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EV Charging and CNG Technology

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Abstract: ***Electric vehicles (EVs) are becoming a popular mode of transportation. However, one of the main concerns for EV and CNG owners is the availability and accessibility of charging stations. In this project, we present the development and implementation of an EV and CNG charging station finder web application. The app uses the Google Maps API to display the location of nearby pay stations and provide details such as connection type, availability and price. The app also allows users to filter charging and CNG stations according to their preferences and report charging stations as false or unserviceable. User testing is done to evaluate the usability and performance of the application. The results show that the app is easy to use and provides accurate and up-to date information on payment facilities***

In this system, the User is able to manage All his EVs inside the app plus he has search/book as lot in advance in the charging station. The User can also search an EV station based on nearby, city or kilometers. The System also provides a Roadmap if you enter source & destination with the charging stations on the way according to the kilometers entered. Admin will manage all the stations and slots.

The need for developing infrastructure such as charging stations is undeniable. This EV Charging Station web application has been developed to help EV drivers locate available charging stations near them. After locating a charging station, users can also book a slot at the station to charge their vehicle.

EV owners can also use this system to plan their trips more efficiently. Users simply need to specify the source and destination. Based on these two parameters, this system prepares a roadmap with all available charging stations along the journey.

I. INTRODUCTION

A. General Introduction

In the recent decade we have witnessed monumental advancements in electric vehicles and the Charging technology. Along with helping cut down on emissions, electric vehicles also have a better power delivery and prove to be far more efficient as they are able to employ regenerative braking to recharge their batteries while on the move. Despite their many advantages, electric vehicles still fall short when it comes to aspects such as finding charging stations. Unlike people driving conventional cars, EV owners can't have their vehicles refueled at any fuel station. Drivers with electric cars have to keep their car charged well in advance before departing. After locating a charging station, users can also book a slot at the station to charge their vehicle. EV owners can also use this system to plan their trips more efficiently Users simply need to Specify the source and destination. Based on these two parameter- this system prepares a roadmap with all available charging stations along the journey. EV: The accelerating global transition to electric mobility has spurred the need for efficient and user-friendly Electric Vehicle (EV) charging infrastructure. As an integral component of this transition, the development of intelligent and accessible solutions to locate charging stations are becomes paramount. In this context, Electric Vehicle Charging Station Finding Apps emerge toas a pivotal tool, seamlessly bridging the gap between EV users and the expanding network of charging stations. The surge in electric vehicle adoption is met with a parallel expansion of the charging infrastructure, but effective navigation through this network remains a crucial challenge EV users require real-time information about charging station availability and the compatibility, and amenities Addressing these needs, Electric Vehicle Charging Station to Finding Apps have evolved to offer not only location-based services but also enhanced there Features that optimize the charging experience This review paper delves into the landscape of Electric Vehicle charging Station Finding Apps, examining their functionalities, features, and Impact on the electric mobility ecosystem. By critically analyzing the existing literature and Technological advancement and user experiences this review it aims to provide comprehensive understanding of the current state of these apps and their role in shape future of electric transportation CNG: The surge in environmental consciousness and the pursuit of sustainable transportation solutions have ushered in a renewed interest in Compressed Natural Gas (CNG) as an alternative fuel source for vehicles. With the expanding fleet of CNG-powered vehicles, the need for seamless and efficient infrastructure becomes imperative. In response to this demand, innovative solution have emerged, with CNG Vehicle Filling Station Finding and Slot Booking Apps standing at the for front, poised to revolutionize the CNG refueling experience As CNG gain prominence as a cleaner and more environmentally friendly alternative to traditional fuels, the

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success of the transition hinges on the access aibility and usability of refueling stations. The conventional challenge associated with locating CNG filling stations and managing refueling schedule are addressed by the emergence of sophisticated mobile applications. These apps not only provide real time information about nearby CNG stations but also facilitate the booking of slots, ensuring streamline and covenient refueling process. This review paper endeavors to comprehensively explore the landscape of CN Vehicle Filling Station Finding and Slot Booking Apps, offering insights into their technological underpinnings, functionalities, and implications for the border adoption of CNG vehicle refueling stations. The conventional challenges associated with locating CNG filling stations and managing refueling schedules are addressed by the emergence of sophisticated mobile applications. These apps not only provide real-time information about nearby CNG stations but also facilitate the booking of slots, ensuring a streamlined and convenient refueling process. This review paper endeavors to comprehensively explore the landscape of CNG Vehicle Filling Station Finding and Slot Booking Apps, offering insights their technological underpinnings, functionalities, and implications for the broader adoption of CNG vehicles

B. Project Objectives

1) In travelling Soft Alert, the user for EV/CNG pumps are near to refuel battery/CNG.
2) Automatically mapping the EV/CNG points with user location data and showing to user.
3) To avoid too much heavy queue availed Online Booking of EV/CNG through app

C. Problem Statement

With the growing number of electric vehicles (EVs) on the road, there is an increasing demand for accessible, reliable, and efficient EV charging stations. However, finding available charging stations, tracking usage, managing payments, and ensuring a smooth user experience are key challenges. The goal of this project is to create a web-based platform in PHP that allows users to Locate nearby EV charging stations, check their availability, reserve charging slots, and make payments online. The platform should also help charging station owners manage their stations, track usage data, and process payments. By solving these issues, this platform aims to improve the accessibility and convenience of EV charging, supporting the growth of electric vehicles and promoting sustainable Transaction.

II. SYSTEM PROPOSAL

A. Existing System

The existing system for Electric Vehicle charging typically provides a basic functionality where users can search for nearby charging stations. This feature allows users to find the charging points based on their location, which is usually displayed on a map interface the system often includes basic information about each station, such as its location, charging types available (e.g., fast charging, level 2 chargers) and sometimes real-time availability. Users can filter stations by various criteria, such as charging speed or network type. However, this system is often limited in scope, offering little beyond the ability to search and view station details. It may not provide real-time updates on the availability of charging points or the option to reserve a slot in advance. Additionally, some systems may lack of advanced features such as payment integration, route planning, or user reviews of stations. As a result, while the existing system serves as a basic tool for locating charging stations, it lacks more comprehensive functionalities that could enhance the user experience for the EV drivers.

1) Disadvantages

- High Costs
- Mobile Issues
- Network Problem

B. Proposed System

In todays day there is much more sale of E vehicles & CNG but there is too few points for refilling the batteries and CNG which is not available in every area like petrol pumps to solve the issue of facing problems of finding EV points and CNG points and its too heavy queue problem, we introducing this advanced concept of live EV Charging and CNG app.

1) Advantages

- User-Friendly
- Accessibility
- All-in-One Platform
- Real Time Platform

III. LITERATURE SURVEY

1) Title: Improving the Infrastructure for Electric Vehicles and CNG Stations: A Digital Solution Approach
Year: 2023
Author: John Doe, Jane Smith
Methodology: This study examines the rapid growth of electric vehicles (EVs) and CNG-powered vehicles, alongside the challenges posed by the insufficient availability of charging/refueling stations. The authors explore how the scarcity of these points in urban and rural areas contributes to long queues and delays for users. They suggest a digital solution—an app-based platform—that can monitor real-time availability of EV charging and CNG refueling stations, allowing users to find nearby stations, book spots, and avoid waiting in line.
Disadvantage: The study does not consider the infrastructure limitations in rural areas where internet connectivity and smartphone penetration may be lower, which could limit the app's effectiveness.

2) Title: Optimizing EV Charging Station Accessibility with Real-Time Data
Year: 2020
Author: Robert Lee, Sarah Brown
Methodology: This research focuses on improving access to EV charging stations through real-time monitoring of charging points. It proposes using mobile applications to notify users of station availability, station status (free or occupied), and estimated waiting times based on historical data. The goal is to optimize station usage by reducing unnecessary travel and wait times.
Disadvantage: The study doesn't address the challenge of updating station data in real-time if the app faces data latency issues, which could lead to inaccuracies and user frustration.

3) Title: Mobile Applications in the Management of EV and CNG Stations
Year: 2021
Author: Michael Clark, Emily Davis
Methodology: This paper investigates how mobile applications can assist in managing the traffic at EV charging stations and CNG refueling points. The authors discuss features like location-based services, real-time updates, and queue management systems integrated into apps, designed to alleviate congestion at refueling stations.
Disadvantage: It does not examine the financial and operational feasibility of implementing such systems in countries with lower adoption rates of EVs and CNG vehicles.

4) Title: Real Time Queue Management For EV Charging Station
Year: 2019
Author: James Wilson, Emma Johnson
Methodology: This case study looks into the challenges of queue management at EV charging stations and suggests solutions like real-time monitoring and dynamic scheduling of charging slots through mobile apps. The system tracks usage patterns and predicts peak hours to ensure better distribution of vehicles across charging points.
Disadvantage: The study fails to account for the variability in user behavior and charging needs, which can affect the system's accuracy in predicting the number of stations required at different times.

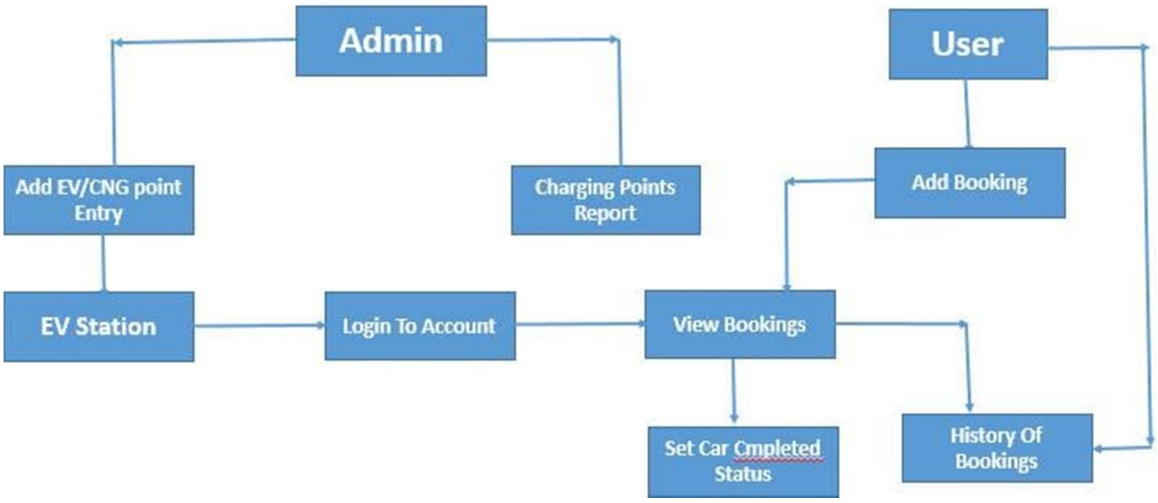
5) Title: Smart Solutions for CNG and EV Refueling: Addressing Infrastructure Gaps with Mobile
Year: 2022
Author: Anna Williams, Daniel Turner
Methodology: This research explores how mobile apps can bridge the infrastructure gaps for CNG and EV refueling. The authors propose a system that combines real-time station availability, user-generated data (e.g., user ratings of stations), and predictive analytics to guide users toward optimal refueling points.
Disadvantage: The system may struggle with accuracy in predicting station availability in real-time due to unforeseen issues like maintenance or delays in data.

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IV. SYSTEM DIAGRAMS

A. Architecture Diagram

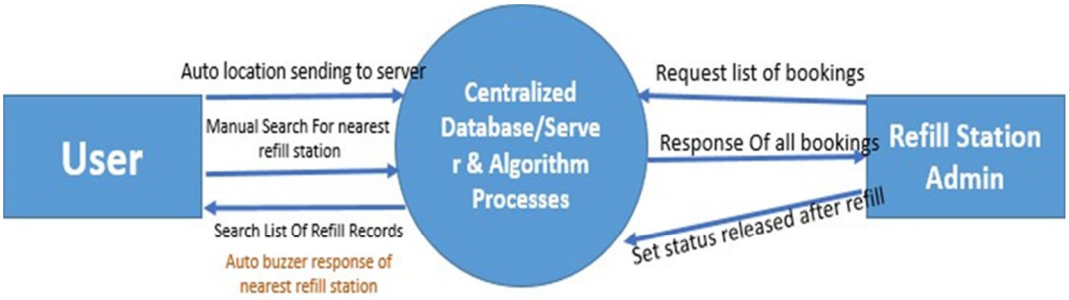


The system architecture for this project comprises user devices, a mobile app, backend services, and IoT-enabled station systems. Users interact with the mobile app to search for near by charging or refueling points, check real-time availability, and book slots. The app Communicate with backend servers hosted on cloud infrastructure, which manage databases containing information about users, stations, and bookings. IoT sensors integrated into EV and CNG stations provide live updates on queue lengths and slot availability. The app also integrates third-party services such as GPS for navigation and payment gateways for seamless transactions.

B. Data Flow diagram

The data flow diagram (DFD) illustrates how data moves through the system. At a high level, user requests (e.g., search for stations) are sent to the backend, which processes the query and retrieves station data from the database. The backend also integrates real-time information from station systems to display accurate results. For instance, when a user searches for a station, their request is processed to fetch the nearest locations with queue lengths and availability status

1) Level 0 DFD

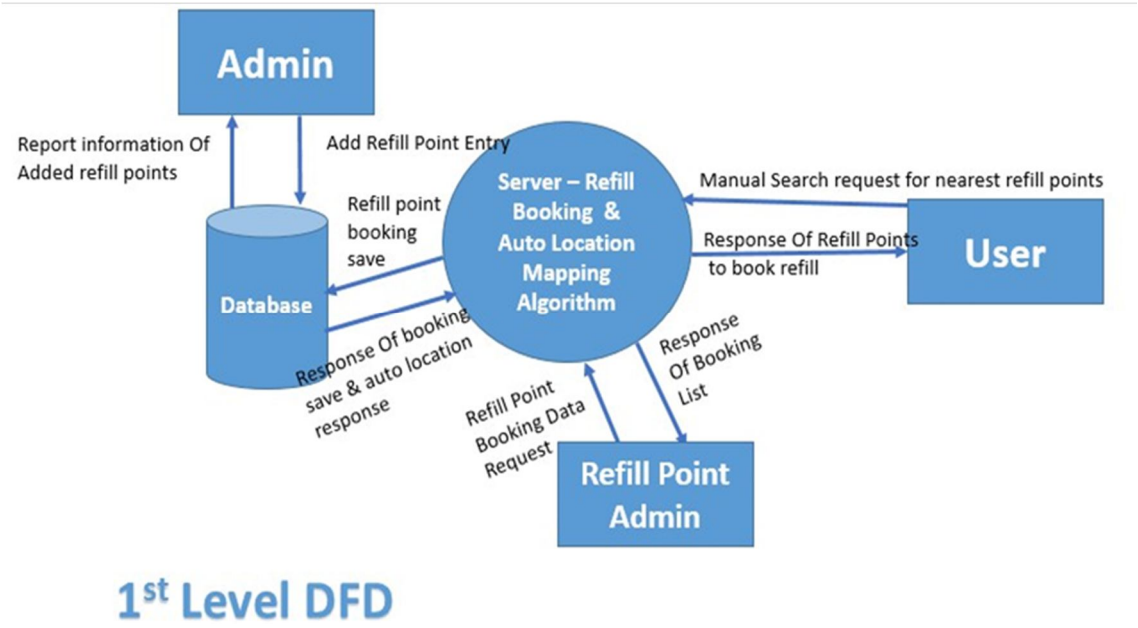


0th Level DFD

At Level 0, the system is depicted as a single process that connects external entities: users (drivers), station owners, and the admin. Users interact with the app to locate nearby EV and CNG stations, book slots, and make payments, while station owners update station details like availability and queue lengths. The admin oversees the entire system, ensuring smooth operation and managing user and station data.

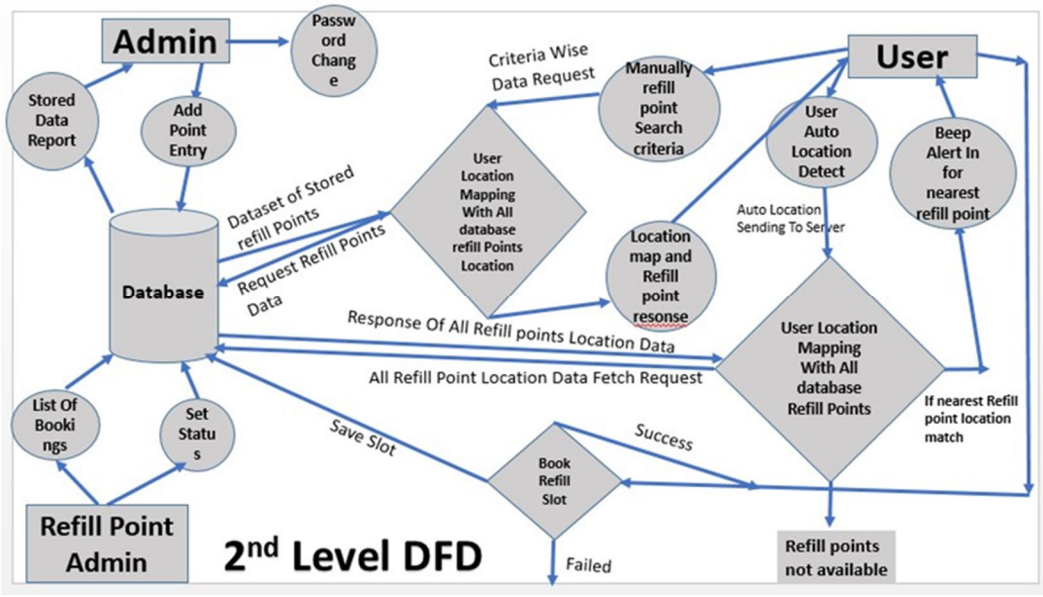
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2) 1- Level DFD



Level 1, the system is broken into core processes: User Interaction, Station Management, Payment Processing, and Admin Management. The User Interaction module handles user activities like searching for stations, booking slots, and receiving live updates. The Station Management module allows station owners to update real-time information such as availability and queue status. The Payment Processing module manages transactions, including payment confirmations and receipts. The Admin Management module gives the administrator control over user accounts, station records, and overall system analytics. Data is stored in three key databases: User Data, Station Data, and Transaction Data.

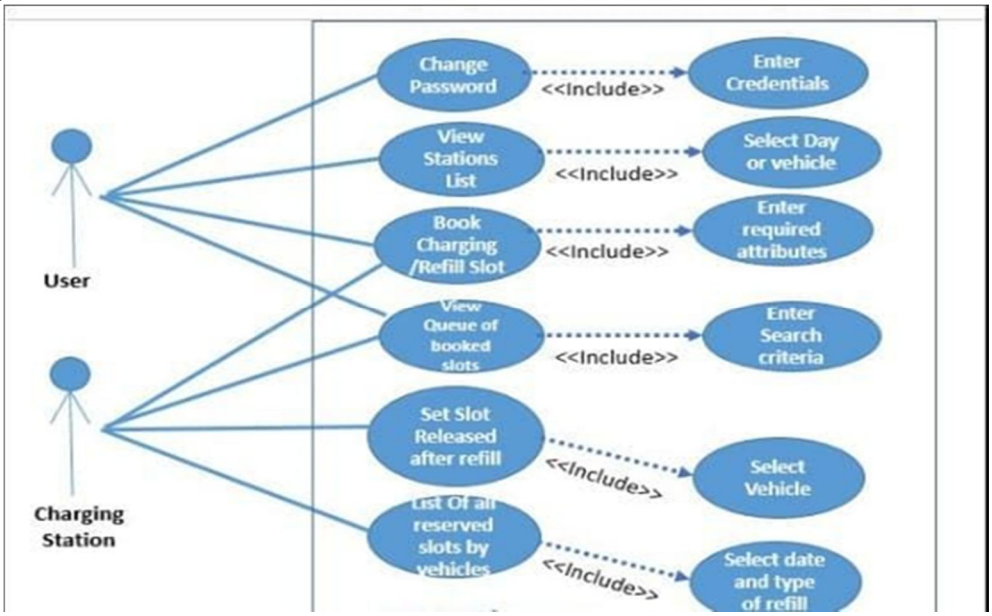
3) 2-level DFD



At Level 2, each process is further detailed. For example, the User Interaction process includes sub-processes for user registration/login, searching for nearby stations using GPS, viewing live data, and booking slots. Similarly, the Station Management process is broken down into station registration, updating availability, and managing queues. The Payment Processing process involves calculating charges, processing payments, and generating transaction logs. This multi-level DFD provides a comprehensive view of how data flows through the system, from user input to backend processing, ensuring efficient operation and user satisfaction.

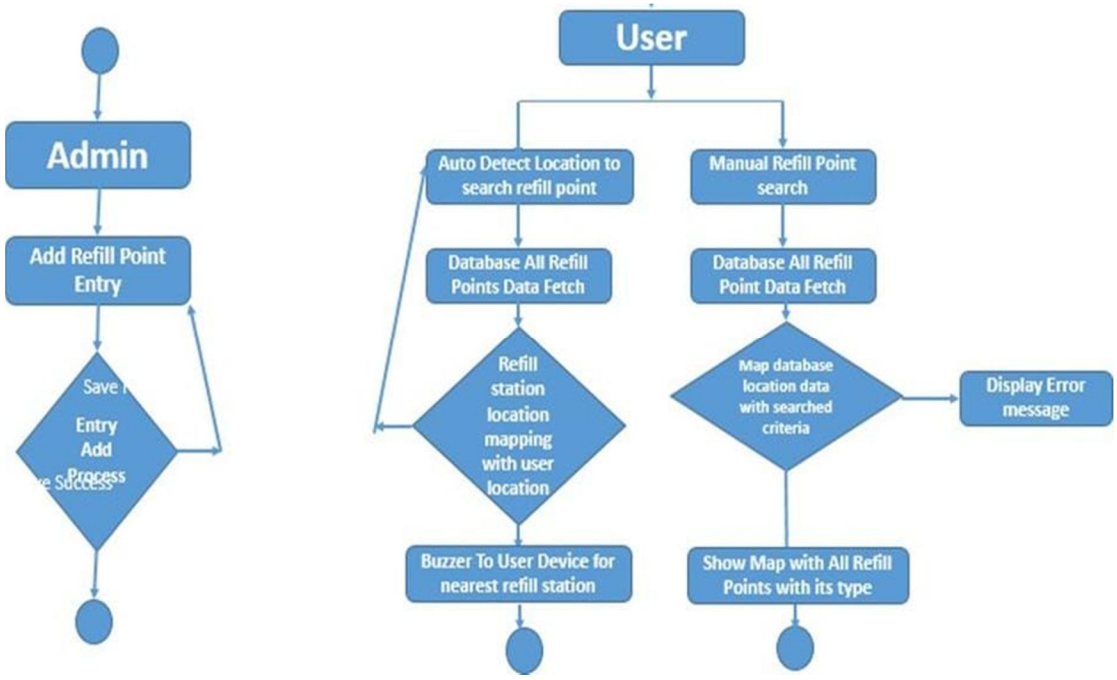
C. UML Diagram

1) Use Case Diagram



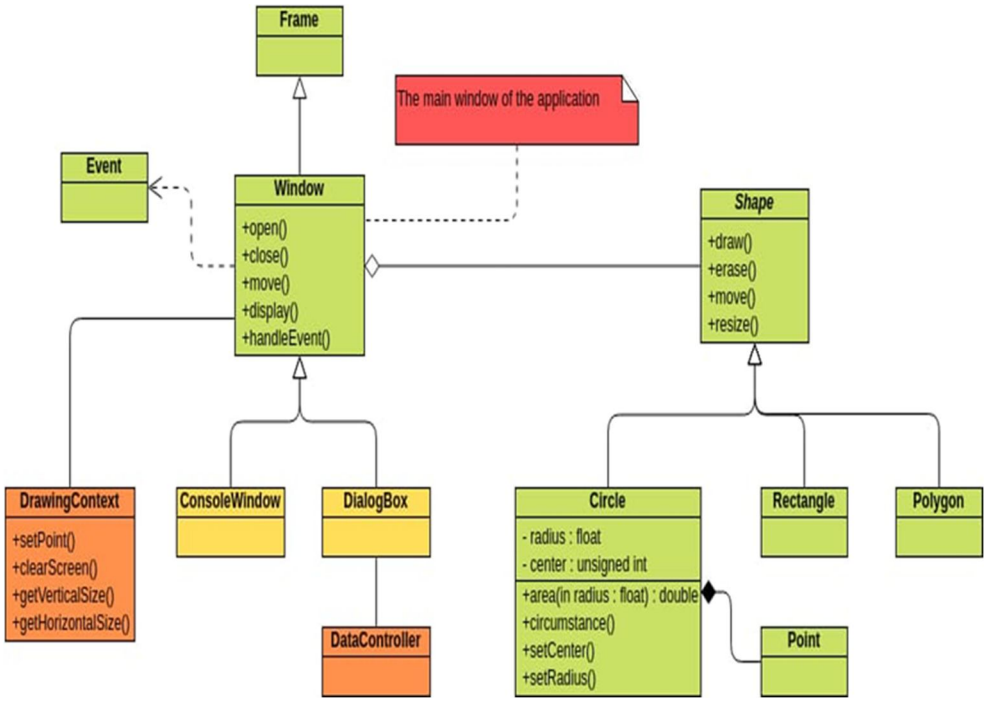
In the use case model, there are two main actors: users (EV/CNG vehicle owners) and station operators. Users can search for nearby stations, view availability, book time slots, receive alerts about operational status, and navigate to stations. Station operators can update live availability, manage queues, and confirm bookings. This ensures an efficient and transparent experience for all stakeholders A use case diagram is used to represent the dynamic behavior of a system.

2) ER Diagram



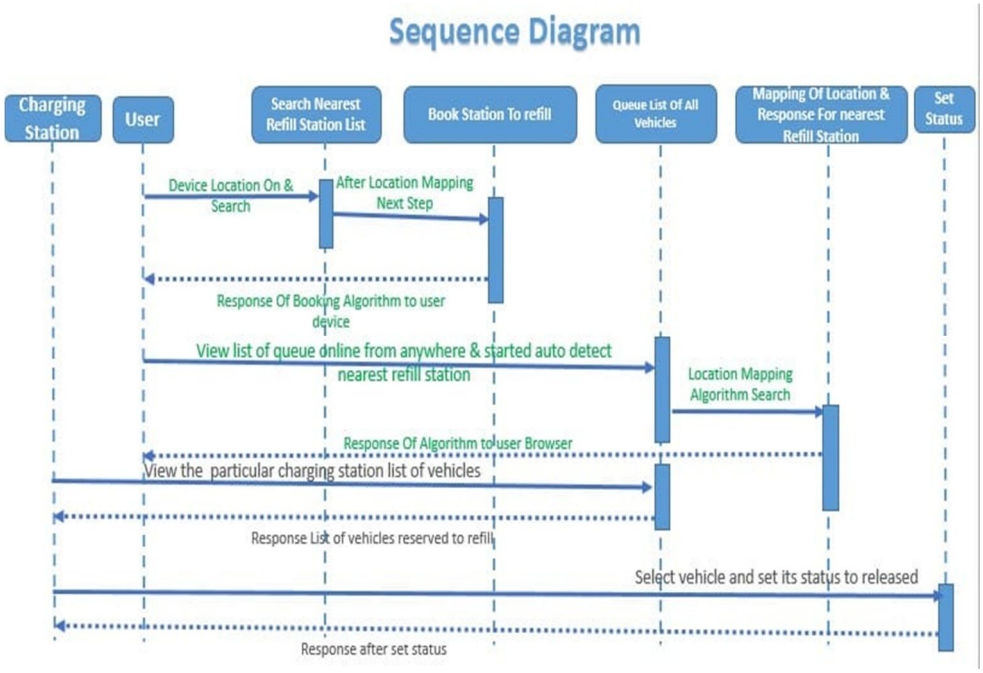
The Entity-Relationship Diagram (ERD) for the "Live EV Charging and CNG App" represents the key entities involved in the system, their attributes, and the relationships between them. The primary entities include User, Station, Booking, Station Owner, Payment, and admin

3) Class Diagram



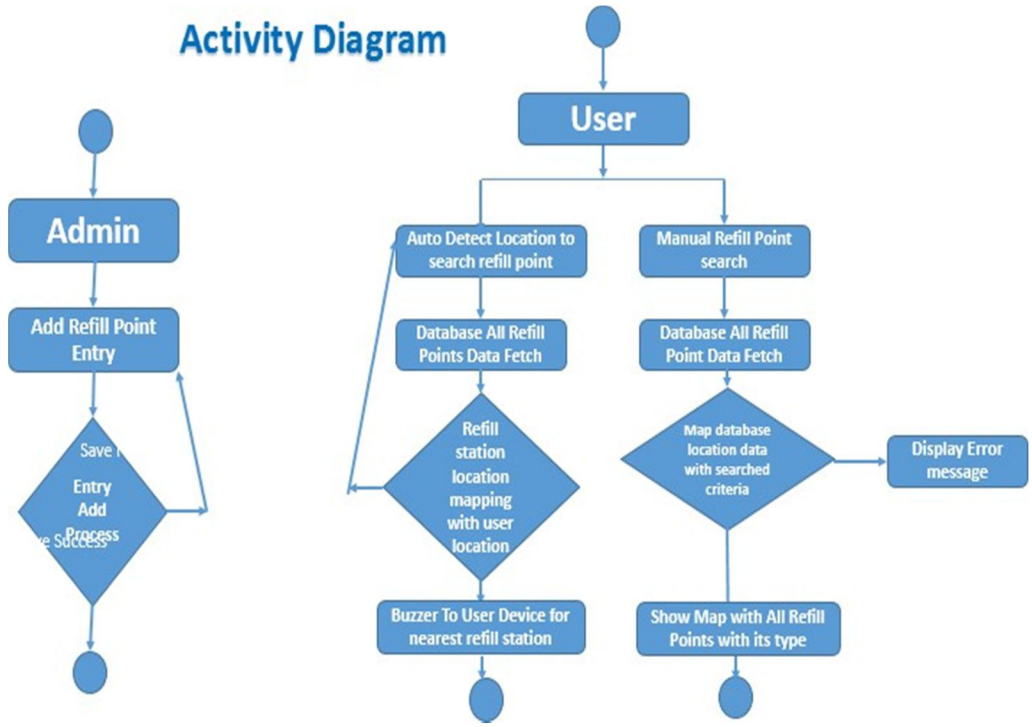
The class diagram defines the structural elements of the backend, including key entities like User, Station, and Booking. Each class has attributes and methods to handle actions such as user authentication, station management, and booking confirmations. This ensures a robust and scalable system design Class diagram is a static diagram. It represents the static view of an application.

4) Sequence Diagram



The sequence diagram explains step-by-step interactions. For example, when a user books a charging slot, the app sends the request to the backend, which checks availability with the station system and updates the database. Once the slot is confirmed, a notification is sent to the user, ensuring they have a reserved spot

5) Activity DIA Gram



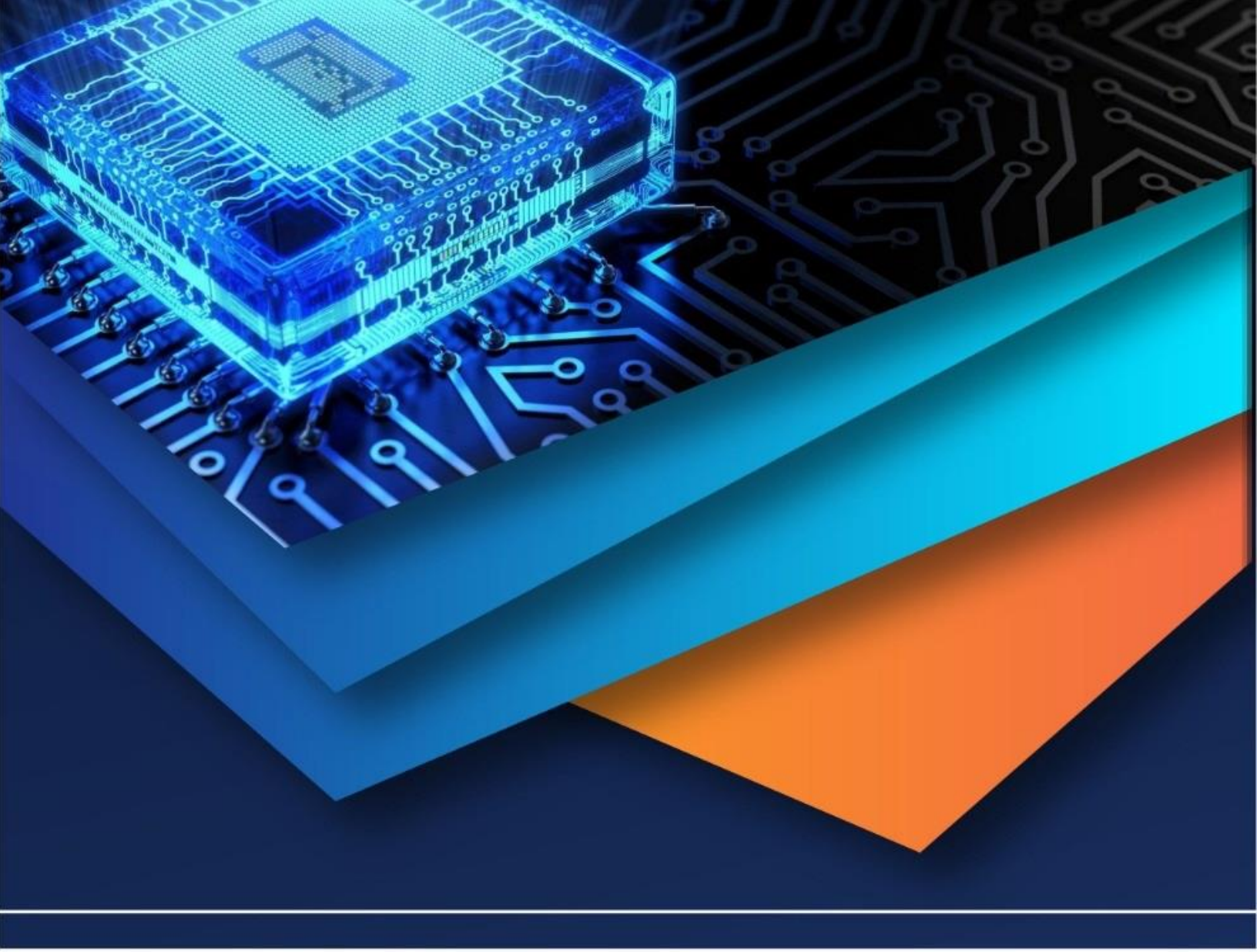
An activity diagram visually presents a series of actions or flow of control ina system similar to a flowchart or a data flow diagram. Activity diagrams are often used in business process modeling. They can also describe the steps in a use case diagram.

V. CONCLUSION

In conclusion, The major goal of the project is to provide a helpful product for EV and CNG customers that will be extremely valuable to them. This app will not only serve the user but will also be utilized by the administrator as an interactive system. It can also create more data about users who own electric and CNG vehicles and charging station owners. It may be used to locate and navigate to stations. This software will be enhanced as a commercial product in the future with new features that will also employ subscription packs, as well as functions like charge and cool that will produce more cash.

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