iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 14 **Issue:** IV **Month of publication:** April 2026

DOI: https://doi.org/10.22214/ijraset.2026.79737

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue IV Apr 2026- Available at www.ijraset.com

Electric Vehicle Charging Station App

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Abstract: ***The demand for electric vehicles (EVs) is increasing rapidly due to high fuel prices and rising environmental concerns. EVs are considered a better option compared to petrol and diesel vehicles because they help reduce pollution and harmful emissions. However, even with these advantages, EV users still face some difficulties in daily use. One of the main problems is finding nearby charging stations, especially in unknown areas. This situation leads to range anxiety, where users worry about their vehicle battery getting discharged without access to a charging point. To solve this issue, this project presents an Android-based mobile application that helps users locate EV charging stations easily. The main goal of the application is to provide a simple, fast, and easy-to-use platform for EV users. The app uses GPS to identify the user's current location and shows nearby charging stations on a map. It also provides useful details such as station location and navigation support to help users reach the station without confusion. The application is developed using Android Studio, while Firebase is used as a cloud database for storing and managing data. Google Maps API is integrated to display maps and provide navigation. The design of the app is kept simple so that even new users can operate it without any technical knowledge. This system improves the overall experience of EV users by saving time and reducing effort in searching for charging stations. It also supports the adoption of electric vehicles by making charging facilities more accessible. In future, features like slot booking, online payment, and real- time updates can be added to enhance the system further.***

Keywords: Electric Vehicle (EV), EV Charging Station, Android Application, GPS Tracking, Firebase Database, Google Maps API, Location-Based Services, Mobile Application, Smart Transportation, Real-Time Data

I. INTRODUCTION

In the past few years, electric vehicles (EVs) have become more popular due to increasing fuel costs and environmental issues. Petrol and diesel vehicles release harmful gases that cause air pollution and contribute to global warming. To reduce these problems, people are gradually shifting towards electric vehicles, which are cleaner and more environmentally friendly.

Even though EVs offer many benefits, there are still certain challenges that affect their usage. One of the major issues is the limited availability of charging stations. Unlike petrol pumps, EV charging stations are not available everywhere, which creates inconvenience for users, especially while traveling to new places.

Another problem is the lack of proper information about charging stations. Users often face diffiulty in finding the exact location, availability, or directions to reach a station. This results in confusion, time loss, and range anxiety.

To overcome these issues, this project proposes an Android-based application that helps users easily find nearby EV charging stations. The app uses GPS to detect the user's location and displays nearby stations on a map. It also provides navigation support so that users can reach the station without any difficulty.

The main aim of this project is to create a simple and effective solution that improves user experience, saves time, and encourages the use of electric vehicles.

II. LITERATURE REVIEW

1) Many studies highlight the increasing use of electric vehicles and the importance of proper charging infrastructure.
2) Various mobile applications are developed to help users locate nearby charging stations using map-based services.
3) Most existing systems mainly focus on showing location but do not provide complete details about the stations.
4) Some applications do not offer real-time updates, which may cause inconvenience to users.
5) Many systems have complex interfaces that are difficult for beginners to understand.
6) Studies show that users prefer applications that are simple, quick, and easy to use.
7) GPS and Google Maps API are commonly used for accurate location tracking and navigation.
8) Cloud databases like Firebase are widely used for real-time data storage and management.
9) Some advanced applications include booking and payment features, but these are not available in all systems.
10) There is still a need for a system that provides all features such as real-time updates, easy navigation, and user-friendly design in one application

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III. SYSTEM ARCHIETECTURE

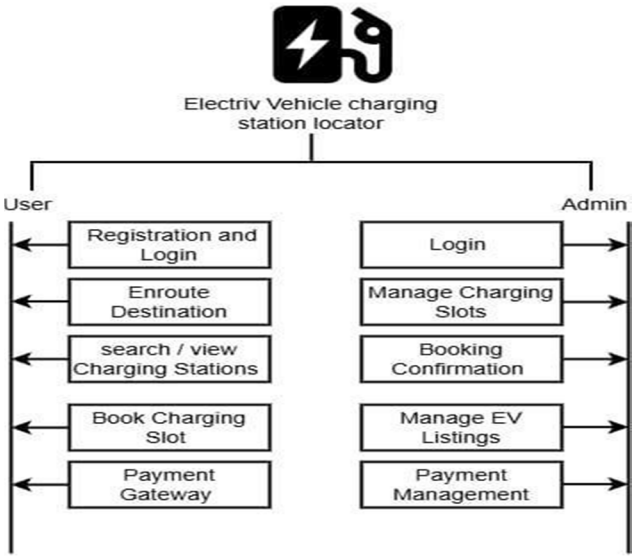


Figure:-System Architecture Diagram

The diagram represents the basic working flow of an Electric Vehicle Charging Station Locator system. The system is mainly divided into two parts: User and Admin.

On the user side, the first feature is registration and login. This allows a new user to create an account and access the system. After logging in, the user can enter their destination or route details. Based on this information, the system displays nearby charging stations available along the selected route.

The user can then search and view charging stations. This includes information such as station location, available charging slots, charging type, and other related details. If the user finds a suitable station, they can book a charging slot in advance. After completing the booking process, the user can make payment through the payment gateway.

On the admin side, the admin first logs into the system. The admin is responsible for managing charging slots, which includes updating slot availability, booked slots, and maintenance status. The admin also confirms the bookings made by users.

In addition, the admin manages EV listings, including charging station details, EV-related information, and other updates. Through the payment management module, the admin can track payments, view transaction history, and monitor pending payments.

Overall, this system helps users easily find suitable charging stations, book charging slots, and complete payments, while also helping the admin efficiently manage stations, bookings, and payment activities.

IV. METHODOLOGY

The development of this application is carried out in a systematic way to ensure proper working and reliability.

1) Requirement Analysis: The problems faced by EV users were studied, and the need for an application to locate charging stations was identified.
2) System Design: The structure of the system was planned, including UI design and interaction between modules.
3) Application Development: The app was developed using Android Studio with Java/Kotlin. Features like login, maps, and database integration were implemented.
4) Database Integration: Firebase is used to store and manage data with real-time updates.
5) Testing and Debugging: The system was tested to find errors and improve performance.
6) Deployment: The application is ready to be installed on Android devices after testing.

V. TECHNOLOGIES USED

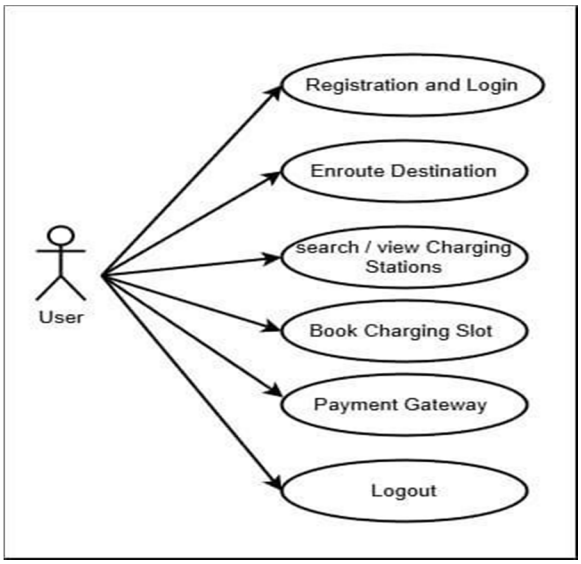
The proposed system is developed using a combination of modern tools and technologies to ensure smooth performance and user-friendly operation. The main technology used for application development is Java/Kotlin in Android Studio. Android Studio provides a powerful environment for designing, coding, and testing mobile applications. It also offers built-in tools for debugging and performance optimization, which helps in creating a reliable application.

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For location tracking and map visualization, Google Maps API is used. This technology helps in displaying maps, identifying the user's current location using GPS, and showing nearby EV charging stations. It also provides navigation support, which allows users to find the shortest route to reach a selected charging station easily.

Firebase is used as a cloud-based database for storing and managing application data. It allows real-time data synchronization, which means users can get updated information about charging stations without refreshing the app. Firebase also provides authentication services, which help in implementing secure user login and registration features.

GPS (Global Positioning System) plays an important role in detecting the real-time location of the user. It helps the application to provide accurate results based on the user's current position. Additionally, XML is used for designing the user interface of the application, ensuring a clean and simple layout.Overall, these technologies work together to make the system efficient, reliable, and easy to use for EV users.



1) User Authentication Module

This module is responsible for User registration and login.

- It allows new users to create an account
- It verifies existing users during login
- It ensures system security by validating user credentials

2) Location and Navigation Module

This module handles the user's location and route details.

- The user enters their destination or route
- The system detects current location
- It suggests nearby charging stations along the route

3) Charging Station Search Module

This is the core module of the system.

- It displays nearby charging stations
- It shows details like location, availability, and charging type
- It helps users choose the best station

4) Slot Booking Module

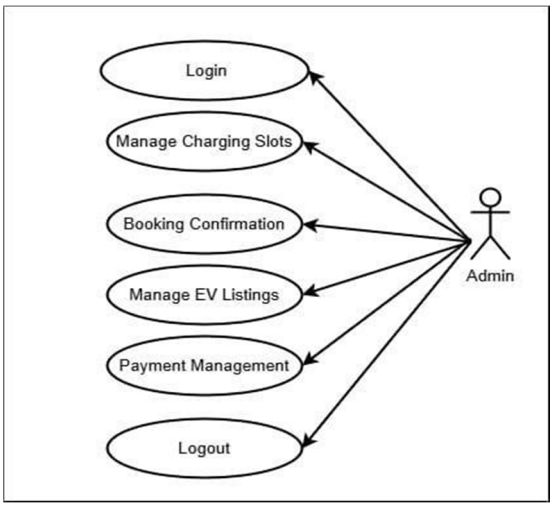
This module allows users to book a charging slot in advance.

- Users select an available slot
- Booking is confirmed
- Time-based reservation is done

5) Payment Module

This module manages the online payment process.

- Users can pay after booking a slot
- Supports different paymentmethods



6) Admin Management Module

This module is used by the admin to control the system.

- Admin logs into the system
- Manages users and system activities
- Maintains overall system performance

7) Slot Management Module

This is an admin-side module for managing charging slots.

- Updates available and booked slots
- Handles maintenance status
- Controls slot availability

8) EV / Station Management Module

This module manages charging station information.

- Adds new stations
- Updates existing station details
- Maintains station database

9) Payment Management Module

This module is used by admin to track and manage payments.

- Monitors transactions
- Maintains payment history
- Handles pending payments

VI. FEATURES OF THE SYSTEM

1) Simple and user-friendly interface
2) Automatic GPS-based location detection
3) Nearby charging station search
4) Real-time updates of station information
5) Navigation support using maps

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6) Secure login system
7) Smooth and fast performance

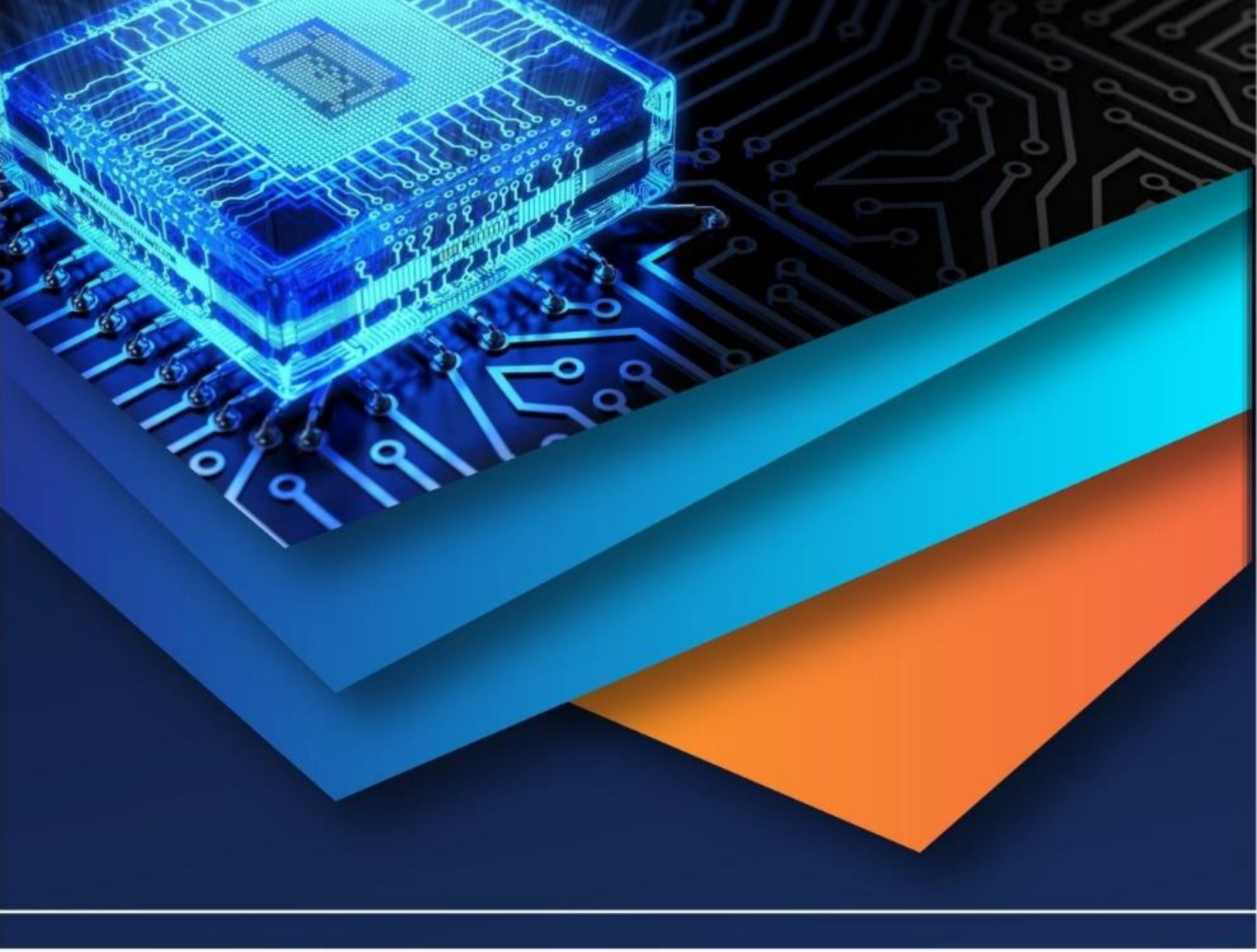
VII. CONCLUSION

This project provides a useful solution for EV users by helping them find nearby charging stations easily. The Android application allows users to locate stations, get directions, and access necessary information without difficulty. The system is designed to be simple and efficient, which helps in saving time and reducing effort. By improving access to charging infrastructure, the application also supports the growth of electric vehicles. In future, additional features such as booking, payment integration, and advanced functionalities can be added to improve the system further. Overall, this project contributes to smart and eco- friendly transportation.

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