Internship: Data Analytics with Tableau

Date	25 June 2025
Team ID	LTVIP2025TMID20808
Project Name	Visualization tool for electric charge and range analysis

Team Details Section:

Name	Role	
Prathipati Dinesh	Project Lead	
Pallem Akshitha	Data Analyst	
Pamarthi Lakshmi Durga	Data Analyst	
Nomula Tapasvi	Dashboard Developer	

Institution/Organization: Seshadri Rao Gudlavalleru Engineering College

Date: 26 june 2025

Visualization Tool for Electric Charge and Range Analysis:

Abstract:

This project develops a data visualization dashboard to analyse electric vehicle (EV) charging trends, vehicle range behaviour, and infrastructure availability. The tool addresses key challenges in the EV ecosystem such as uneven distribution of charging stations, range anxiety among users, and the need for optimized planning.

Using data visualization through Tableau and data management in MySQL Workbench, the system uncovers patterns from EV usage data. It highlights peak charging times, under-utilized locations, and regional performance of vehicle types.

The dashboard and story were designed after stakeholder consultations, empathy analysis, and design-thinking brainstorming. This project concludes with strategic insights for urban planners, EV manufacturers, and government bodies to strengthen clean mobility infrastructure and policy formulation.

Table of Contents

1. Introduction

1.1 Overview

The electric vehicle (EV) industry is experiencing rapid growth across the globe as nations strive toward a cleaner, more sustainable future. However, EV adoption is challenged by the uneven distribution of charging stations, long waiting times, and uncertainty around vehicle range.

This project, titled *Visualization Tool for Electric Charge and Range Analysis*, leverages **Tableau's interactive dashboard capabilities** along with **MySQL Workbench** to analyse EV charging data and vehicle performance. It provides clear, visual insights into charging behaviour, infrastructure needs, and efficiency patterns.

1.2 Purpose

The main goal of this project is to develop a **data-driven decision support system** that simplifies EV data into meaningful visualizations. The tool:

- Assists users in understanding **where** and **when** charging demand peaks
- Highlights areas lacking infrastructure
- Identifies patterns in **range efficiency** across EV brands and models
- Empowers government bodies, city planners, and EV manufacturers to make informed, proactive decisions,

2.Ideation Phase:

2.1 Problem Statement

With the growing popularity of EVs, users and stakeholders require an easy way to compare different models and understand their performance and feasibility. The problem is to consolidate and visualize EV data from various sources to help with decision-making.

about charging station availability, and **lack of real-time insights** into infrastructure usage.

Urban planners and infrastructure providers also struggle to decide **where to place new stations** and how to monitor **peak charging demand** effectively.

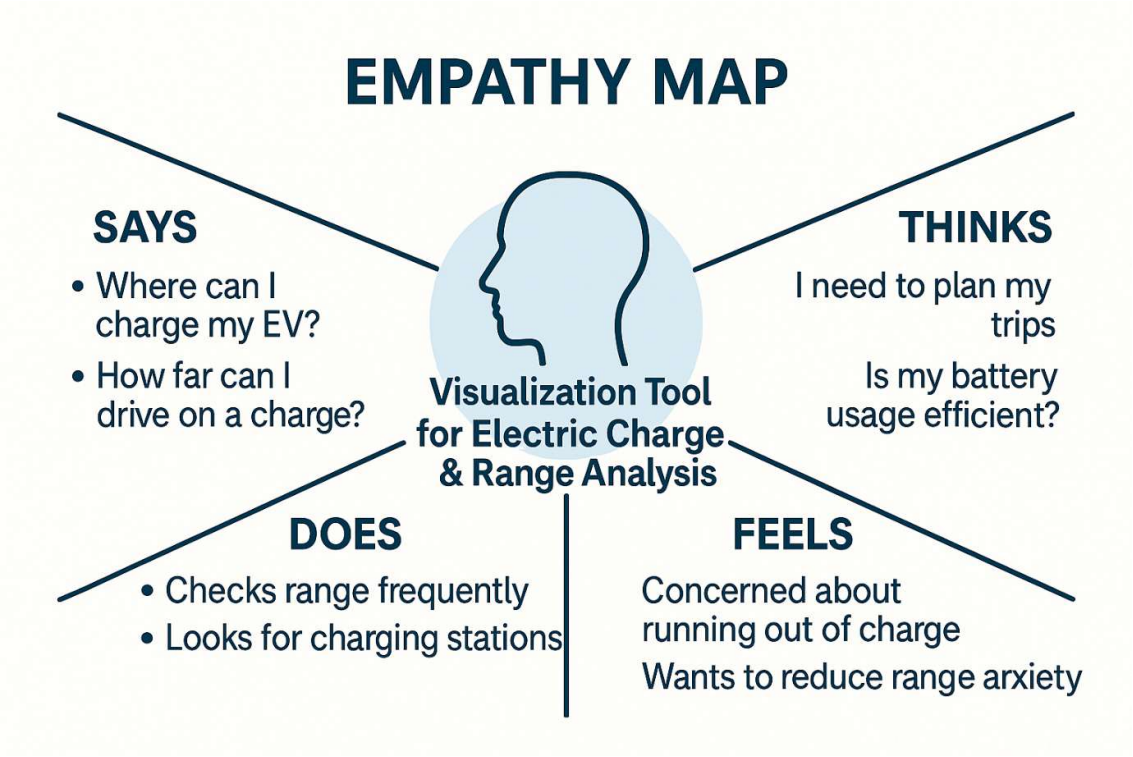
Currently, **no visual tool** exists that clearly shows these patterns in an interactive and user-friendly way.

Hence, there is a strong need for a **data-driven visualization platform** that simplifies EV charge and range data to support users, planners, and government authorities.

2.2 Empathy Map

The empathy map focuses on understanding EV consumers who are interested in efficiency, affordability, and availability of charging infrastructure. Users are influenced by what they see in advertisements, hear from peers, and feel in terms of financial impact and environmental responsibility.

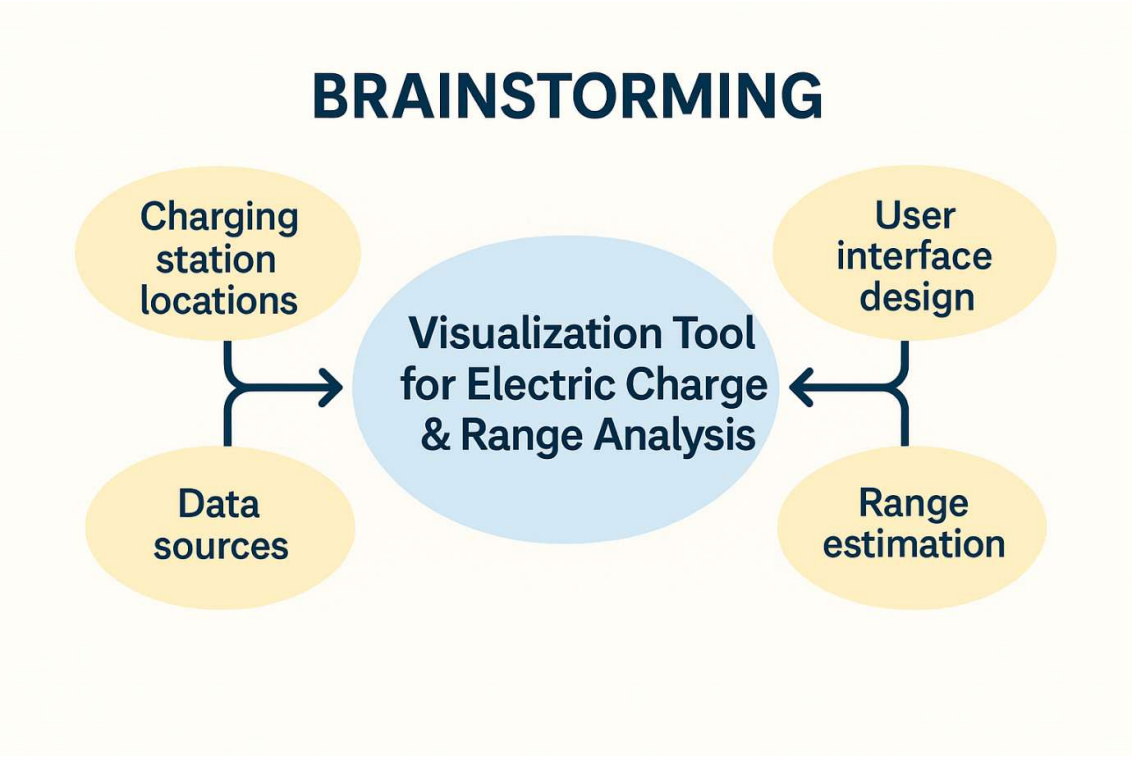
The empathy map focuses on understanding EV consumers who are interested in efficiency, affordability, and availability of charging infrastructure. Users are influenced by what they see in advertisements, hear from peers, and feel in terms of financial impact and environmental responsibility.



2.3 Brain Storming:

Ideas considered include comparing price-to-range ratios, mapping charging stations across India, and showcasing EV adoption trends by brand. We decided to utilize Tableau due to its powerful data visualization and dashboard creation capabilities.

In the initial brainstorming session, our team identified the key problems and opportunities related to EV (Electric Vehicle) adoption. We focused on solving the pain points faced by users through data visualization.


BRAINSTORMING
Charging station locations
User interface design
Visualization Tool for Electric Charge & Range Analysis
Data sources
Range estimation

3. Requirement Analysis:

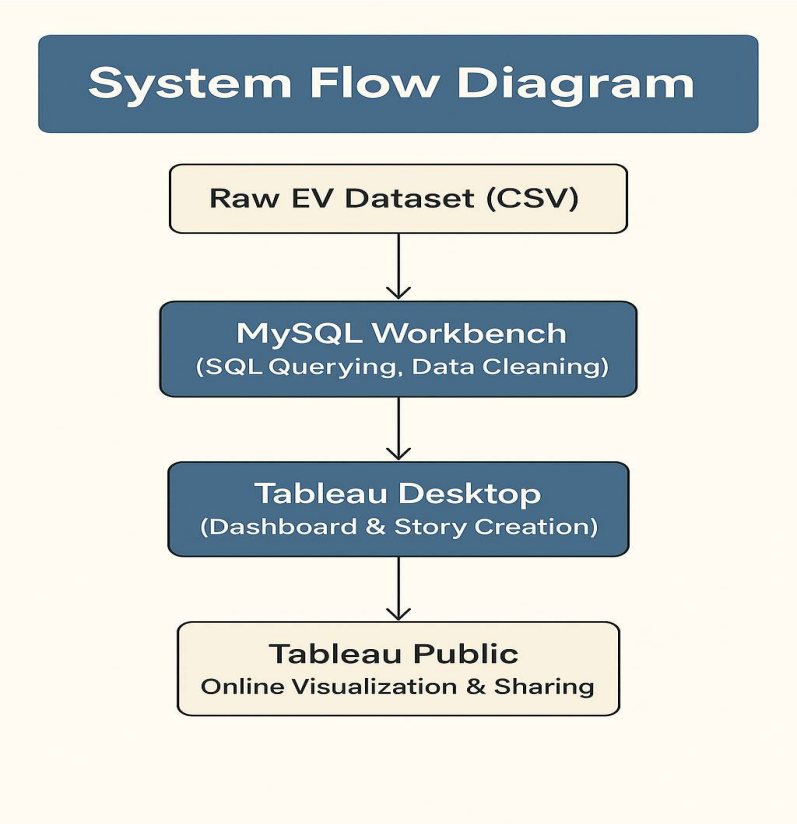
Data Flow Description

The following describes the data flow in the Visualization Tool for Electric Charge and Range Analysis project.
This DFD outlines how the raw EV data moves through the system and gets transformed into interactive visualizations.

1. Raw EV Dataset (CSV format) – collected data containing charging station information, vehicle type, charging duration, and range stats.
2. MySQL Workbench – used for storing, cleaning, and structuring the dataset. SQL queries filter and organize the data.
3. Tableau – connects to MySQL to generate dashboards and stories using charts, filters, and storyboards.
4. Tableau Public – the final dashboard and story are published online for public access.
5. Website – Tableau dashboards and stories can be embedded on platforms like Netlify.

Text-Based DFD Representation

Raw Dataset (CSV)
↓
MySQL Workbench (SQL Queries, Cleaned Tables)
↓
Tableau Desktop (Dashboards + Story Design)
↓
Tableau Public (Web-Based Publishing)
↓
Website Integration (Netlify/Github)



1. Functional Requirements

FR No.	Functionality	Description
FR-1	Data Upload	Upload EV charge and range dataset (CSV)
FR-2	Dashboard Visualizations	Visualize charging station usage and vehicle range
FR-3	Filtering & Search	Filter by vehicle type, region, charger type, and duration
FR-4	Interactive Story	Walkthrough showing charging trends and infrastructure needs
FR-5	Export Options	Export dashboard/story as image or PDF

2.Non-Functional Requirements

NFR No.	Requirement	Description
NFR-1	Usability	Clean and responsive dashboard for all user types
NFR-2	Performance	Load within 3–4 seconds even with 10,000+ rows
NFR-3	Scalability	Support adding more EV data or new filter types

NFR-4	Reliability	System must not crash on filtering or switching story pages
NFR-5	Security (Basic)	Store dataset safely with access control to Tableau Public

Technology Stack:

The project uses Tableau Public for visualization, Google Sheets/CSV for data storage, and HTML/CSS for web integration. Supporting tools include Microsoft Word for documentation and GitHub for code/version management.

S.No	Component	Description	Technology Used
1	User Interface	Visual interface for EV charge/range dashboards and story	Tableau Public
2	Data Preparation Logic	Scripts and logic to clean and format EV dataset	SQL queries, MySQL Workbench
3	Data Analysis Logic	Generate charge duration, range, usage pattern charts	Tableau Calculated Fields, Filters
4	Data Source	Raw dataset used for charging and vehicle range analysis	CSV Files
5	Database (optional)	Storage for backup data	MySQL Workbench
6	Cloud Storage (optional)	Storing final reports, screenshots, and dashboard exports	Google Drive, Tableau Public
7	File Storage	Local system for raw data, Tableau files, screenshots	Local File System
8	External APIs (optional)	Real-time EV station/traffic data (future scope)	Google Maps API, Open Charge Map API
9	Infrastructure	Platform used for building and publishing dashboards	Local System + Tableau Public

Project Plan

The project followed a phased approach over a span of four weeks. In the initial phase, datasets were identified and pre-processed. Subsequently, data was imported into Tableau, and individual sheets were prepared with various visuals such as bar charts, maps, and KPIs. Once individual visuals were ready, dashboards were designed and arranged using layout containers. Lastly, the entire dashboard and story were published and embedded into a custom-built HTML webpage. Tools used include Tableau Public, Excel, and VS Code for web integration.

4. Problem and Solution Phase:

- **Problem:**
  EV users often suffer from range anxiety due to lack of transparent and accessible charging station data. City planners and policymakers also lack interactive tools that display EV infrastructure gaps, leading to underutilized or poorly located chargers.
- **Solution Fit:**
  Our Tableau dashboard solves this by integrating EV charge station and range data into an interactive visualization platform. It shows usage patterns, peak charge times, vehicle efficiency, and allows filtering by region, vehicle type, and charger availability. This helps:
- Users make better travel decisions
- Planners visualize infrastructure needs
- Policy decisions backed by real-time data

- ## Proposed Solution
- The proposed solution includes:
- **Data Collection:**
  - Collecting EV charging and range datasets from reliable sources
  - Cleaning and formatting data using MySQL Workbench
- **Data Visualization:**
  - Connecting Tableau to MySQL
  - Creating dashboards showing charging station usage, peak times, vehicle performance
- **Storytelling:**
  - Using Tableau Stories to walk users through data insights step by step
- **Deployment:**
  - Publishing the dashboard and story on Tableau Public
  - Optionally embedding on a custom-built Netlify website

Solution Architecture

Raw Dataset (CSV/Excel)

↓

MySQL Workbench (Structured storage & SQL filtering)

↓

Tableau Desktop (Interactive Dashboards + Story)

↓

Tableau Public (Online Publishing)

↓

Website with embedded Tableau links

5. **Function and Performance Testing**

Functional Testing

We tested the system features to ensure that everything worked as expected and provided correct outputs.

Features Tested:

Functionality	Tested?	Result
Dashboard filters (location, time, vehicle)	Yes	Working
Story navigation in Tableau	Yes	Smooth
Range and charger data charts	Yes	Accurate
Data import from MySQL	Yes	Successful
Dashboard responsiveness	Yes	Fast & Clean

Performance Testing

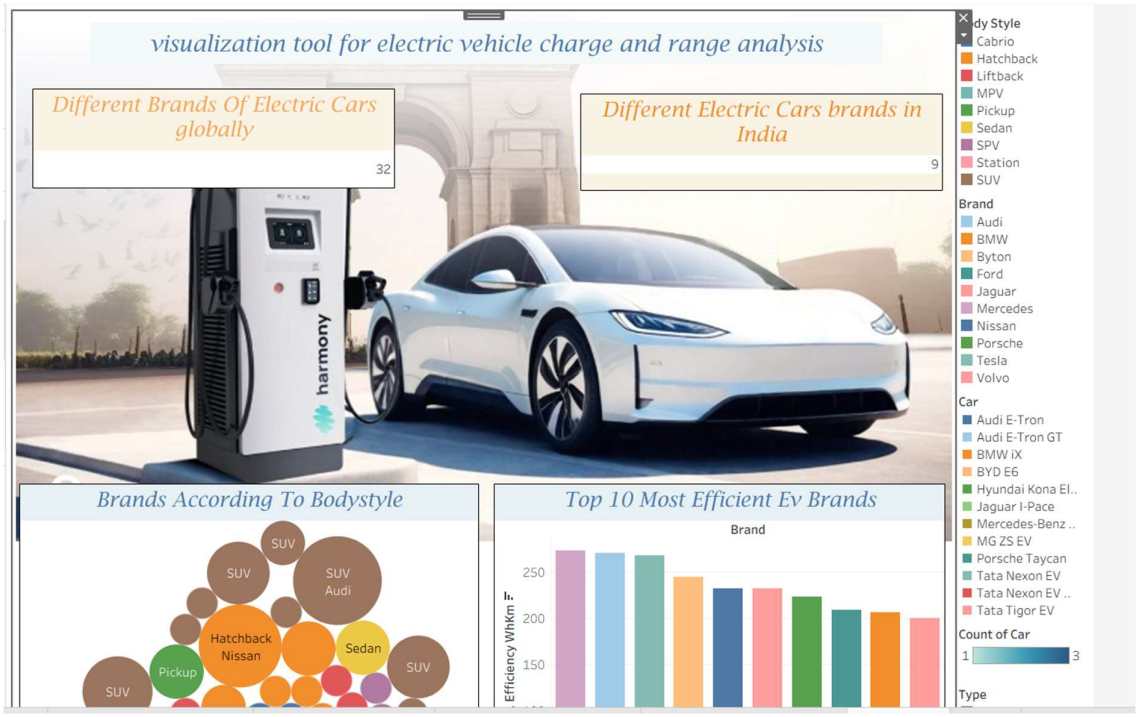
We ensured that the dashboard performs smoothly and loads quickly even with a decent dataset size.

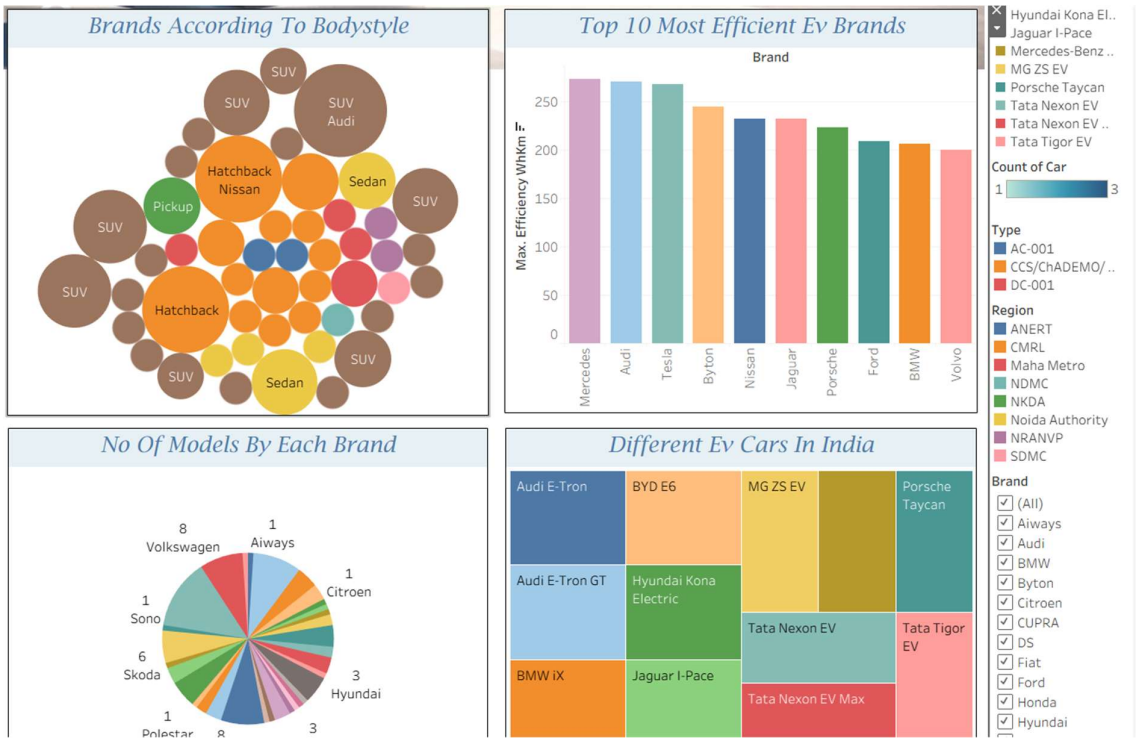
Performance Metrics:

- **Data Size Tested:** according to the datasets
- **Load Time (Tableau Public):** Less than 4 seconds
- **Story Slide Transition:** Smooth and lag-free
- **Dashboard Interactivity:** No delay on filter selection
- **Cross-device Testing:** Mobile & Desktop – Responsive Website

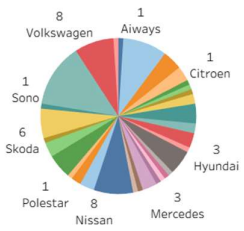
6. Results:

Screenshots of Dashboard

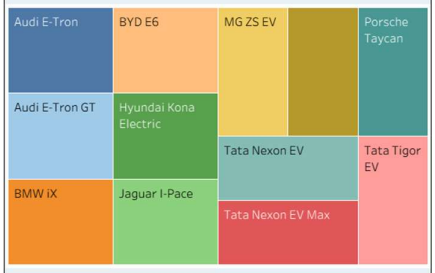




No Of Models By Each Brand



Different Ev Cars In India

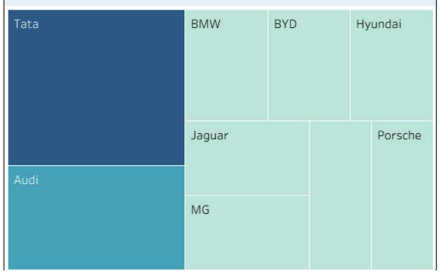


NRANVP
SDMC

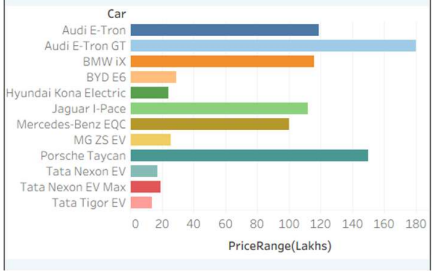
Brand

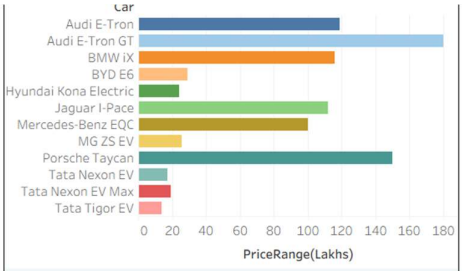
- (All)
- Aiways
- Audi
- BMW
- Byton
- Citroen
- CUPRA
- DS
- Fiat
- Ford
- Honda
- Hyundai
- Jaguar
- Kia
- Lexus
- Lightyear
- Lucid
- Mazda
- Mercedes
- MG
- Mini
- Nissan
- Opel
- Peugeot
- Polestar
- Porsche
- Renault
- SEAT
- Skoda
- Sono
- Tesla
- Volkswagen
- Volvo

Brand Filtered By PowerTrain Type



Price for Different Cars

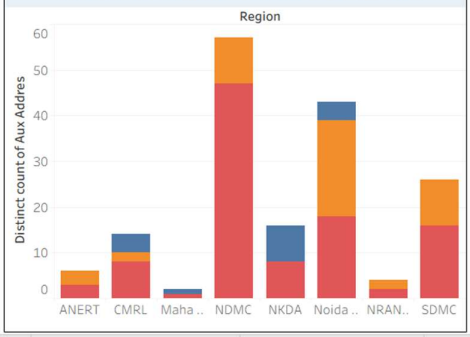




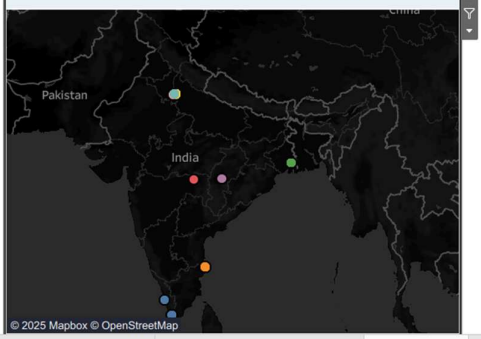
- MG
- Mini
- Nissan
- Opel
- Peugeot
- Polestar
- Porsche
- Renault
- SEAT
- Skoda
- Sono
- Tesla
- Volkswagen
- Volvo

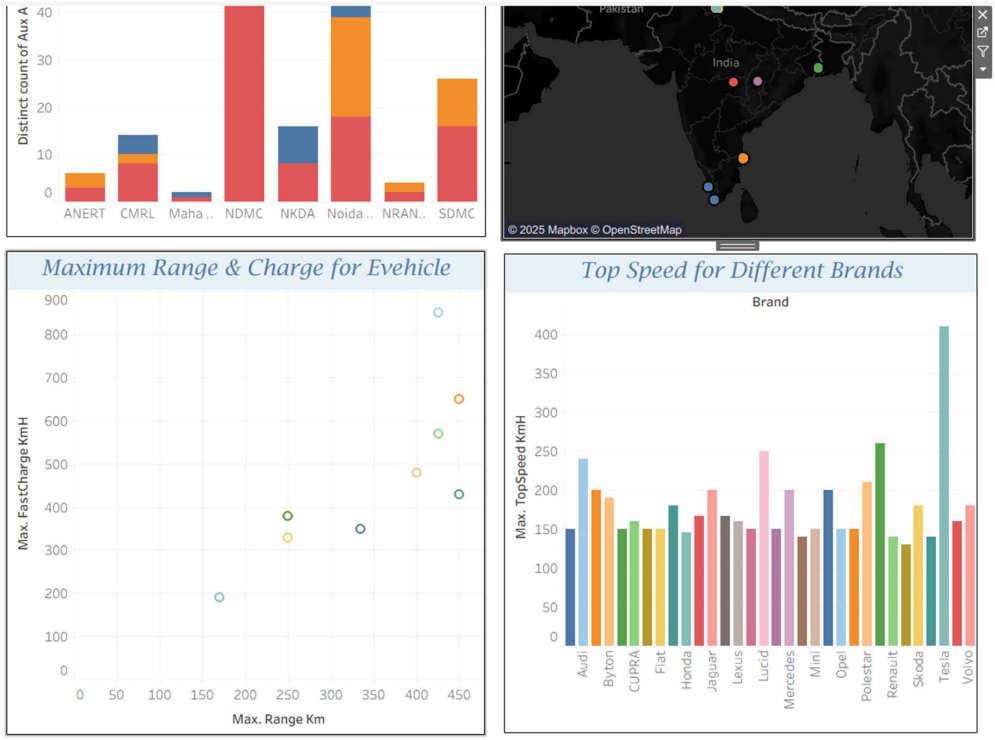
Limit
Top 10 by COUNT([Acceleration])

Type of Charging Stations in regions

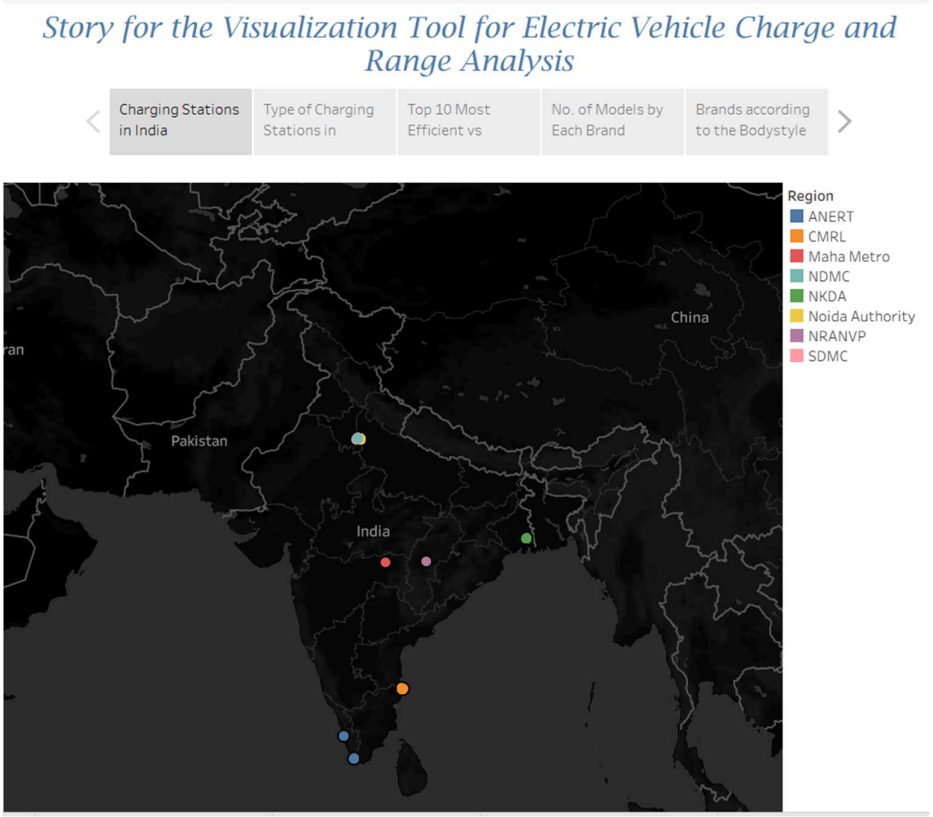


Charging Stations in India





Screenshots of Story



7. Advantages and Disadvantages

Advantages of the Project:

1. Real-Time Decision Support:
The dashboard provides clear and interactive insights that help EV users and city planners take timely decisions regarding charging needs.

2. Reduced Range Anxiety:
By analysing range performance and charging patterns, the tool builds confidence among EV users about how far they can drive safely.

3. Infrastructure Optimization:
Helps identify under-served areas with low charger availability, which supports better placement of new charging stations.

4. Enhanced Policy Making:
The visualized data supports government bodies in designing electric mobility policies aligned with real usage patterns.

5. Eco-Friendly Planning:
Encourages green mobility by making the EV experience more predictable and user-friendly.

6. Easy Data Interpretation:
Even non-technical users can understand complex patterns easily due to visual storytelling and interactive charts.

7. Scalable Design:
The system can be expanded to other cities or datasets without major changes, making it future-ready.

Disadvantages of the Project:

1. Static Dataset Limitation:
Without live API integration, the dashboard cannot reflect real-time changes in EV activity or charger status.

2. Data Accuracy Dependency:
Inaccurate or incomplete data can mislead interpretations and affect planning.

3. Internet & Tool Dependency:
Requires Tableau Public and online access, which may not be feasible in all areas.

4. Lacks Behavioural Data:
Does not include driver behaviour, charging preferences, or environmental factors unless further datasets are added.

5. Learning Curve:
Some users may require basic training to navigate and interpret interactive dashboards efficiently.

8. Applications

The *Visualization Tool for Electric Charge and Range Analysis* has a wide range of applications in both public and private sectors. It supports smarter mobility, optimized infrastructure deployment, and enhanced user experience. Some key applications include:

Urban Infrastructure Planning:
City planners and municipal bodies can use the dashboard to identify high-demand areas and deploy charging stations accordingly.

EV Fleet Management:
Businesses managing electric fleets (like delivery services or public transport) can monitor usage trends and schedule efficient charging cycles.

Government Policy and Subsidy Planning:
Helps authorities assess EV adoption levels and plan supportive policies, incentives, or infrastructure investments.

Consumer Awareness and Experience:
EV users can use the insights to plan routes, avoid congestion at charging stations, and manage range expectations.

Private Charging Network Expansion:
Charging solution providers can identify the best locations for commercial charging station setups.

Educational and Research Institutions:
Useful for case studies, urban mobility research, and development of intelligent transportation systems.

9. Conclusion

The *Visualization Tool for Electric Charge and Range Analysis* serves as a powerful platform to decode EV charging patterns, vehicle range behaviour, and infrastructure utilization. It transforms complex datasets into meaningful dashboards and stories that are easily understood by users, planners, and policymakers.

By using Tableau for visualization and MySQL Workbench for backend support, the project delivers a seamless interface to explore data interactively. It empowers stakeholders to make smart, data-driven decisions for expanding EV infrastructure and promoting green mobility.

While the tool currently relies on static datasets, it lays the groundwork for a more dynamic and scalable future. The insights generated help solve real-world problems like range anxiety, inefficient station placement, and user confusion — contributing to a smarter and cleaner transport ecosystem.

10. Future Scope

The project has immense potential for future development, both in terms of features and real-world applications. Here are some enhancements that can be implemented:

1. Real-Time API Integration:
Connecting the dashboard to live EV charging APIs will allow users to monitor real-time charger availability and station status.

2. Mobile Application Support:
A companion mobile app can be developed so that EV users can access the dashboard on the go, plan routes, and find nearby charging stations easily.

3. Predictive Analytics:
Machine learning models can be used to predict charging demand, peak hours, and user behavior for better resource planning.

4. Battery Health & Degradation Analysis:
Incorporating battery analytics will help users understand long-term performance and maintenance needs.

5. Multi-City Comparative Dashboards:
Expand the tool to visualize EV data across multiple cities or regions for government-level infrastructure planning.

6. Integration with Navigation Systems:
Integrate the tool with EV navigation apps like Google Maps or PlugShare for real-time routing based on charge and range predictions.

7. IoT Device Sync:
With support from IoT-enabled chargers, the tool can collect real-time usage and environmental data like temperature impact on range.

Links of project:

Tableau link:

Dashboard link:
https://public.tableau.com/app/profile/pamarthi.lakshmi.durga/viz/Book3_17511083492780/Dashboard1

Story Link:

https://public.tableau.com/app/profile/pamarthi.lakshmi.durga/viz/Book2_17511079452700/Story1

Project Link: https://lively-meerkat-8c23fb.netlify.app/

References:

Smartbridge portal