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Charge EV: EV Station Locator Web Application

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Abstract: ***The rapid growth of Electric Vehicles (EVs) is transforming the transportation sector globally. However, one of the primary concerns among EV users is locating reliable and available charging stations efficiently. This paper presents ChargeEV, a web-based Electric Vehicle charging station locator application designed to provide real-time, location-based services using GPS and mapping technologies. The system integrates frontend web technologies, backend server architecture, and a structured database to deliver accurate information regarding station availability, charging types, operational hours, and distance calculation. The proposed solution aims to reduce range anxiety, improve infrastructure utilization, and promote sustainable mobility. The system is scalable, cost-effective, and accessible through standard web browsers without requiring dedicated mobile applications.***

Keywords: Electric Vehicles, EV Charging Station, Web Application, GPS, Google Maps API, Sustainable Transportation, Smart Mobility.

I. INTRODUCTION

The transportation sector significantly contributes to greenhouse gas emissions and environmental pollution. To reduce carbon emissions, countries like India are actively promoting Electric Vehicle adoption through subsidies and infrastructure development programs. Although EV adoption is increasing, users still face difficulties in locating charging stations during travel. This issue leads to *range anxiety*, a psychological concern where users fear running out of battery before reaching a charging facility.

Charge EV is proposed as a browser-based web application that allows EV users to:

1) Detect their current location automatically
2) View nearby EV charging stations
3) Check availability status
4) Calculate distance from current location
5) Get charging type information (Fast / Normal / DC / AC)

This system enhances user convenience and supports smart city infrastructure development.

II. LITERATURE SURVEY

The goal of the EVSC paper is to create a comprehensive and sustainable electric vehicle charging and car booking system. The project aims to provide a user-friendly platform that enables individuals to conveniently and easily book electric vehicles for rent and access electric vehicle charging stations. This system will promote the adoption of electric vehicles and reduce carbon emissions associated with traditional gasoline-powered vehicles.

1) Existing EV charging Networks Include

- Tesla Supercharger Network
- ChargePoint
- PlugShare

2) Most existing systems

- Are brand-specific
- Require mobile app installation
- Do not always provide real-time slot availability
- Have limited open-access APIs

Research studies indicate that web-based centralized platforms increase accessibility and reduce dependency on proprietary systems. Therefore, a lightweight browser-accessible solution like ChargeEV can improve usability and scalability.

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III.PROBLEM STATEMENT

Despite the increasing number of EV charging stations, users face several challenges:

1) Lack of centralized information system
2) Inaccurate or outdated availability data
3) No real-time distance calculation
4) Limited cross-platform accessibility
5) Poor user interface in some existing systems

There is a need for a scalable, user-friendly, real-time web application that provides accurate EV charging station information.

IV.SYSTEM ARCHITECTURE

The ChargeEV system is designed using a three-layer architecture:

1) Presentation Layer (Frontend)

- HTML
- CSS
- JavaScript
- Responsive UI design
- Map integration

2) Application Layer (Backend)

- Node.js / Python Flask
- REST API services
- Location processing

3) Data Layer (Database)

- MySQL / MongoDB
- Stores:
    - Station ID
    - Name
    - Latitude & Longitude
    - Charging Type
    - Availability Status
    - Contact Details
    - Operating Hours

Google Maps API is used for displaying station markers and route navigation.

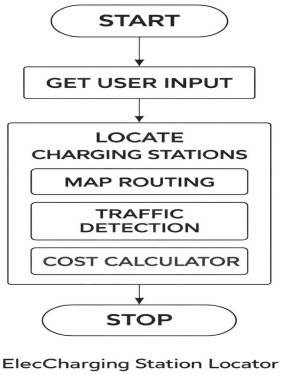


Fig System Architecture Diagram

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V. METHODOLOGY

The system development follows these steps:

1) Step 1: Requirement Analysis

Understanding user needs such as real-time location tracking and charging availability.

2) Step 2: System Design

Designing architecture diagram, database schema, and user interface.

3) Step 3: Implementation

- GPS integration using browser Geolocation API
- Distance calculation using Haversine Formula
- API integration for station data

4) Step 4: Testing

- Functional testing
- Usability testing
- Performance testing

5) Step 5: Deployment

Hosting using cloud services.

VI. DISTANCE CALCULATION MODEL

To calculate the distance between user location and charging station, the **Haversine formula** is used:

$$d = 2r \cdot \arcsin\left(\sqrt{\sin^2\left(\frac{\Delta\phi}{2}\right) + \cos(\phi_1)\cos(\phi_2)\sin^2\left(\frac{\Delta\lambda}{2}\right)}\right)$$

Where:

- r = Radius of Earth
- φ = Latitude
- λ = Longitude

This ensures accurate geographic distance calculation.

VII. APPLICATIONS

1) Urban EV commuters
2) Highway travelers
3) Fleet management systems
4) Government EV monitoring systems
5) Smart city infrastructure

VIII. FUTURE SCOPE

1) Online slot booking system
2) Payment gateway integration
3) AI-based demand prediction
4) Integration with IoT-enabled smart chargers
5) Mobile application development
6) Integration with government EV portals

IX. CONCLUSION

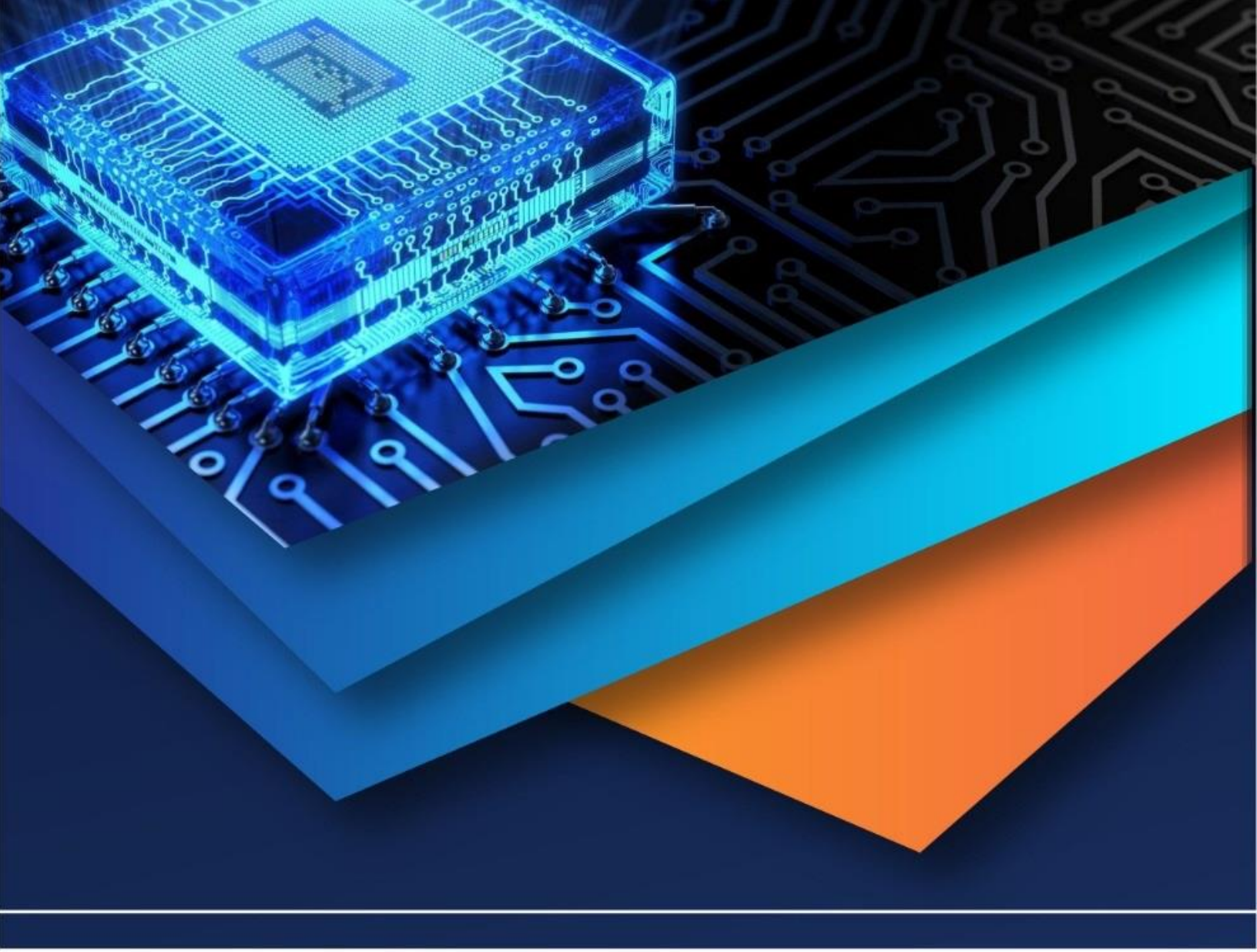
Charge EV provides an efficient, scalable, and user-friendly solution for locating EV charging stations using web technologies. By combining GPS tracking, database management, and map visualization, the system improves user confidence and encourages EV adoption. The proposed solution can be further enhanced using AI, IoT, and cloud computing technologies to build a complete smart EV ecosystem.

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