International Journal of Advance Research Publication and Reviews

Vol 03, Issue 10, pp 821-823, October, 2026

EVCHARGEX: SMART EV CHARGING STATION MANAGEMENT SYSTEM

Pradeep M[1], Sharmitha C[2], Prijitha S[3], Rithika R[4], Saranya M[5]

Department of Computer Science and Engineering, Sri Shakthi Institute of Engineering and Technology, Coimbatore, Tamil Nadu, India
Corresponding author: pradeepm1658@gmail.com

ABSTRACT :

The growing adoption of electric vehicles increases the need for convenient access to charging-station information. This paper presents EVChargeX, a web-based Smart EV Charging Station Management System designed to help users discover nearby charging stations within a 50 km radius and provide administrators with a separate interface for station management. The system separates user and administrator access through role-based login interfaces. Location-based station discovery uses the user's location, when permission is granted, and station-coordinate data to identify nearby options. A distance calculation can be used to filter stations by the specified radius. The application is organized around a web frontend, application services, station records, and map/location integration. The administrator interface is intended to support maintaining station information, while the user interface presents relevant station details. The project report describes additional functions such as booking, route assistance, and recommendations; these functions should be reported as implemented only where confirmed by the final working build. The proposed platform aims to make charging-station discovery more organized and improve access to station information. Further evaluation with verified station data and measured test results is required to quantify performance and usability.

Keywords: Electric Vehicles, Charging Station Management, Location-Based Services, Geolocation, Haversine Distance, Role-Based Access

1. INTRODUCTION

Electric vehicles (EVs) are increasingly used as an alternative to vehicles powered by conventional fuels. As EV adoption grows, drivers need accessible information about charging locations to plan trips and reduce the effort required to find a suitable charging point. Station discovery can be inconvenient when information is distributed across different sources or when users cannot quickly compare locations. EVChargeX is a web-based Smart EV Charging Station Management System that brings station discovery and administrative station management into one application. Its central user requirement is to show nearby charging stations within a 50 km radius. The application also provides separate login interfaces for users and administrators so that user- facing functions and station-management functions can be accessed through distinct portals.

1.1 Problem Statement

EV users may have difficulty identifying charging stations close to their current location and accessing organized station information. Administrators also need a structured way to maintain station records. The project addresses these needs through location-based station discovery and a separate administration interface.

1.2 Objectives

The objectives are to (i) provide a user interface for finding nearby EV charging stations within 50 km, (ii) present station information available in the configured data source, (iii) separate user and administrator access, and (iv) provide an administrative interface for maintaining charging-station information.

2. SYSTEM OVERVIEW

The system is organized into a presentation layer, application logic, station data storage, and location/map services. Users interact with the frontend to sign in and search for stations. The location service can obtain the browser location after permission is granted. Station coordinates and the selected radius are then used to identify stations that meet the proximity requirement. Administrators use a separate portal to access station-management functions permitted by the application.

2.1 User and Administrator Portals

The user portal is intended to provide access to the station locator and the station details supported by the current build. The administrator portal is intended to maintain station records and related information. Role separation helps keep administrative operations distinct from ordinary user activities.

2.2 Technology Stack

The project report identifies HTML, CSS, and JavaScript for the frontend, a web server exposing REST-style APIs, a database for station and user-related records, and Google Maps JavaScript API/browser Geolocation integration for map and location functions. The report contains inconsistent framework/database descriptions; the exact backend framework and database should be confirmed against the working source code before final submission.

3. METHODOLOGY

The station-discovery workflow begins when a user signs in and opens the station locator. If location permission is granted, the application obtains the current coordinates. The system compares the user location with the coordinates stored for each charging station, filters the stations by the 50 km radius, and displays the matching station records. If location permission is denied or location data is unavailable, location-based results may be limited.

3.1 Distance-Based Filtering

The project report refers to the Haversine formula for distance calculation. Given the latitude and longitude of the user and a station, the formula estimates the great-circle distance between the two coordinate points. A station is included in the nearby list when its calculated distance is less than or equal to 50 km. The result depends on the accuracy of the user coordinates and the station coordinates. For latitude φ and longitude λ expressed in radians, the Haversine calculation may be expressed as:

$$a = \sin^2(\Delta\varphi/2) + \cos(\varphi_1)\cos(\varphi_2)\sin^2(\Delta\lambda/2);\ d = 2R \cdot \operatorname{asin}(\sqrt{a})$$

where R is the Earth's mean radius and d is the calculated distance. This equation should be retained only if the implemented code uses this calculation or an equivalent verified distance method.

3.2 Access Control Workflow

The application accepts login credentials and directs an authenticated user to the corresponding portal according to the configured role. Users access the user-facing station functions, while authorized administrators access the management interface. Authentication and role-handling details should be aligned with the actual implementation before publication.

3.3 Station Management

The administrator interface is intended to maintain station details such as name, location, connector information, pricing, and status where those fields are supported by the current application. The accuracy of the user-facing station list depends on the quality and freshness of the underlying station data.

4. IMPLEMENTATION AND RESULTS

The project report describes a web interface, location-based station discovery, separate user and administrator portals, station information management, and additional proposed or reported modules. The core workflow relevant to this paper is the retrieval and display of charging stations within the configured 50 km radius. The user interface and station- management interface provide the interaction points for the two roles.

4.1 Functional Outcome

The intended functional outcome is a consolidated interface through which users can locate nearby charging stations and administrators can manage station information. The 50 km filter narrows the station list to the requested vicinity when valid user-location permission and station-coordinate data are available.

4.2 Evaluation and Limitations

The supplied project report does not provide a reproducible quantitative evaluation, such as test-case pass rates, response- time measurements, location-error measurements, or a verified count of stations tested. Therefore, this draft does not claim a measured improvement in search time or system accuracy. Before journal submission, the team should run documented tests and insert actual observations, screenshots, and numerical results. Real-time charger availability should not be claimed unless the application is connected to a reliable live data source.

5. DISCUSSION

A single platform for station discovery and station administration can make station information easier to access and maintain. Location-based filtering gives users a clear search boundary and can reduce the number of distant stations shown. However, the usefulness of the result depends on accurate coordinates, browser location permission, connectivity to map/location services, and regularly maintained station data. The current report also describes booking, route assistance, and station recommendations; each should be included as a demonstrated result only after verification against the running system.

6. CONCLUSION AND FUTURE WORK

This paper presents EVChargeX, a Smart EV Charging Station Management System focused on location-based discovery of charging stations within a 50 km radius and separate user and administrator access. The system is intended to organize charging-station information and provide an interface for station management. The next steps are to validate the complete implementation, measure the station-search workflow using a defined test set, verify database persistence and role-based access, and document the results. Future enhancements may include reliable real-time availability integration, improved route planning, enhanced station ranking, and stronger security and data-quality checks.

ACKNOWLEDGEMENTS

The authors thank the Department of Computer Science and Engineering, Sri Shakthi Institute of Engineering and Technology, Coimbatore, and the project supervisor for their guidance and support. Please confirm the preferred acknowledgement wording with the project team and supervisor.

REFERENCES :

- Google. (n.d.). Maps JavaScript API documentation. Google for Developers. https://developers.google.com/maps/documentation/javascript
- Mozilla. (n.d.). Geolocation API. MDN Web Docs. https://developer.mozilla.org/en-US/docs/Web/API/Geolocation_API
- World Wide Web Consortium. (2024). Geolocation. W3C. https://www.w3.org/TR/geolocation/