contemporary electric vehicle charging networks [1].
- 2) S. K. Kim discussed the role of IoT-enabled sensors and their real-time monitoring capabilities for charging station availability [2].
- 3) A. Peterson introduced the concept of user-centric feedback and applied it to qualitative research to understand how EV owners utilized real-time data and scheduling apps. The AI-driven notification system played a crucial role in transitioning drivers toward more efficient and sustainable charging habits [3].
- 4) R. Gupta developed a predictive framework utilizing deep learning to forecast station occupancy and wait times. The study demonstrated that providing accurate, data-driven predictions to drivers significantly reduced

"range anxiety" and improved the overall distribution of vehicle traffic [4].

- 5) L. Martinez explored the integration of vehicle-to-grid (V2G) communication protocols within urban charging systems. The focus was on utilizing intelligent scheduling to balance grid load and prevent power outages during high-demand periods [5].
- 6) J. Wang investigated the impact of cloud-based navigation tools on EV energy efficiency. The paper proposed an integrated route-planning algorithm that combined battery health monitoring with real-time station discovery to ensure seamless long-distance travel [6].
- 7) H. Zhang proposed a paper that investigated the use of neural networks to monitor battery health during high-speed charging sessions. The focus was on prolonging battery life by adjusting charging speeds based on real-time temperature and chemical data to prevent long-term degradation [7].
- 8) F. Silva discussed the role of automated reservation systems in reducing wait times at urban charging hubs. The paper proposed a cooperative scheduling algorithm that allowed vehicles to book slots in advance based on their estimated time of arrival, ensuring a more balanced distribution of users across available stations [8].

## III. PROJECT CONCEPT

### A. ChargeMate

The rapid global shift toward electric vehicles has created an urgent need for more intelligent and reliable charging infrastructure management. ChargeMate addresses this challenge by introducing an AI-driven platform designed to streamline the process of locating and scheduling vehicle charging. By leveraging real-time data and predictive machine learning algorithms, the system accurately forecasts station availability and identifies the most convenient locations.

### B. Software Requirements

- 1) Visual Studio Code: Visual Studio Code, commonly known as VS Code, is a free and highly versatile code editor developed by Microsoft that has become the primary tool for developers worldwide. It bridges the gap between a simple text editor and a complex development environment by being lightweight and fast while offering powerful features like smart code completion, built-in debugging, and version control. Its greatest strength lies in its massive library of extensions, which allow users to customize the software to support almost any programming language or technology, from web development to artificial intelligence.

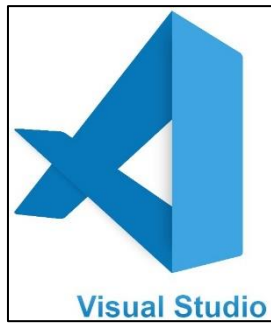


Fig. 1: Visual Studio Code

- 2) Supabase: Supabase is an open-source "Backend-as-a-Service" (BaaS) platform designed to help developers build and scale applications quickly by providing all the necessary backend infrastructure in one place. Often described as a powerful alternative to Google Firebase, Supabase is built on top of PostgreSQL, a highly reliable and advanced database system that allows for complex data management and relationships. It offers a suite of integrated tools, including secure user authentication, real-time data synchronization, file storage, and serverless functions, making it an ideal choice for modern applications like ChargeMate.



Fig. 2: Supabase

- 3) Netlify: Netlify is a leading cloud platform designed to simplify the deployment and hosting of modern web applications by automating the entire development-to-production workflow. It stands out for its seamless integration with version control systems like GitHub, allowing for "Continuous Deployment" where any code update is automatically built and pushed to a live, high-performance global network.



Fig. 3: Netlify

- 4) WebIntoApp: WebIntoApp is a specialized online platform that enables developers to transform their existing web applications into fully functional mobile apps for Android and iOS without the need for complex mobile-specific coding. By utilizing a "WebView" wrapper, the service allows a website's content to be packaged as a downloadable application, making it an

excellent bridge for projects that need to be accessible via app stores. For a project like ChargeMate.

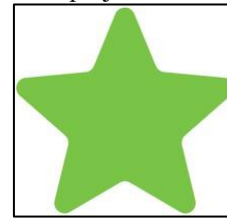


Fig. 4: WebIntoApp

### C. System Architecture

The system architecture of ChargeMate is built on a modular, cloud-based framework designed to handle real-time data processing and intelligent user interactions seamlessly. At the frontend, the platform provides a responsive user interface—developed with modern web technologies and converted for mobile use via WebIntoApp—that allows drivers to view interactive maps and manage their charging schedules. This frontend communicates through secure APIs with a backend powered by Supabase, which manages a PostgreSQL database for storing user profiles, station metadata, and reservation logs while handling secure authentication. The "brain" of the system is an AI service layer that utilizes machine learning algorithms to analyze historical usage patterns, real-time battery data, and traffic conditions to predict station availability and suggest the most efficient charging windows. To ensure the data is accurate, the architecture integrates external APIs such as Google Maps for precise navigation and live EV infrastructure databases for up-to-the-minute station status. Finally, the entire web ecosystem is hosted and deployed through Netlify, ensuring high availability and fast load times. This multi-tiered structure ensures that ChargeMate is scalable, secure, and capable of delivering fast, data-driven recommendations that eliminate wait times and optimize the charging experience for every user. predict peak activity periods, thereby improving operational efficiency and resource utilization. Additionally, the Smart Receptionist's AI algorithms can continuously learn and adapt to user preferences and behaviors, enhancing the overall user experience over time. Beyond the basic structural components, ChargeMate's architecture incorporates a sophisticated data synchronization layer that continuously pulls live telemetry and status updates from global charging network providers to ensure data integrity and minimize errors. The core AI engine utilizes advanced predictive modeling, such as time-series forecasting, to analyze peak usage hours and estimate the exact duration a vehicle will occupy a charging port before it even arrives. This intelligence is coupled with a dynamic route-optimization module that calculates the energy consumption required to reach a station based on the vehicle's current state-of-charge, weather conditions, and real-time traffic data. To manage high volumes of concurrent users, the backend implements a serverless logic approach through Supabase and Netlify, allowing the system to scale its processing power automatically during high-demand periods without performance lag or system crashes.

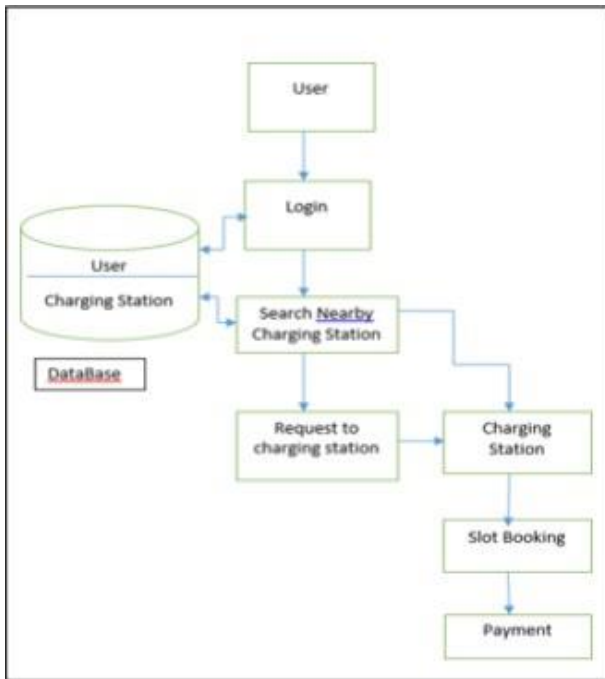


Fig. 5: Architecture

#### IV. CONCLUSION

ChargeMate represents a significant advancement in electric vehicle infrastructure management by successfully integrating artificial intelligence with real-time data to solve the most pressing challenges of modern EV ownership. By offering a unified platform for station discovery and smart scheduling, the system effectively eliminates range anxiety and reduces the logistical hurdles associated with charging downtime and long wait times. The project demonstrates how modern cloud technologies and predictive algorithms can optimize power distribution and improve the overall efficiency of the sustainable transportation network.

##### A. Future Scope:

The future scope of ChargeMate lies in its potential to integrate with autonomous vehicle technology, enabling self-driving cars to navigate and charge themselves without any human intervention. There is a significant opportunity to incorporate Vehicle-to-Grid (V2G) capabilities, allowing the platform to manage energy flow back into the power grid, thereby turning electric vehicles into mobile energy storage units that support grid stability.

#### REFERENCES

- [1] M. Al-Garni proposed a paper that explored the application of machine learning to enhance the management of demand complexities in a 2022 article in the Journal of Sustainable Energy [1].
- [2] S. K. Kim discussed the role of IoT-enabled sensors and their real-time monitoring capabilities for charging station availability in a 2023 article in the IEEE Transactions on Smart Grid [2].
- [3] A. Peterson applied qualitative research to understand how EV owners utilized real-time data and scheduling apps in a 2021 article in the International Journal of Transportation Research[3].

- [4] R. Gupta developed a predictive framework utilizing deep learning to forecast station occupancy and wait times in a 2022 article in AI in Automotive Engineering [4].
- [5] L. Martinez explored the integration of vehicle-to-grid (V2G) communication protocols within urban charging systems in a 2023 article in Power Systems and Energy Management [5].
- [6] J. Wang investigated the impact of cloud-based navigation tools on EV energy efficiency in a 2022 article in the Journal of Green Mobility [6].
- [7] H. Zhang introduced the use of neural networks to monitor battery health during high-speed charging sessions in a 2023 article in the Battery Technology Review [7].
- [8] F. Silva proposed a cooperative scheduling algorithm that allowed vehicles to book slots in advance in a 2021 article in the Smart City Logistics Print Edition [8].
- [9] T. Smith and D. Johnson explored the role of Backend-as-a- Service (BaaS) platforms in supporting scalable mobile infrastructure in a 2022 article in the Journal of Software Engineering [9].
- [10] Y. Zhao discussed the future of autonomous EV charging and its integration into smart city ecosystems in a 2023 article in the World Electric Vehicle Journal [10].