

Visualization Tool for Electric Vehicle Charge and Range Analysis

This document outlines a data-driven approach to analyze Electric Vehicle (EV) charging behavior, battery range, and adoption trends using interactive Tableau dashboards. It details the project objectives, methodology, and key insights derived from a comprehensive analysis of global and Indian EV datasets.

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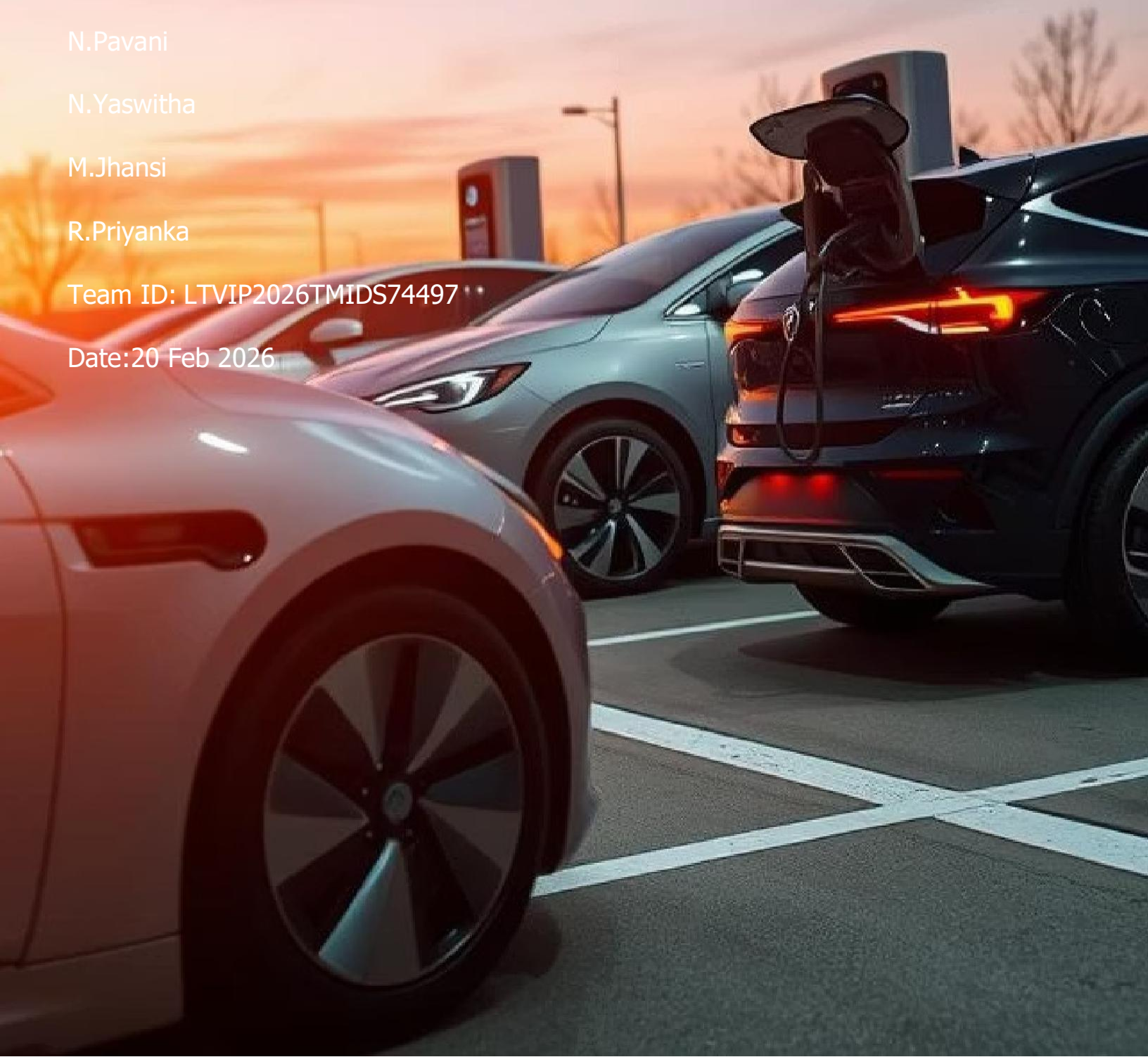
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Project Overview

The project titled "**Visualization Tool for Electric Vehicle Charge and Range Analysis**" focuses on analyzing key data related to electric vehicles (EVs) using Tableau.

It aims to deliver clear and interactive dashboards that visualize EV performance, battery range, charging types, efficiency, and adoption trends in both global and Indian markets.

Purpose

The purpose of this project is to transform raw EV datasets into insightful visualizations that support data-driven decisions for consumers, policymakers, and researchers.

By leveraging Tableau, the project highlights trends in EV model efficiency, price-to-range ratios, and the availability of charging infrastructure across regions.



IDEATION PHASE

Problem Statement

With the growing shift toward electric vehicles (EVs), understanding key aspects such as range, price, charging infrastructure, and adoption trends has become critical. The problem is that raw EV data from various sources is often fragmented and difficult to interpret without a visual tool. This project aims to solve that by transforming complex EV datasets into insightful dashboards.



Empathy Map Canvas

The empathy map was built with the end-user in mind 4 typically, EV buyers, researchers, or policy makers. We considered what users **see** (market data, models), **hear** (brand claims), **think** (cost vs range), and **feel** (confused or uncertain about EV decisions). This helped guide our design to make the dashboard easy to navigate, insightful, and reliable.



Brainstorming

Our team conducted multiple brainstorming sessions to finalize the scope of the project. We evaluated different datasets, shortlisted key business questions like <Which EV offers best range?=>, <Where are charging stations located?=>, and <What are the most affordable models?=>. These ideas shaped the layout and filters of our Tableau dashboards.



REQUIREMENT ANALYSIS

Customer Journey Map

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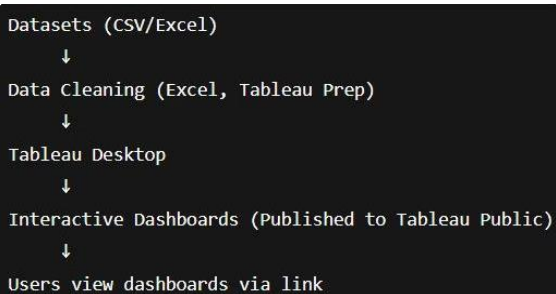
Our target users are EV consumers and researchers who want to compare electric vehicle models based on cost, range, and charging options.

The typical customer journey:

1. **Awareness** – Learns about EVs, confused by technical terms
2. **Research** – Looks for model comparisons and charging data
3. **Decision** – Wants a simple dashboard to help decide based on price/range
4. **Action** – Uses our dashboard to make a data-driven choice

Data Flow Diagram

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Solution Requirement

The solution must meet the following requirements:

- Integrate and clean 4 different EV-related datasets
- Present clear, interactive dashboards using Tableau
- Allow filtering by model, price, country, charging type
- Support both **global** and **India-specific** analysis
- Be easy to access and navigate for non-technical user

Technology Stack

Tool/Technology	Purpose
Tableau	Dashboard creation and publishing
MS Excel / CSV	Data cleaning and preprocessing
Tableau Public	Hosting and sharing final dashboards
Google Drive	Storing demo video and documentation

PROJECT DESIGN

In accordance with the SmartInternz project methodology, we systematically collected, explored, and refined several EV-related datasets. This rigorous process was crucial to ensure that only accurate and high-quality data would be used in the visualization phase, thereby guaranteeing the extraction of meaningful and reliable insights.

Problem-Solution Fit

The raw EV data available from multiple sources lacked structure, clarity, and visual insights.

Consumers and analysts needed a way to explore EV model performance, price-range comparisons, and infrastructure readiness.

Our solution bridges this gap by turning fragmented datasets into **interactive Tableau dashboards**, making the information accessible, visual, and actionable.

Proposed Solution

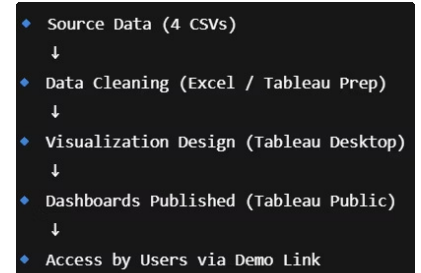
We developed **two dashboards** that visually explore:

- Global and Indian EV **model range, pricing, and efficiency**
- Regional **charging infrastructure availability**
- Comparison of **budget EV options** for consumers

These dashboards allow users to **filter by brand, model, charger type, or region** enabling tailored analysis and better decision-making.

Solution Architecture

Here's a quick breakdown of our architecture:



PROJECT PLANNING & SCHEDULING

Our project followed a meticulously structured approach, as guided by the SmartInternz program. This systematic process began with a thorough understanding of the raw data and culminated in the publication of interactive stories and dashboards. Below is a detailed, step-by-step breakdown of our methodology:

Week 1:

- ◆ Team formation
- ◆ Project topic selection
- ◆ Dataset research and confirmation

Week 2:

- ◆ Data cleaning and preprocessing
- ◆ Initial dashboard planning and brainstorming

Week 3:

- ◆ Dashboard creation in Tableau
- ◆ Visual tuning and insights drafting.

Week 4:

- ◆ Documentation and final demo preparation
- ◆ Team review and submission

FUNCTIONAL AND PERFORMANCE TESTING

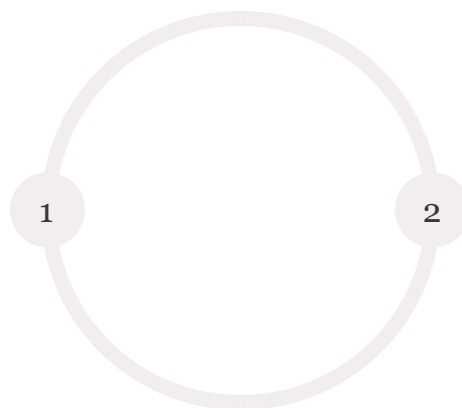
To ensure our dashboards were effective and user-friendly, we conducted basic functional and performance testing.

The goal was to confirm that all interactive elements worked correctly and that the dashboards performed smoothly when published online.

Functional Testing

We verified that all dashboard features work as expected across use cases:

- Filters respond correctly (Brand, Region, Body Style, Powertrain)
- All charts update dynamically based on filter input
- Tooltips display accurate values for each data point
- Dashboard navigates smoothly between global and India views



Performance Testing

Performance was tested by checking:

- **Dashboard load time** on different internet speeds (under 3 seconds on broadband)
- **Responsiveness** across desktop and mobile browsers
- **Data consistency** – Verified no null values or mismatches post-cleaning
- **Publishing stability** – Dashboards remained fully interactive after uploading to Tableau Public

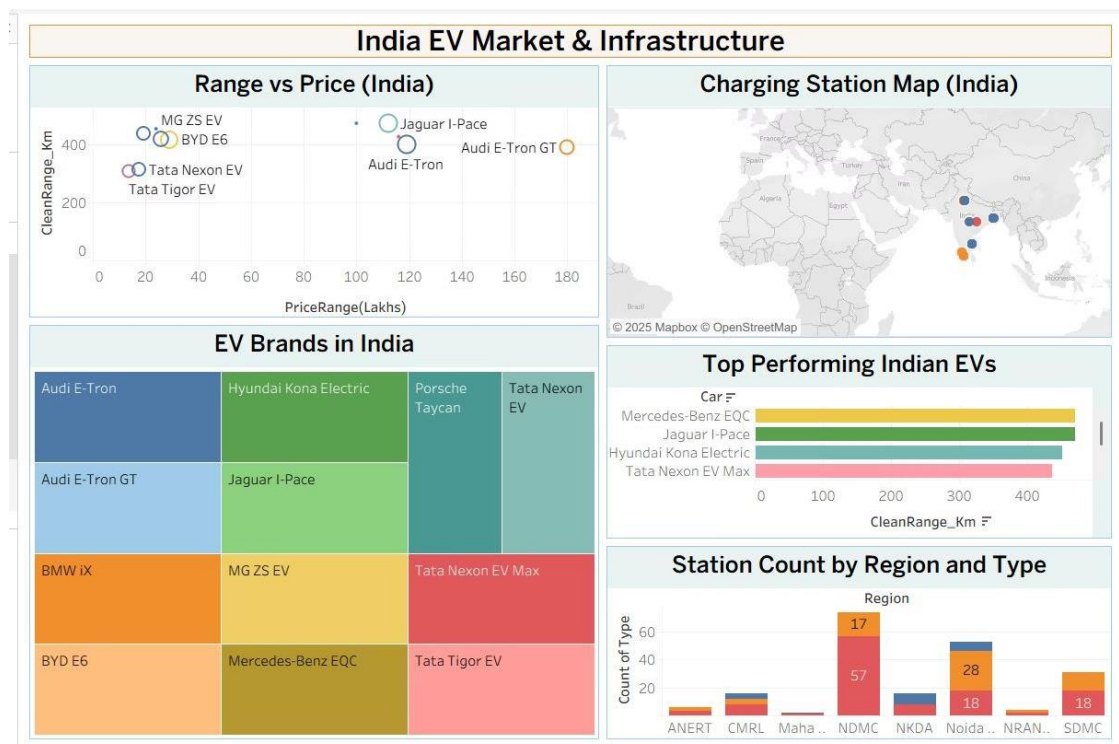
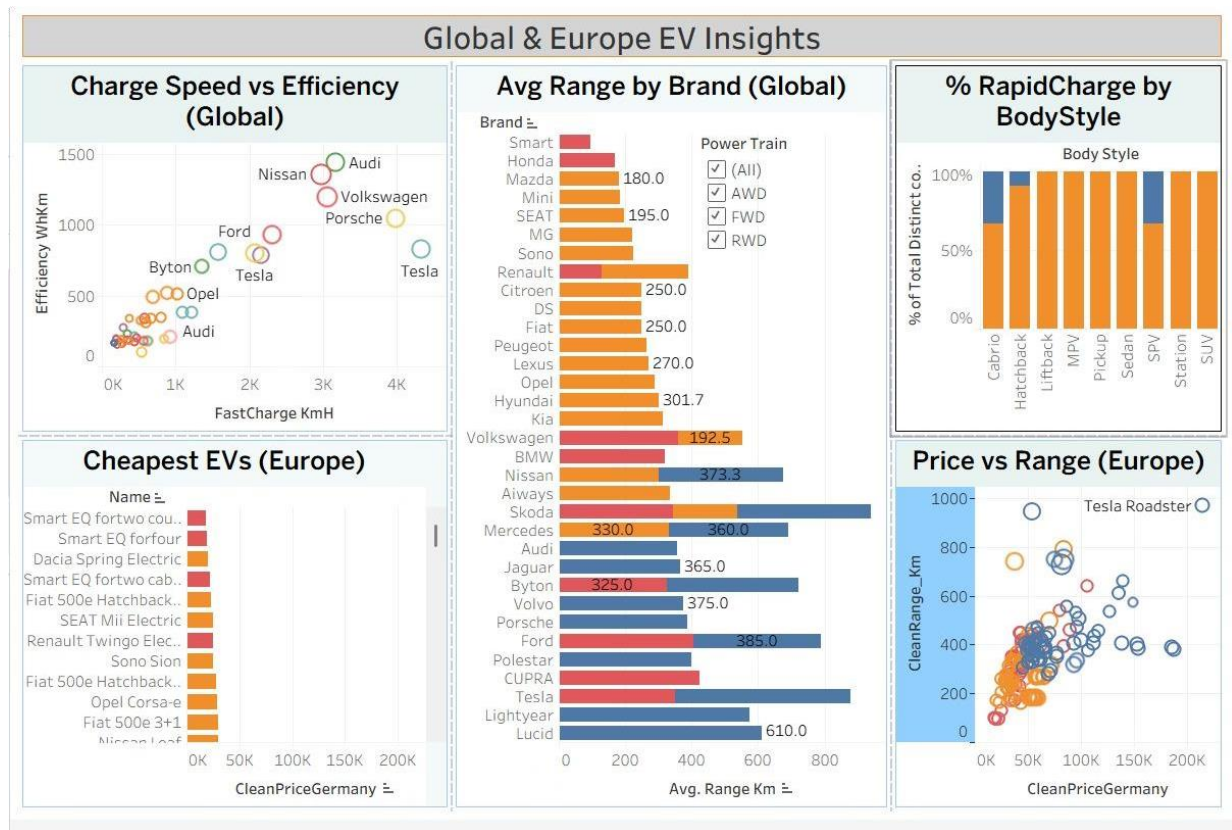


PDF file



RESULTS

The project resulted in two fully functional and interactive dashboards built using Tableau. These dashboards visualize key electric vehicle insights across global and Indian markets 4 helping users explore EV models, performance, pricing, and infrastructure with ease.



ADVANTAGES & DISADVANTAGES

Every project has strengths and limitations. This section outlines the key advantages of our dashboard-based EV analysis solution, as well as the challenges and limitations we encountered during development and testing.

ADVANTAGES



- **Interactive Dashboards:** Users can filter by region, brand, charger type, and EV models.
- **Visual Clarity:** Simplifies complex data for non-technical users.
- **Global & Local Scope:** Covers both global and Indian EV trends in a single project.
- **No-Code Solution:** Built entirely using Tableau without coding knowledge.




DISADVANTAGES

- **Static Data:** Dashboards rely on manually uploaded datasets and are not real-time.
- **Device Responsiveness Limitations:** Some Tableau visuals are harder to view on smaller screens.
- **Dependent on Data Accuracy:** Incomplete or outdated datasets can impact insights.
- **Limited Predictive Capabilities:** Focused on descriptive analysis, not forecasting.


Conclusion & Future Scope

The project offered a valuable opportunity to explore Electric Vehicle data through a practical lens. From raw datasets to interactive Tableau dashboards, we built a solution that highlights performance, charging behavior, and adoption trends, proving the feasibility of a robust EV data visualization tool.




✓ Successful Analysis

Successfully analyzed multiple EV datasets related to model performance, charging time, and battery range.



✓ Dashboard Development

Developed a comprehensive Tableau dashboard to support data-driven decision making.



✓ Functional Tool

Delivered a functional visualization tool that simplifies EV data interpretation for stakeholders.

Future Scope:

Real-Time Data Integration

Connect live APIs or streaming EV data to update dashboards dynamically, providing the most current insights.

More KPIs & Filters

Introduce filters for cost, emission reduction, and user reviews to broaden insights and cater to diverse analytical needs.

Predictive Analytics

Apply forecasting techniques to predict EV market trends or battery lifespan, offering proactive strategic planning.

User Interface Improvements

Design cleaner, mobile-friendly dashboards for wider accessibility and an enhanced user experience across devices.

APPENDIX

This section provides all supporting information related to the project, including the datasets used, tools and platforms applied during development, and access links to the final dashboards and demo video. These references validate the analysis and ensure transparency of the solution built.

Datasets Used:

- `ElectricCarData_Clean.csv` – Global EV specifications
- `Cheapestelectriccars-EVDatabase.csv` – Budget EV data (Europe)
- `EVIndia.csv` – Indian EV models and pricing
- `electric_vehicle_charging_station_list.csv` – Charging station locations in India.

Tools & Platforms:

- **Tableau Desktop & Tableau Public** – Dashboard creation & publishing
- **Microsoft Excel** – Data cleaning and preprocessing
- **Gamma** – Project documentation & presentation
- **Google Drive / YouTube** – Hosting demo video

Demo & Dashboard Access:



Tableau Public Dashboard



Project Demo Video



GitHub Link