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Zaptrack: An Intelligent Electric Vehicle Route Optimizer with Real-Time Charging Station Integration

Swati Gurav, Mohammad Maaz Shaikh, Mohammed Zaid Shaikh,Ammar Siddiqui, Faraz Siddiqui
Students, Department of IT
MH Saboo Siddik College of Engineering, Mumbai, India

Abstract: *The rapid advancement in electric vehicle (EV) technology necessitates equally innovative software solutions to support their adoption and usability. Zaptrack is a novel web-based EV route planning application designed to optimize travel routes for electric vehicles by minimizing charging stops and ensuring optimal battery utilization. Leveraging the power of the MERN stack and integrating GraphHopper and Overpass APIs, the system dynamically computes the most efficient routes while identifying strategically located charging stations. The application not only calculates the route using the A* algorithm, considering real-time road conditions and EV-specific constraints such as battery capacity and consumption rate, but also visually represents the route and stations using Leaflet. This ensures users receive intuitive, map-based guidance tailored to their vehicle's capabilities. Zaptrack stands out by combining robust backend computations with a user-friendly frontend interface, providing a seamless experience for EV users. This research paper outlines the architectural design, core functionalities, and the technological innovations embedded in Zaptrack, while also evaluating its performance and potential for real-world deployment. The proposed solution aims to bridge the gap between rising EV usage and the need for intelligent route management systems, contributing significantly to the fields of smart transportation and sustainable urban mobility.*

Keywords: Electric Vehicle, Route Optimization, A* Algorithm, Charging Stations, GraphHopper API, Overpass API, MERN Stack

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