

Project Report

TITLE :

Visualization Tool for Electric Vehicle Charge and Range Analysis.

Team ID : LTVIP2025TMID48669

Team Members :

Team Leader : Likitha Dadi

Team member : Ella Likhitha

Team member : Gandi Dinesh

Team member : Allada Vasanth

Team member : Goona Ganapathi Swamy

1. INTRODUCTION

1.1 Project Overview

This project analyzes Electric Vehicle (EV) data using MySQL and Tableau to create an interactive dashboard and storyboard. It covers data collection, database connection, visualization, and web integration. The final output offers valuable insights into EV charge and range patterns, published via Tableau Public and embedded in a web application.

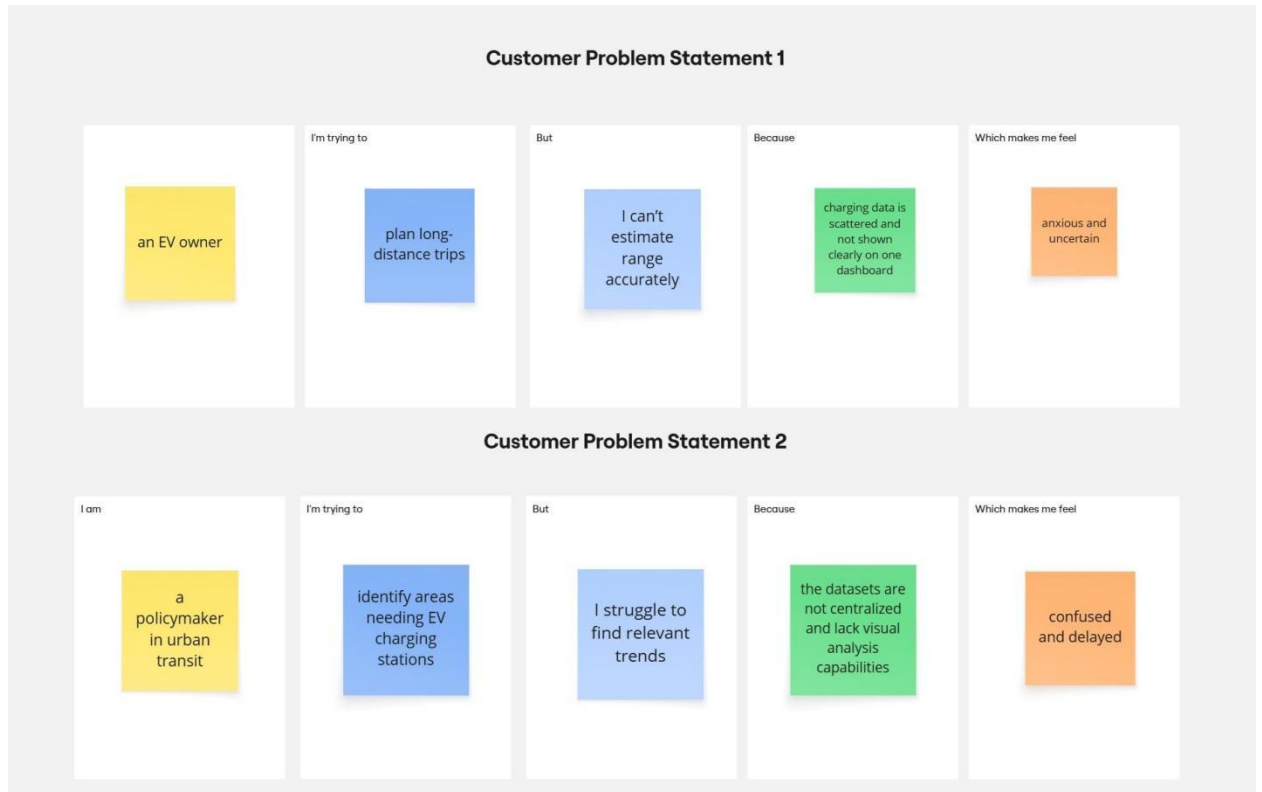
1.2 Purpose

To analyze and visualize Electric Vehicle (EV) charge and range data from multiple sources, enabling users to gain insights into EV usage patterns, improve decision-making, and promote data-driven planning through an interactive dashboard integrated with a web application.

2. IDEATION PHASE

2.1 Problem Statement

Date	20 June 2025
Team ID	LTVIP2025TMID48669
Project Name	Visualization Tool for Electric Vehicle Charge and Range Analysis.
Maximum Marks	2 Marks

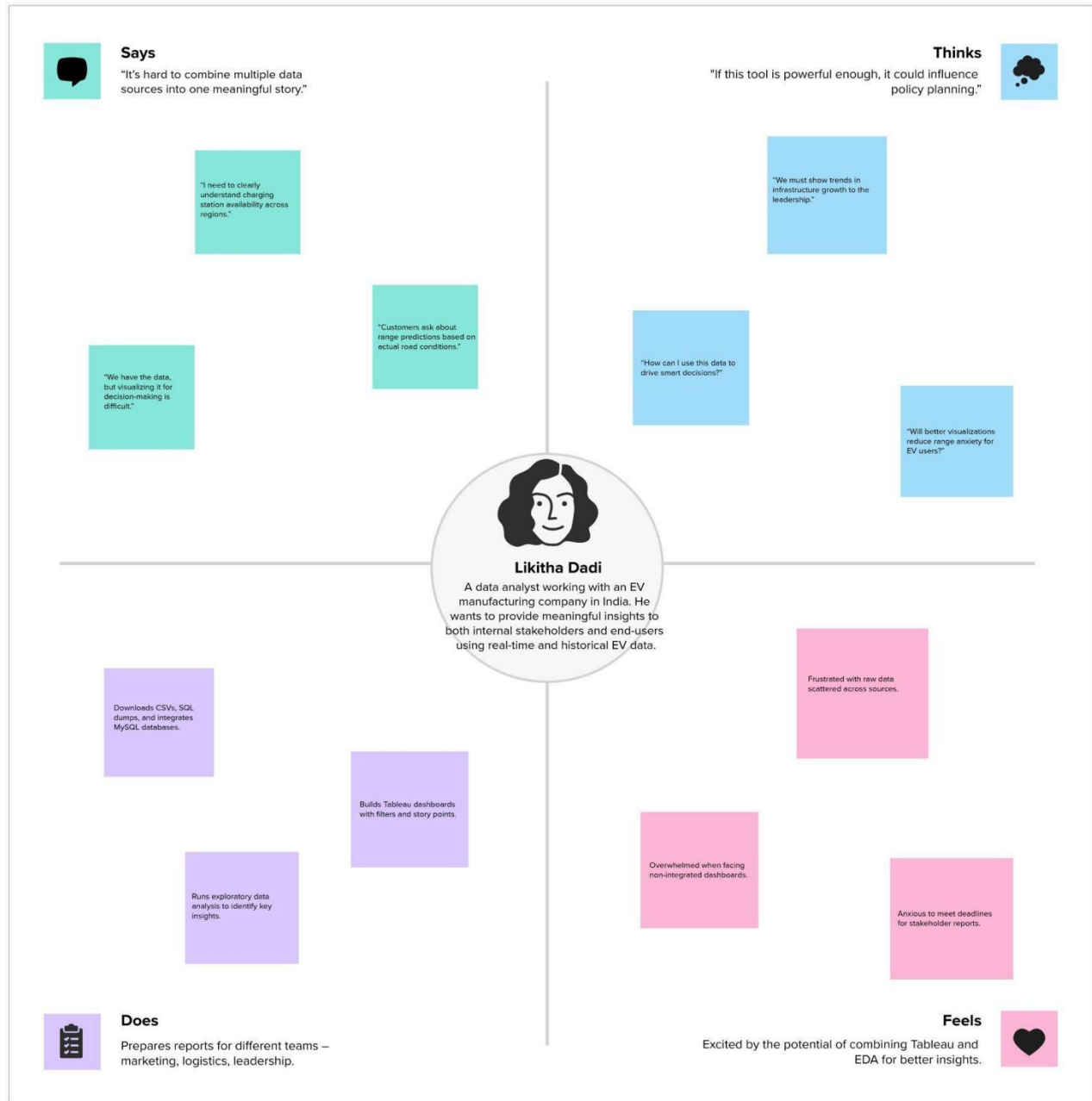


Problem Statement (PS)	I am (Customer)	I’m trying to	But	Because	Which makes me feel
PS-1	an EV owner	plan long-distance trips	I can’t estimate range accurately	charging data is scattered and not shown clearly on one dashboard	anxious and uncertain
PS-2	a policymaker in urban transit	identify areas needing EV charging	I struggle to find relevant trends	the datasets are not centralized and lack visual analysis	confused and delayed

		stations		capabilities	
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2.2 Empathy Map Canvas

Date	22 June 2025
Team ID	LTVIP2025TMID48669
Project Name	Visualization Tool for Electric Vehicle Charge and Range Analysis.
Maximum Marks	4 Marks



2.3 BrainStorming

Date	23 June 2025
Team ID	LTVIP2025TMID48669
Project Name	Visualization Tool for Electric Vehicle Charge and Range Analysis.
Maximum Marks	4 Marks



3. REQUIREMENT ANALYSIS

3.1 Customer Journey Map



3.2 Solution Requirements

Date	24 June 2025
Team ID	LTVIP2025TMID48669
Project Name	Visualization Tool for Electric Vehicle Charge and Range Analysis.
Maximum Marks	4 Marks

FUNCTIONAL REQUIREMENTS

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Data Upload	Upload EV Charge Data Upload EV Range Data Upload Global Market Data Upload Battery Data
FR-2	Data Cleaning & Transformation	Handle missing values Standardize units (km, miles) Merge datasets from multiple sources
FR-3	Data Visualization	View dashboards for Charge Time Analysis View dashboards for Range Comparison View dashboards for Market Trends View dashboards for Battery Technology Analysis
FR-4	Reporting & Export	Export dashboard visuals as PDF Download charts as images Share reports with stakeholders

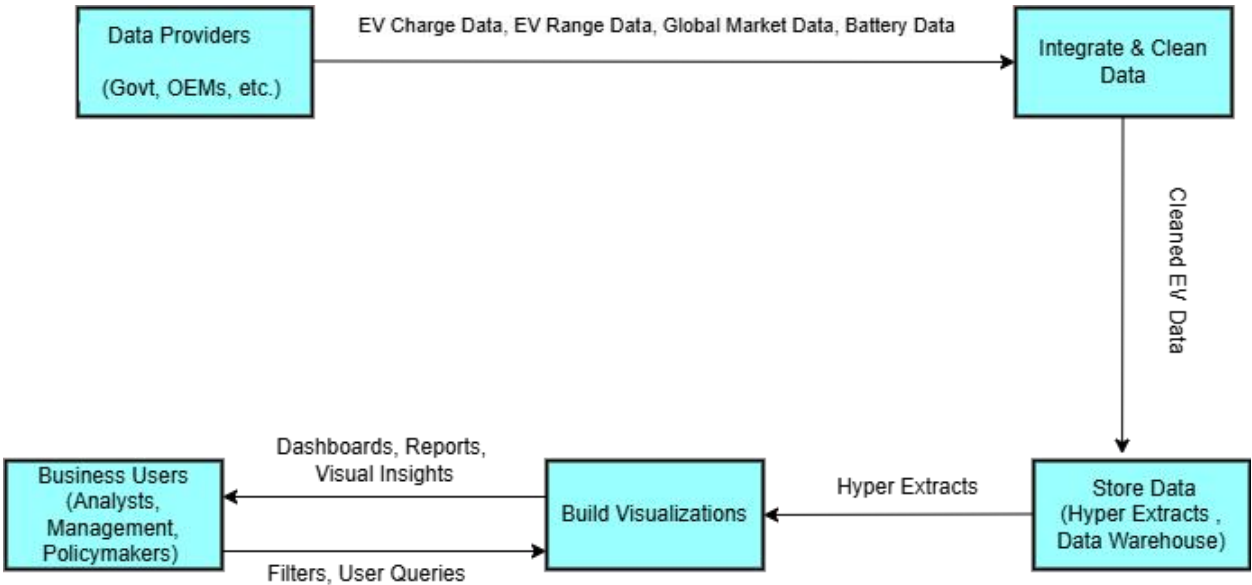
UNFUNCTIONAL REQUIREMENTS

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	The tool shall provide intuitive dashboards with user-friendly filters for easy data exploration.
NFR-2	Security	The tool shall ensure secure data upload and user authentication to protect sensitive EV data.

NFR-3	Reliability	The tool shall operate reliably without errors during dashboard interactions or data refreshes.
NFR-4	Performance	Dashboards shall load within 3 seconds for typical user queries on standard hardware.
NFR-5	Availability	The system shall be available 99.5% of the time during business hours for all users.
NFR-6	Scalability	The solution shall support increasing data volumes and additional users without performance loss.

3.3 Data Flow Diagram & User Stories

Date	25 June 2025
Team ID	LTVIP2025TMID48669
Project Name	Visualization Tool for Electric Vehicle Charge and Range Analysis.
Maximum Marks	4 Marks



USER STORIES

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance Criteria	Priority	Release
Customer (Web user)	Data Upload	USN-1	As a user, I can upload multiple EV datasets (e.g. charge data, range data, battery data) to the platform.	I can successfully upload and see confirmation for each dataset.	High	Sprint-1
Customer (Web user)	Data Visualization	USN-2	As a user, I can view dashboards showing EV charge time, range performance, and market trends.	I can see charts, graphs, and filter data interactively in the dashboards.	High	Sprint-1
Customer (Web user)	Data Filtering	USN-3	As a user, I can filter dashboard visuals by region (India, Global) or EV brand.	I can apply filters and dashboards update accordingly.	High	Sprint-1

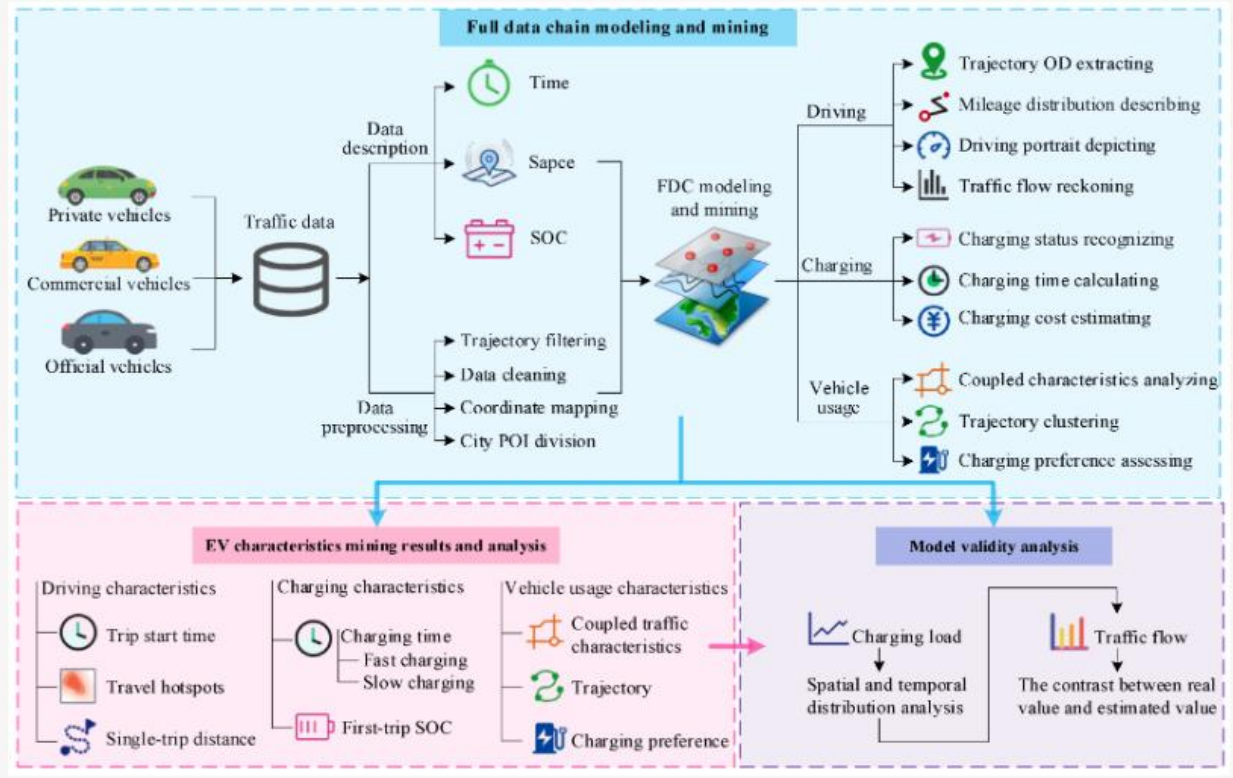
Customer (Web user)	Export Reports	USN-4	As a user, I can export EV analytics reports and visuals as PDF or image files for sharing.	I can download reports in selected formats.	Medium	Sprint-2
Customer Care Executive	User Assistance	USN-5	As a customer care executive, I can help users troubleshoot issues related to uploading data or using dashboards.	I can view user accounts and respond to help requests.	Medium	Sprint-2
Administrator	User Management	USN-6	As an admin, I can manage user roles and permissions for accessing specific dashboards and data.	I can add, edit, or deactivate user accounts and assign permissions.	High	Sprint-1
Administrator	Data Source Management	USN-7	As an admin, I can manage connections to external data sources for EV	I can add or remove data connections and confirm they are working.	Medium	Sprint-2

			analytics.			
Administrator	Dashboard Publishing	USN-8	As an admin, I can publish dashboards to make them available to specific user groups.	I can control which dashboards are visible to each user group.	High	Sprint-1

3.4 Technology Stack

Date	26 June 2025
Team ID	LTVIP2025TMID48669
Project Name	Visualization Tool for Electric Vehicle Charge and Range Analysis.
Maximum Marks	4 Marks

Figure 1. Architecture of the FDC-based EV modeling and analysis.



S.No	Component	Description	Technology Used
1	User Interface	Front-end for users to interact with dashboards and reports	Tableau Web UI, Tableau Server
2	Application Logic-1	Data Cleaning, Data Transformation	Python, SQL
3	Application Logic-2	Data Blending, Joining datasets	Tableau Prep, SQL
4	Application Logic-3	Dashboard Logic, Calculations, Filters	Tableau Calculated Fields, LODs
5	Database	Structured data storage	PostgreSQL, MySQL
6	Cloud Database	Cloud-based scalable data warehouse	Snowflake, AWS RDS
7	File Storage	Storage for raw data uploads, extracts, and exports	AWS S3, Azure Blob Storage
8	External API-1	Fetch government data for EV sales, policies	Indian Govt Open Data API
9	External API-2	Fetch market research and OEM data feeds	Automotive Market APIs (e.g. Statista)
10	Machine Learning Model	Optional for future predictions (battery life, range)	Python ML Libraries (scikit-learn)

11	Infrastructure (Server/Cloud)	Deployment and hosting	AWS EC2, Azure VM, Kubernetes
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APPLICATION CHARACTERISTICS



S.No	Characteristics	Description	Technology Used
1	Open-Source Frameworks	Tools for data prep and transformation	Python, Pandas, SQLAlchemy
2	Security Implementations	Authentication and access control, data encryption	IAM (AWS/Azure), SSL/TLS, Tableau Permissions
3	Scalable Architecture	Architecture capable of handling increasing data volume and user load	Cloud-based Snowflake, Kubernetes
4	Availability	High availability via cloud infrastructure and load balancers	AWS ELB, Azure Load Balancer
5	Performance	Caching, fast extracts, optimized queries, low dashboard load times	Tableau Hyper Extracts, Tableau Cache, CDN for web access

4. PROJECT DESIGN

4.1 Problem Solution Fit

Date	27 June 2025
Team ID	LTVIP2025TMID48669
Project Name	Visualization Tool for Electric Vehicle Charge and Range Analysis.
Maximum Marks	2 Marks

Problem-Solution Fit canvas		Purpose / Vision: Help EV users make smarter charging and travel decisions.		Version:
Define CS, fit into CL	1. CUSTOMER SEGMENT(S) CS <ul style="list-style-type: none"> - EV owners (urban and suburban) - Fleet operators - City planners - EV rental services 	6. CUSTOMER LIMITATIONS CL <small>EG. BUDGET, DEVICES</small> <ul style="list-style-type: none"> - Not tech-savvy - Limited access to premium apps or tools - Device compatibility (mobile/tablet only users) - Budget-conscious (prefer free/low-cost tools) 	5. AVAILABLE SOLUTIONS AS <small>PLUSES & MINUSES</small> <ul style="list-style-type: none"> - Google Maps: Shows locations but not real-time availability (-) - OEM EV apps: Often brand-specific and not customizable (-) - Third-party apps: May lack data accuracy 	Explore AS, differentiate
	2. PROBLEMS / PAINS PR <small>+ ITS FREQUENCY</small> <ul style="list-style-type: none"> - Difficulty finding available EV charging stations (daily/regularly) - Range anxiety due to poor route planning - Lack of visibility into past charging trends 	9. PROBLEM ROOT / CAUSE RC <ul style="list-style-type: none"> - No centralized data hub combining real-time charge availability + range prediction - Fragmented data across various platforms - Lack of predictive analytics 	7. BEHAVIOR BE <small>+ ITS INTENSITY</small> <ul style="list-style-type: none"> - Regular use of mobile apps for navigation - Active search for charging stations - Strong interest in optimizing time/cost (high intensity) 	
Identify strong TR & EM	3. TRIGGERS TO ACT TR <ul style="list-style-type: none"> - Long wait times at charging stations - Running out of charge mid-journey - Rising electricity costs and need for efficient planning 	10. YOUR SOLUTION SL <ul style="list-style-type: none"> - A data visualization dashboard built with Tableau - Features: Real-time charging station status, range analysis, historical usage trends - Connects to MySQL database for live data access - Helps users plan routes and charging stops efficiently 	8. CHANNELS of BEHAVIOR CH <ul style="list-style-type: none"> ONLINE <ul style="list-style-type: none"> - Online: EV mobile apps, dashboards, route planners, forums OFFLINE <ul style="list-style-type: none"> - Offline: Asking at fuel stations, printed maps, EV community meetups 	Extract online & offline CH of BE
	4. EMOTIONS EM <small>BEFORE / AFTER</small> <ul style="list-style-type: none"> - Before: Frustrated, anxious, uncertain - After: Confident, informed, in control 			

 Problem-Solution fit canvas is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License. Designed by Daria Nepriukhina / @daria1983 - we tailor ideas to customer behaviour and increase solution adoption probability.
  IdeaHackers .NL

4.2 Proposed Solution

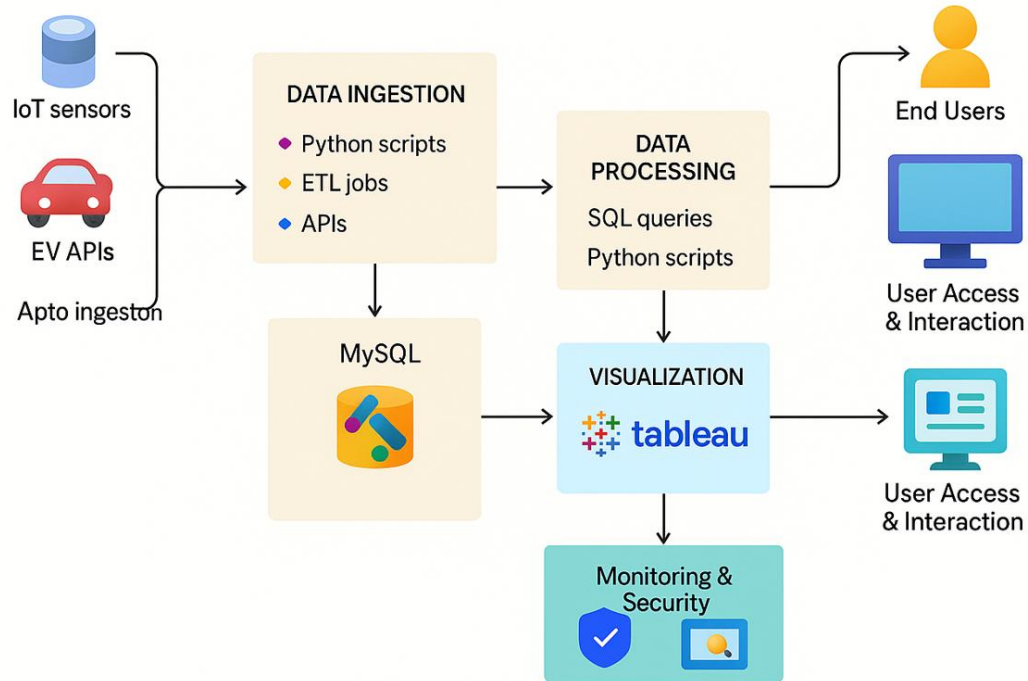
Date	28 June 2025
Team ID	LTVIP2025TMID48669
Project Name	Visualization Tool for Electric Vehicle Charge and Range Analysis.
Maximum Marks	2 Marks

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	EV users often face difficulties in locating available charging stations and estimating range accurately, leading to range anxiety and inefficiencies in trip planning.
2.	Idea / Solution Description	A real-time EV dashboard using MySQL and Tableau that visualizes charging station availability, usage trends, and battery range analysis to support smarter travel and energy decisions.
3.	Novelty / Uniqueness	Combines real-time data analytics and visualization in a user-friendly format; unlike basic maps, it offers predictive insights and customizable dashboards for deeper planning.
4.	Social Impact / Customer Satisfaction	Reduces EV user anxiety and frustration, encourages EV adoption by improving infrastructure usability, and contributes to eco-friendly transportation habits.
5.	Business Model (Revenue Model)	Freemium model with basic dashboard access free for users; premium analytics offered to fleet operators, EV rental companies, and city planners as a subscription service.
6.	Scalability of the Solution	Can scale to include multiple cities, integrate with IoT sensors for live station data, and expand to other smart mobility applications or electric public transport systems.

4.3 Solution Architecture

Date	29 June 2025
Team ID	LTVIP2025TMID48669
Project Name	Visualization Tool for Electric Vehicle Charge and Range Analysis.

Solution Architecture for EV Charge & Range Analysis Dashboard



5. PROJECT PLANNING & SCHEDULING

5.1 PROJECT PLANNING

Date	30 June 2025
Team ID	LTVIP2025TMID48669
Project Name	Visualization Tool for Electric Vehicle Charge and Range Analysis.
Maximum Marks	5 Marks

Product Backlog, Sprint Schedule, and Estimation (4 Marks)

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Data Collection	USN-1	As a user, I want to collect data for analysis	2	High	Likitha Dadi
Sprint-1	Data Collection	USN-2	As a user, I want to load data into the system	1	Medium	Likhitha Ella
Sprint-1	Data Preprocessing	USN-3	As a user, I want to handle missing values	3	High	Dinesh gandhi
Sprint-1	Data Preprocessing	USN-4	As a user, I want to handle categorical values	2	Medium	Allada Vasanth
Sprint-2	Model Building	USN-5	As a user, I want to build a predictive model	5	High	Ganapathy Swamy Goona
Sprint-2	Model Building	USN-6	As a user, I want to test my model on sample data	3	High	Likitha Dadi
Sprint-2	Deployment	USN-7	As a user, I want a working front-end with HTML pages	3	Medium	Likhitha Ella

Sprint-2	Deployment	USN-8	As a user, I want to deploy the project using Flask	5	High	Dinesh Gandhi
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Project Tracker, Velocity & Burndown Chart: (4 Marks)

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	3 Days	5 May2025	8 May 2025	20	5 May2025
Sprint-2	20	3 Days	11 May 2025	14 May 2025	20	11 May 2025
Sprint-3	20	3 Days	17 May 2025	20 May 2025	20	17 May 2025
Sprint-4	20	3 Days	23 May 2025	26 May 2025	20	23 May 2025
Sprint-5	20	3 Days	29 May 2025	2 June 2025	20	29 May 2025
Sprint-6	20	3 Days	5 June 2025	8 June 2025	20	5 June 2025
Sprint-7	20	3 Days	11 June 2025	14 June 2025	20	11 June 2025
Sprint-8	20	3 Days	17 June 2025	20 June 2025	20	17 June 2025

6. FUNCTIONAL & PERFORMANCE TESTING

Date	1 July 2025
Team ID	LTVIP2025TMID48669
Project Name	Visualization Tool for Electric Vehicle Charge and Range Analysis.
Maximum Marks	

6.1 Performance Testing

MODEL PERFORMANCE TEST

S.No.	Parameter	Screenshot / Values
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1.	Data Rendered	<p>4 Datasets rendered successfully from MySQL and CSV sources:</p> <ol style="list-style-type: none"> 1. EV Charging Stations (India) 2. EV Range & Battery Data 3. Global EV Sales Trends 4. State-wise EV Adoption Rates
2.	Data Preprocessing	<ul style="list-style-type: none"> ➤ Null values handled, outliers removed ➤ Data types standardized across tables ➤ Joins and blending done using State, Date, and Vehicle_ID fields
3.	Utilization of Filters	<ul style="list-style-type: none"> ➤ Applied filters on: <ol style="list-style-type: none"> 1. Country/State 2. Battery Capacity 3. Charging Type 4. Manufacturer 5. Year 6. Range Cluster
4.	Calculation fields Used	<ul style="list-style-type: none"> ➤ Calculated Fields: <ol style="list-style-type: none"> 1. Avg_Range = Total Distance / Charge Cycles 2. Charging Efficiency = Energy Used / Charging Time 3. Adoption Rate Growth YoY
5.	Dashboard design	<ul style="list-style-type: none"> ➤ No of Visualizations / Graphs – 7 <p>Types included:</p> <ol style="list-style-type: none"> 1. Map View of Charging Stations 2. Bar Chart: EV Sales by Year 3. Line Chart: Range Over Time 4. Pie Chart: Charging Type Distribution 5. Heatmap: Usage by Region 6. KPI Indicators 7. Comparative Analysis – State vs National Average
6.	Story Design	<ul style="list-style-type: none"> ➤ No of Visualizations / Graphs – 4 <p>Story Points:</p> <ol style="list-style-type: none"> 1. Introduction to Global and Indian EV Trends 2. Challenges in EV Range and Charging 3. Dashboard Visual Insights 4. Recommendations for EV Stakeholders

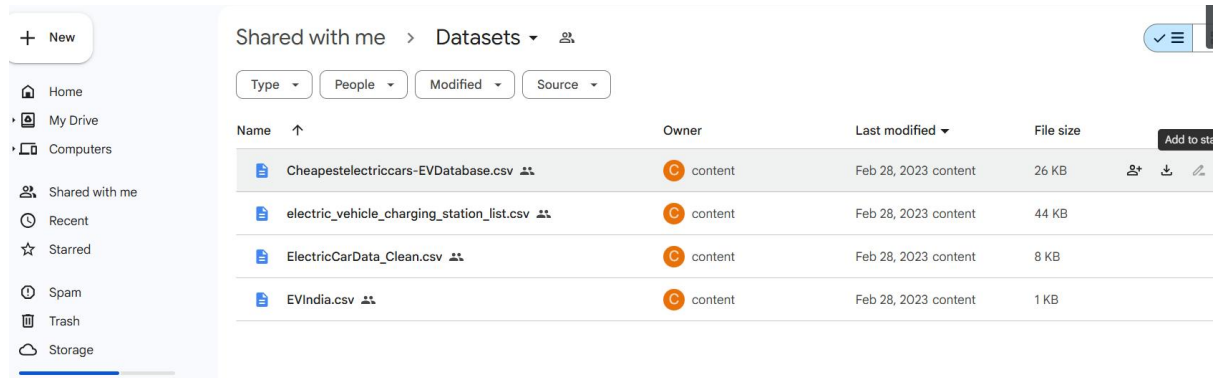
7. RESULTS

7.1 OUTPUT SCREENSHOTS

➤ DATA COLLECTION

collection is the process of gathering and measuring information on variables of interest, in an established systematic fashion that enables one to answer stated research questions, test hypotheses, and evaluate outcomes and generate insights from the data.

➤ DOWNLOADING THE DATASET



Name	Owner	Last modified	File size
Cheapestelectriccars-EVDatabase.csv	content	Feb 28, 2023	26 KB
electric_vehicle_charging_station_list.csv	content	Feb 28, 2023	44 KB
ElectricCarData_Clean.csv	content	Feb 28, 2023	8 KB
EVIndia.csv	content	Feb 28, 2023	1 KB

➤ WORKING WITH DATASET

Here we will start working and understanding the dataset.

1. UNDERSTAND THE DATA

Data contains all the meta information regarding the columns described in the CSV files.
we have provided 4 CSV files:

1. EVIndia
2. Electric_vehicle_charging_station_list
3. ElectricCarData_Clean
4. Cheapestelectriccars-EVDatabase

Column Description for EVIndia:

- Car - Car Brand name and model
- Style Range - Style range of car
- Transmission- Transmission type
- VehicleType – Type of vehicle
- PriceRange(Lakhs) - Price Range in Lakhs

- Capacity - Capacity of car
- BootSpace – Boot space of the car
- BaseModel – Base model name
- TopModel – Top model name

Column Description for Electric_vehicle_charging_station_list:

- region: This column represents the region of the charging station.
- address: This column represents the address of the charging station.
- aux address: This column represents the auxiliary address of the charging station.
- latitude: This column represents the latitude of the charging station.
- longitude: This column represents the longitude of the charging station
- type: This column represents the type of the charging station.
- power: This column represents the power of the charging station.
- service: This column represents the type of service at the charging station.

Column Description for ElectricCarData_Clean:

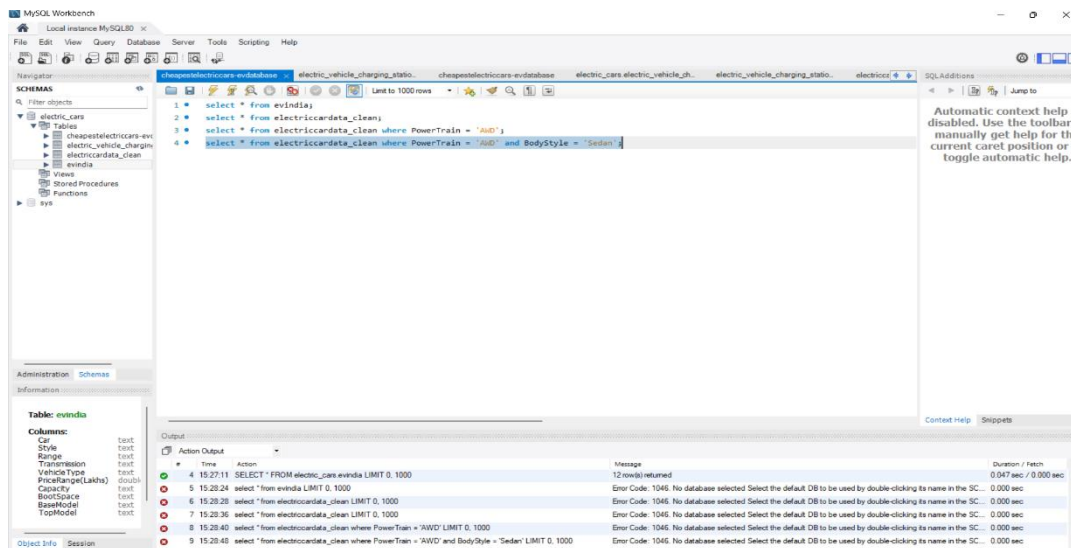
- Brand
- Model
- AccelSec
- TopSpeed_KmH
- Range_Km
- Efficiency_WhKm
- FastCharge_KmH
- RapidCharge
- PowerTrain
- PlugType
- BodyStyle
- Segment
- Seats

- PriceEuro

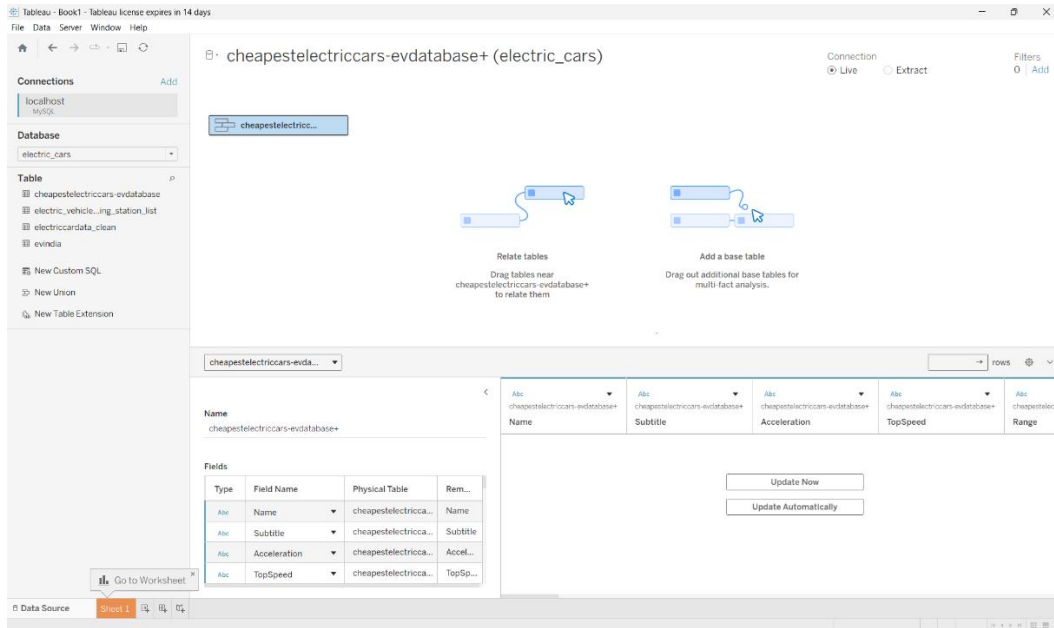
Column Description for Cheapestelectriccars-EVDatabase:

- Name
- Subtitle
- Acceleration
- TopSpeed
- Range
- Efficiency
- FastChargeSpeed
- Drive
- NumberofSeats
- PriceinGermany
- PriceinUK

2. IMPORT DATASET INTO DATABASE

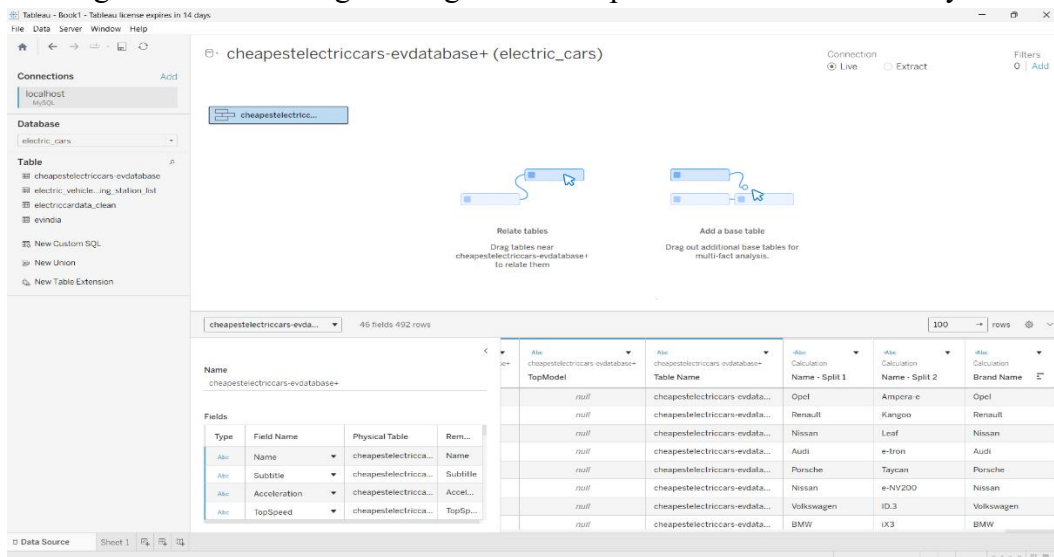


3. CONNECT TABLEAU DESKTOP TO DTBASE SERVER



4. DATA PREPARATION

Preparing the data for visualization involves cleaning the data to remove irrelevant or missing data, transforming the data into a format that can be easily visualized, exploring the data to identify patterns and trends, filtering the data to focus on specific subsets of data, preparing the data for visualization software, and ensuring the data is accurate and complete. This process helps to make the data easily understandable and ready for creating visualizations to gain insights into the performance and efficiency.



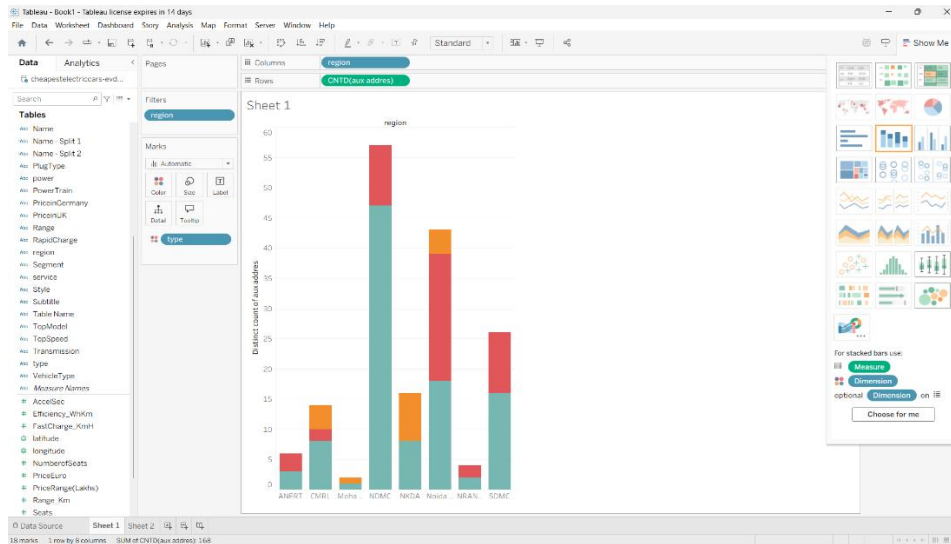
➤ DATA VISUALIZATION

Data visualization is the process of creating graphical representations of data in order to help people understand and explore the information. Data visualisation aims to make complex data sets more accessible, intuitive, and easier to interpret.

By using visual elements such as charts, graphs, and maps, data visualizations can help people quickly identify patterns, trends, and outliers in the data.

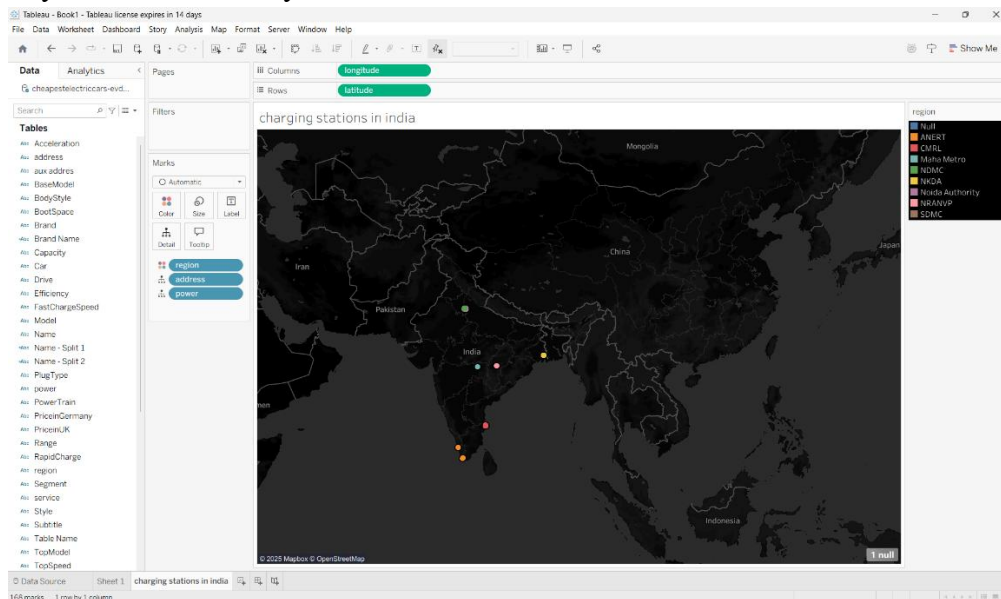
1. CHARGING STATIONS BY REGION AND TYPE IN INDIA

“This chart breaks down the number of charging stations in each region of India by charger type—AC, DC, and fast chargers.”



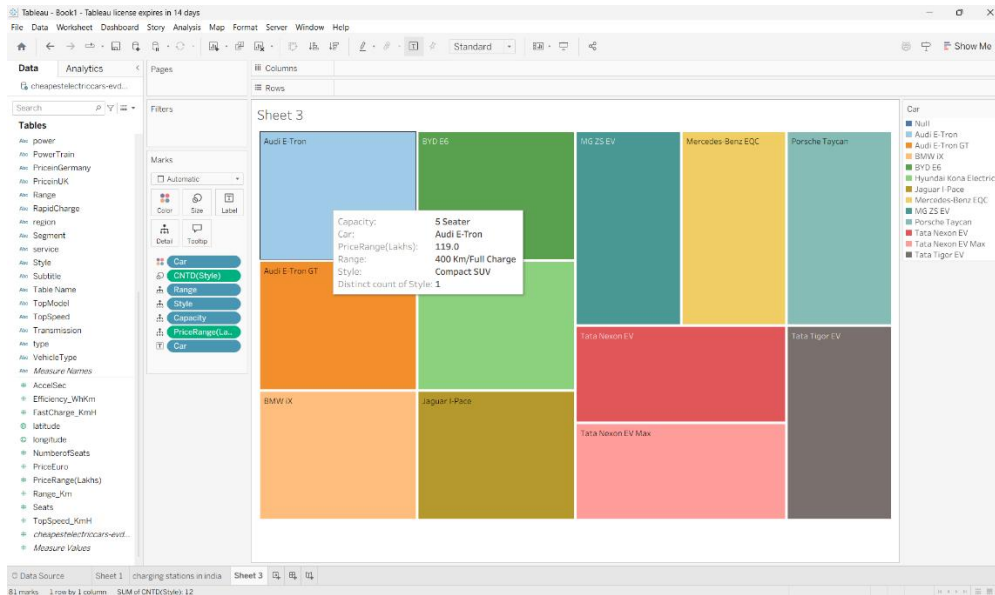
2. EV CHARGING STATIONS MAP IN INDIA

“This map plots the locations of EV charging stations across India, crucial for supporting the country’s electric mobility infrastructure.”



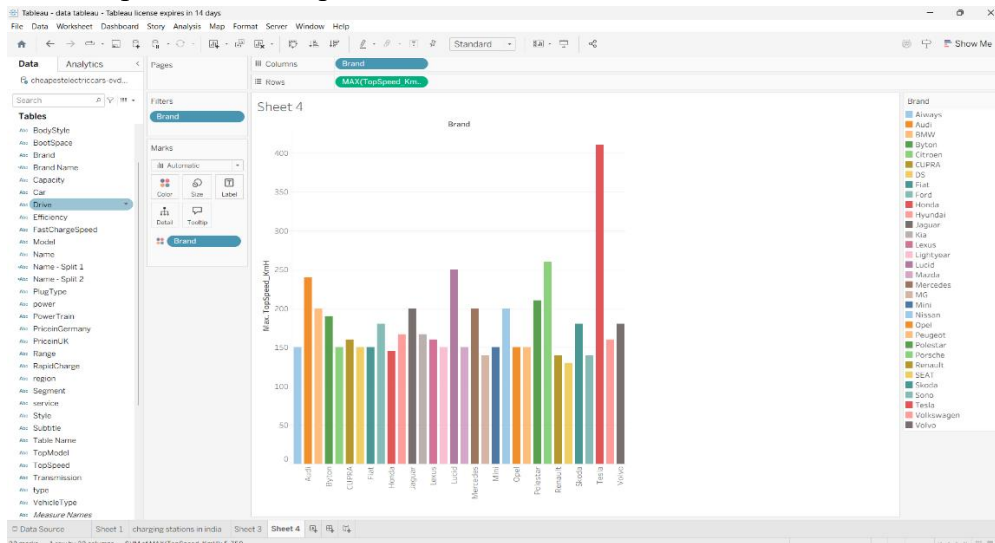
3. DIFFERENT EV CARS IN INDIA

“This treemap highlights the variety of electric car models available in India from various brands, showing the growing local EV market.”



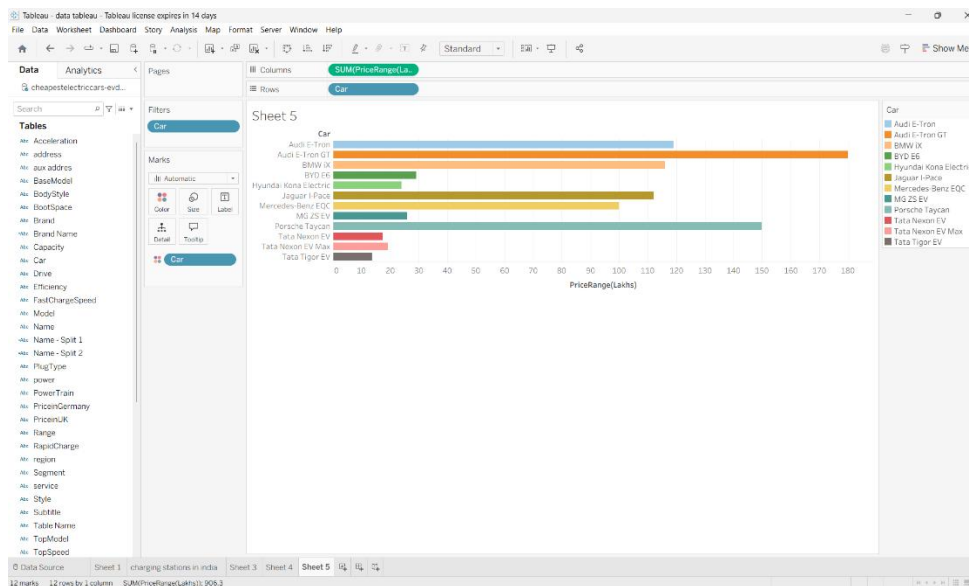
4. TOP SPEED FOR DIFFERENT BRANDS

“This bar graph shows the maximum top speeds achieved by different EV brands, giving an idea of their performance capabilities.”



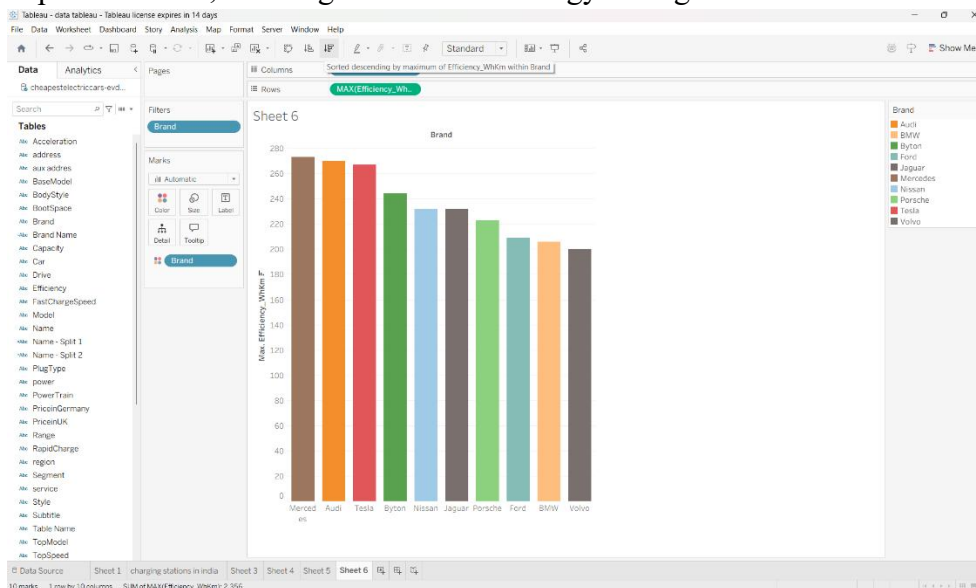
5. PRICES FOR DIFFERENT CARS IN INDIA

“This chart displays the price ranges of different electric car models, helping compare how affordable or premium various EV brands are.”



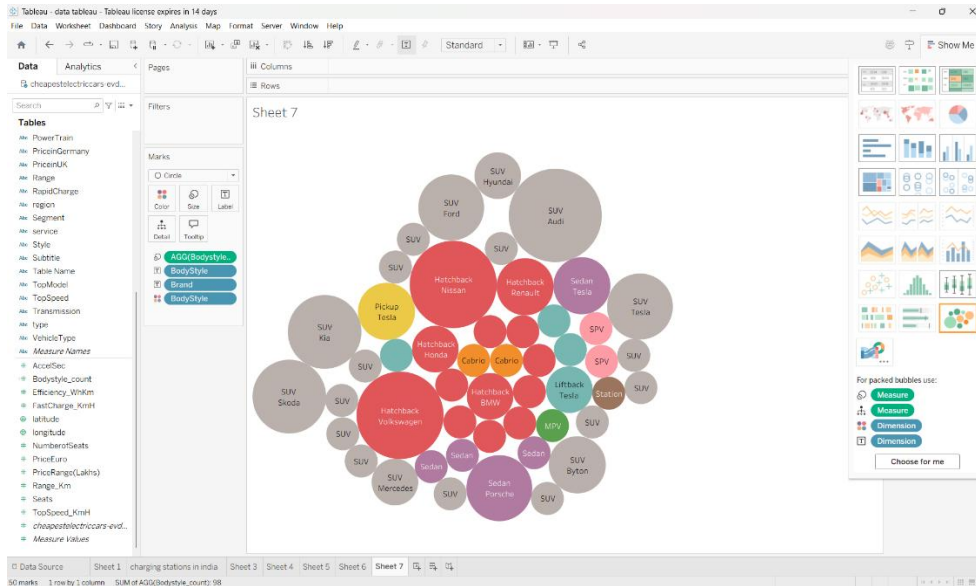
6. TOP 10 MOST EFFICIENT EV BRANDS

“This bar chart ranks the top 10 EV brands with the highest efficiency measured in watt-hours per kilometer, showing who leads in energy savings.”



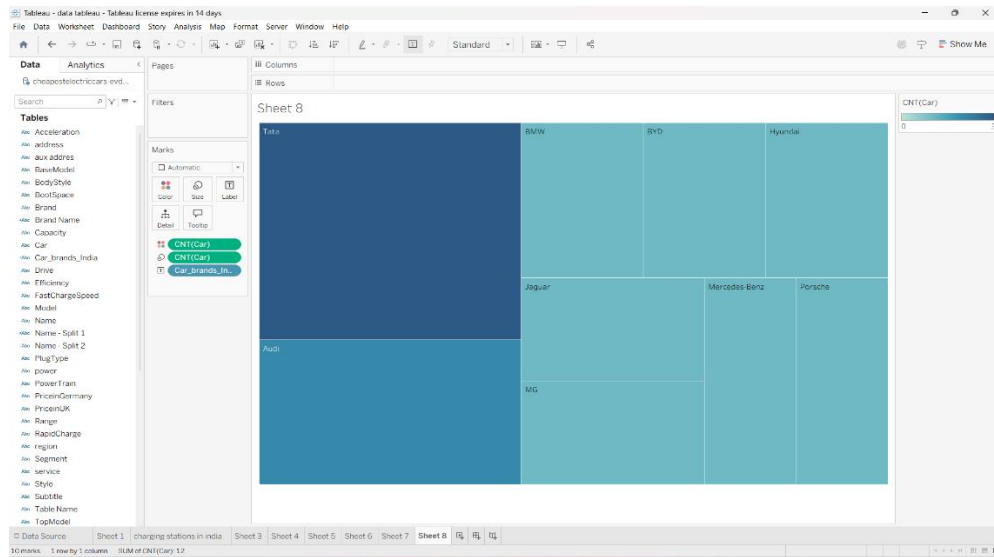
7. BRANDS ACCORDING TO BODYSTYLE

“Here, we see which brands produce EVs in various body styles like SUVs, sedans, hatchbacks, and more, shown as bubbles sized by frequency.”

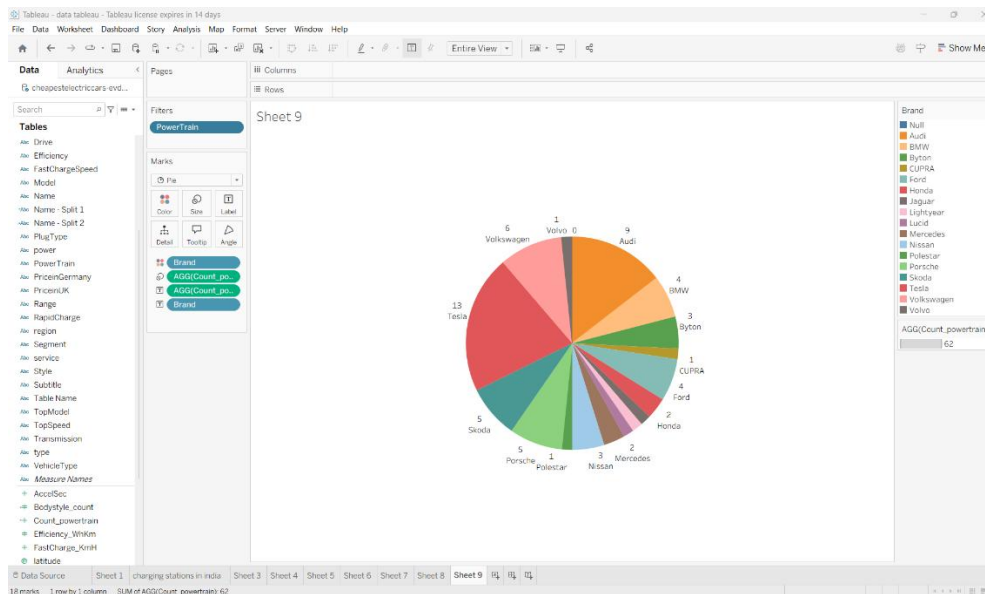


8. BRAND FILTERED BY POWERTRAIN TYPE

“This chart shows how many electric car models each brand offers, filtered by powertrain types like AWD, FWD, and RWD.”



9. NO.OF MODELS OF BY EACH BRAND



➤ DASHBOARD

A dashboard is a graphical user interface (GUI) that displays information and data in an organized, easy-to-read format. Dashboards are often used to provide real-time monitoring and analysis of data, and are typically designed for a specific purpose or use case. Dashboards can be used in a variety of settings, such as business, finance, manufacturing, healthcare, and many other industries. They can be used to track key performance indicators (KPIs), monitor performance metrics, and display data in the form of charts, graphs, and tables.

1. CREATING THE DASHBOARD

The Electric Cars Analytics Dashboard offers a comprehensive view of electric vehicle trends globally and in India. At the top, it highlights the number of different EV brands worldwide (98) and those available in India (9), establishing the scope of analysis. The central image of an electric car charging between two stations visually reinforces the dashboard's theme. A bubble chart categorizes EV brands by bodystyle, with SUVs emerging as the most common type. A bar graph showcases the top 10 most efficient brands, where Mercedes, Audi, and Tesla lead in energy efficiency. The pie chart below filters brands by powertrain types, revealing Tesla and Volkswagen as major contributors. A treemap identifies various EV models available in India, such as Tata Nexon, Audi E-Tron, and MG ZS EV, illustrating the local market landscape. Lastly, a bar chart compares top speeds across different EV brands, with Tesla outperforming others, providing insights into performance benchmarks. This dashboard helps users grasp EV diversity, efficiency, market presence, and performance in a visually engaging format.

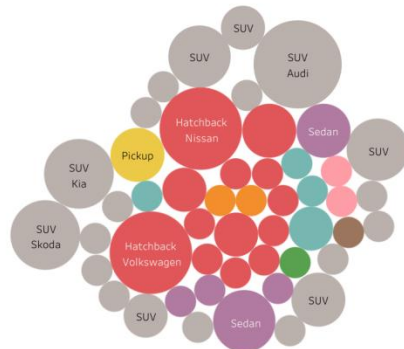
Electric Cars Analytics Dashboard

Different brands of Electric cars globally

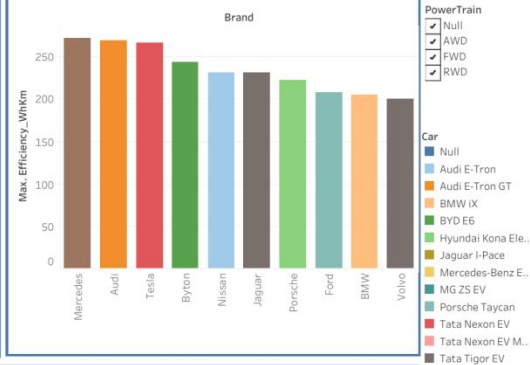
Different Electric Cars brands in India



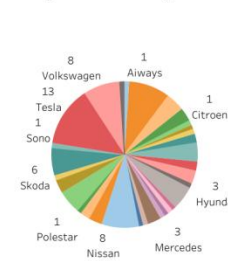
Brands according to bodystyle



Top 10 Most Efficient brands



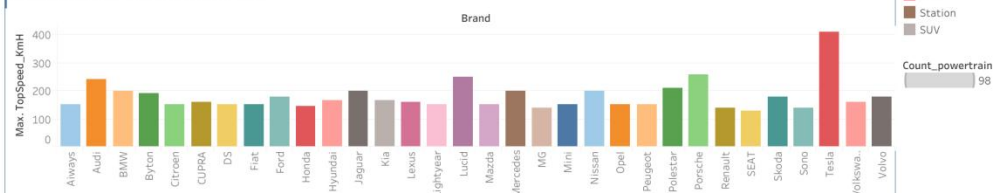
Brand filtered by Powertrain type



Different EV Cars in India



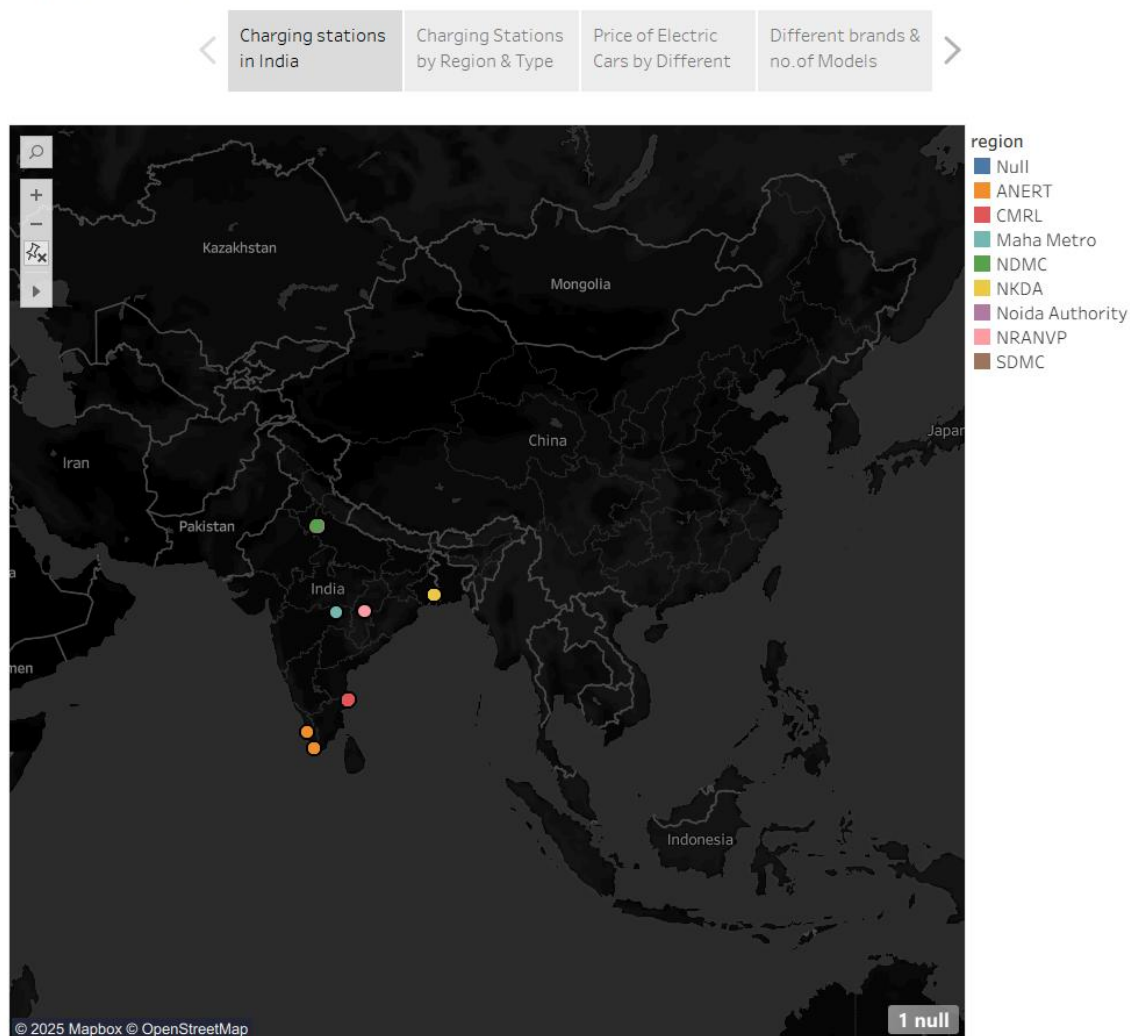
Top Speed For Different Brands

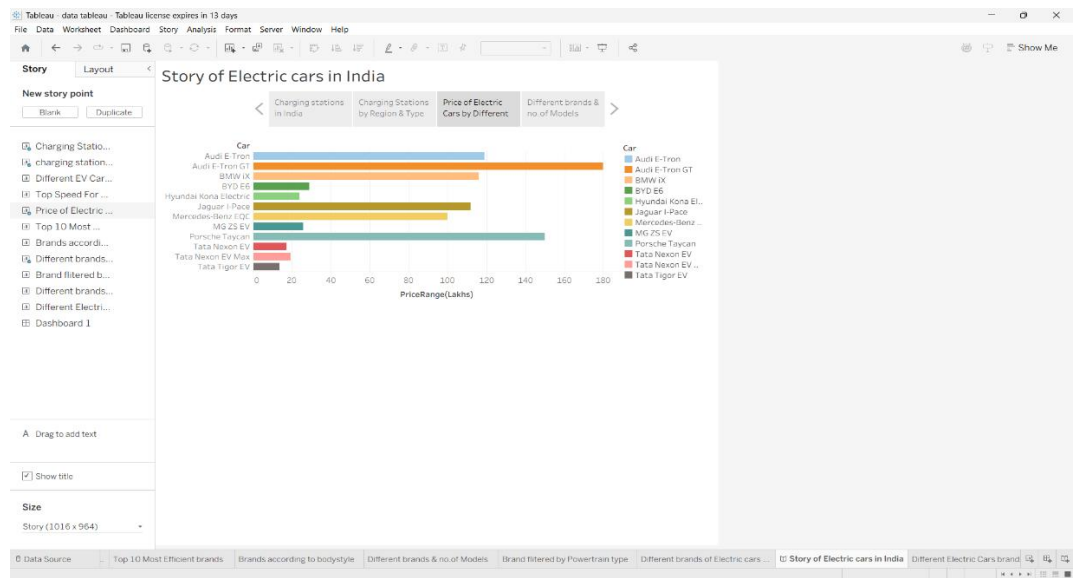
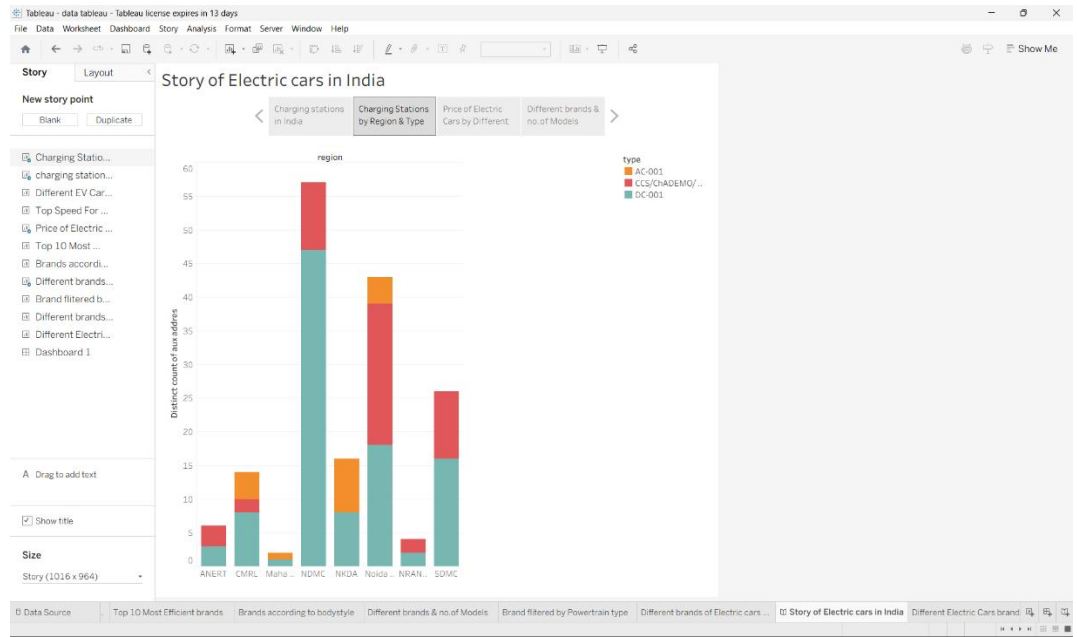


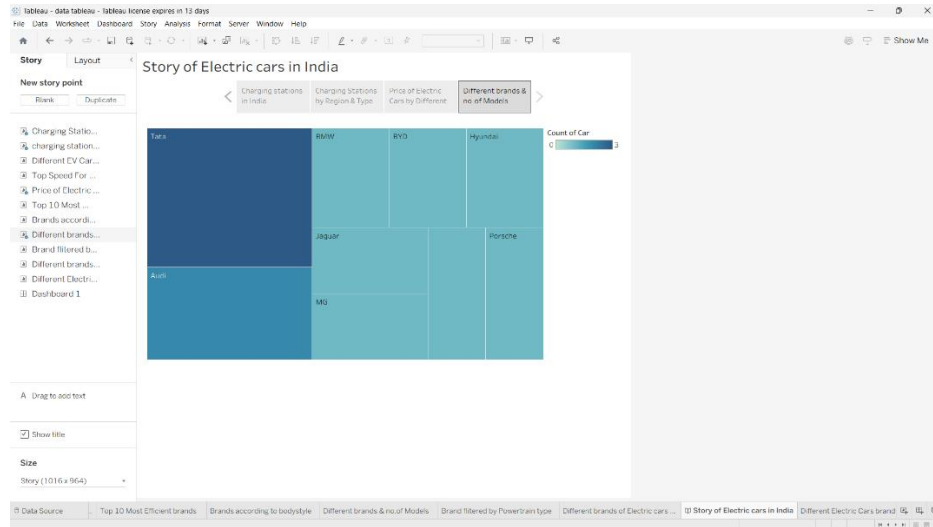
➤ STORY

A data story is a way of presenting data and analysis in a narrative format, with the goal of making the information more engaging and easier to understand. A data story typically includes a clear introduction that sets the stage and explains the context for the data, a body that presents the data and analysis in a logical and systematic way, and a conclusion that summarizes the key findings and highlights their implications. Data stories can be told using a variety of mediums, such as reports, presentations, interactive visualizations, and videos.

Story of Electric cars in India

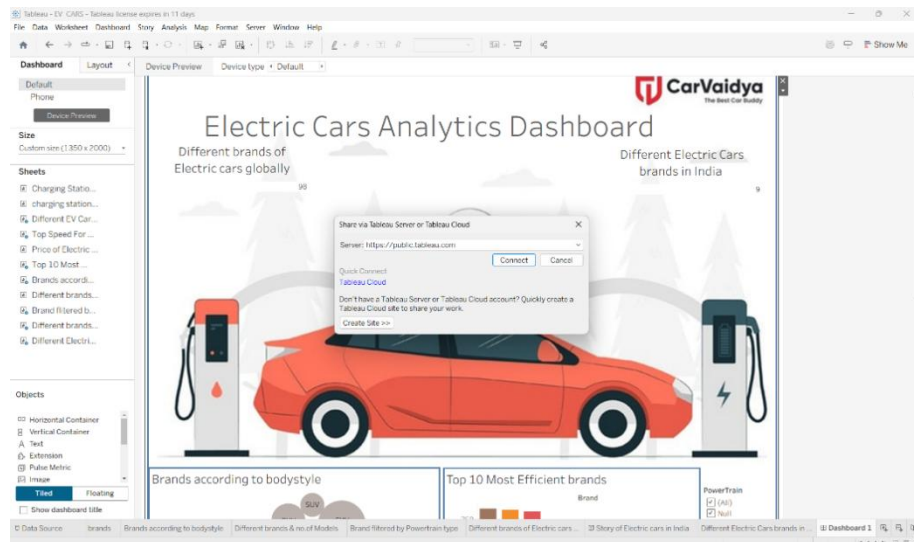






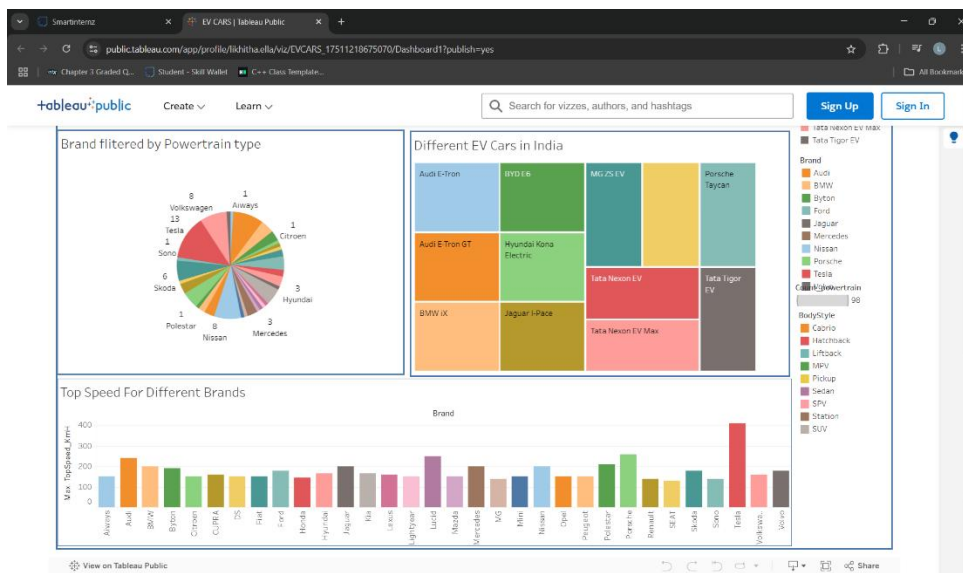
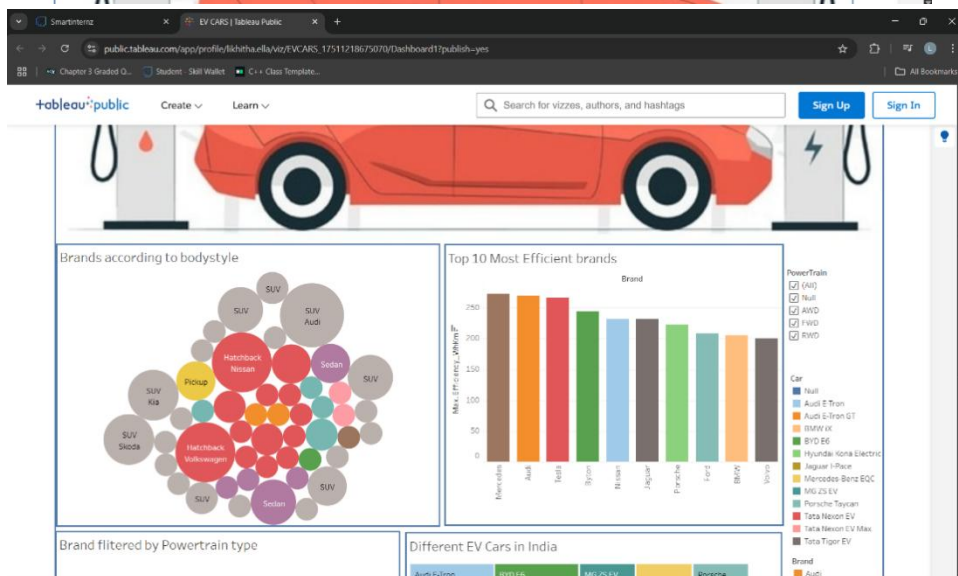
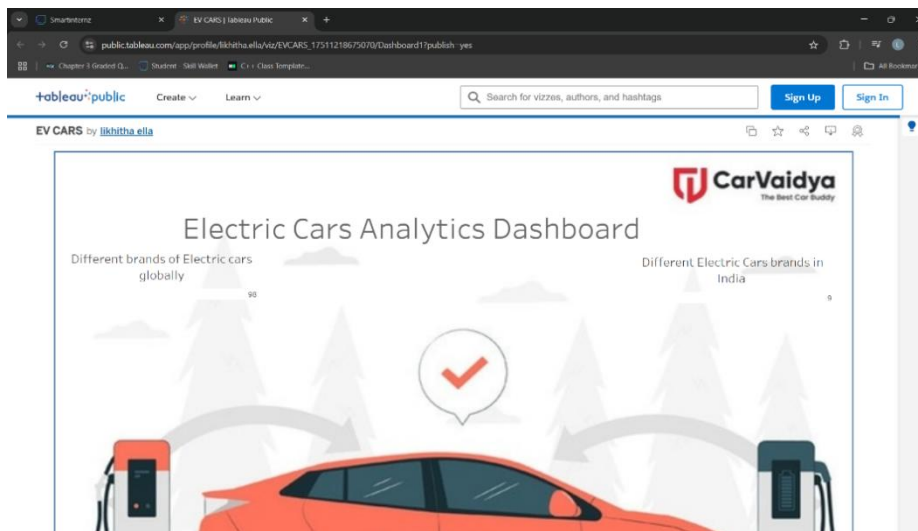
➤ PUBLISHING AND WEB INTEGRATION

1. PUBLISHING DASHBOARD AND REPORTS TO TABLEAU PUBLIC

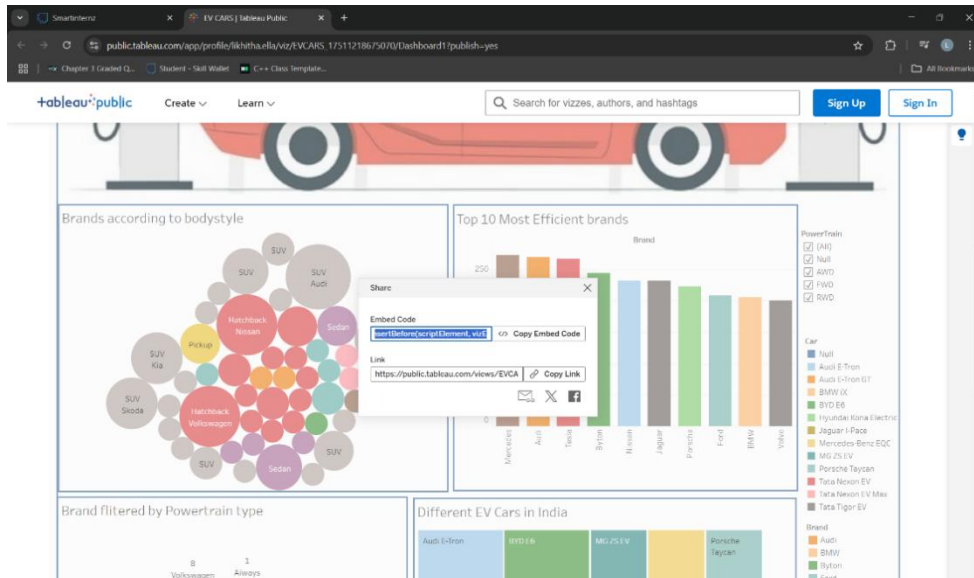


2. EMBED DASHBOARD & STORY WITH WEB BOOTSTRAP

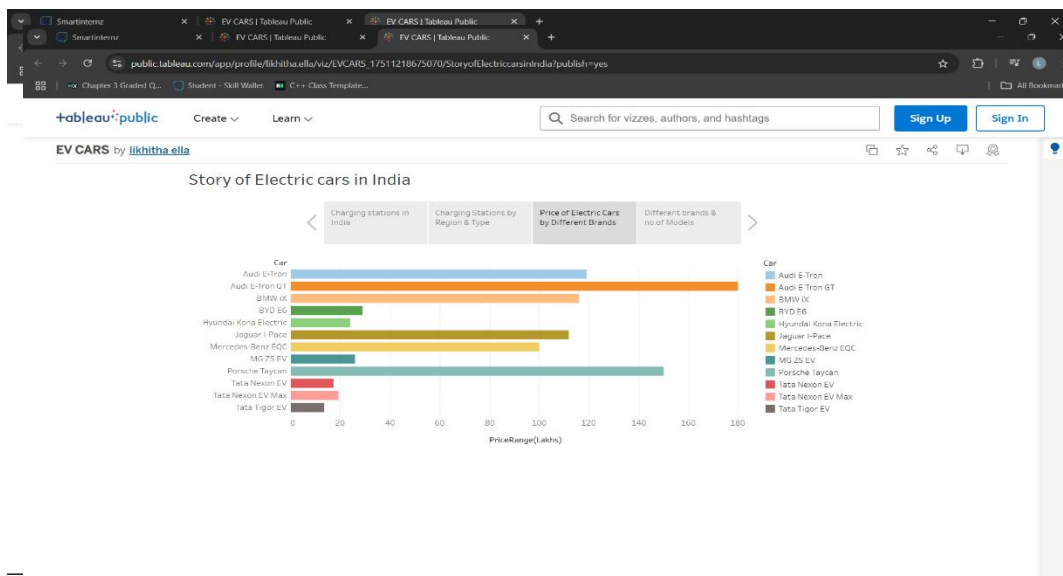
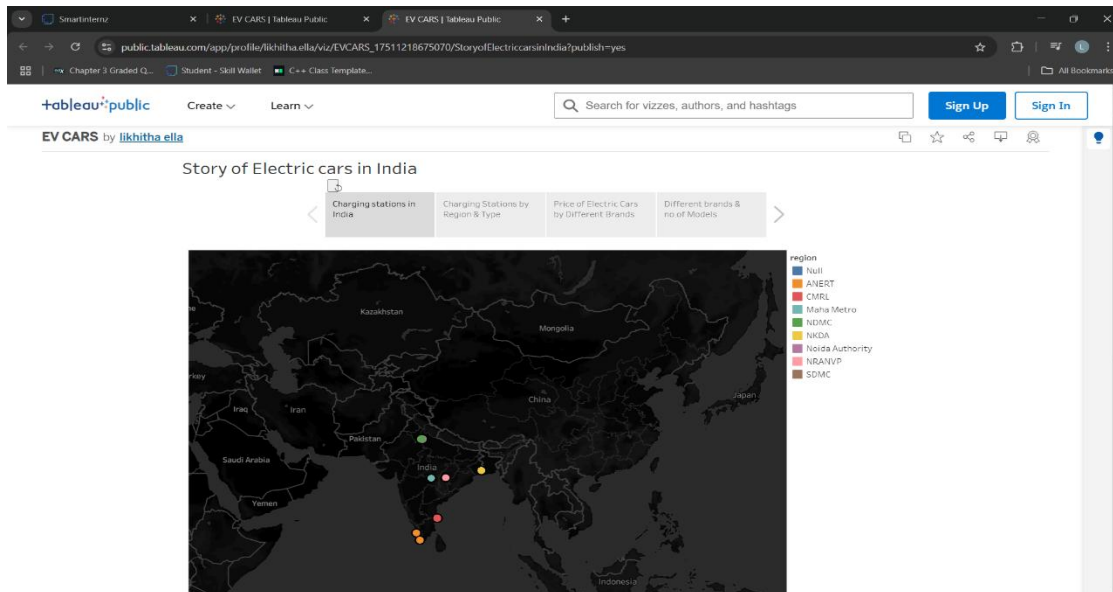
DASHBOARD

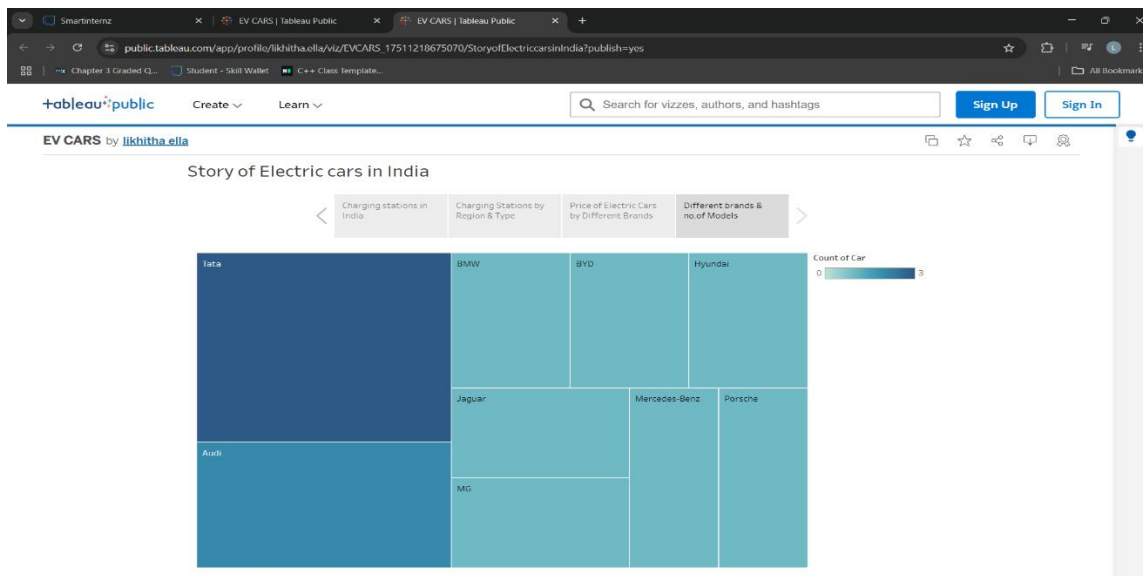


DASHBOARD EMBED CODE

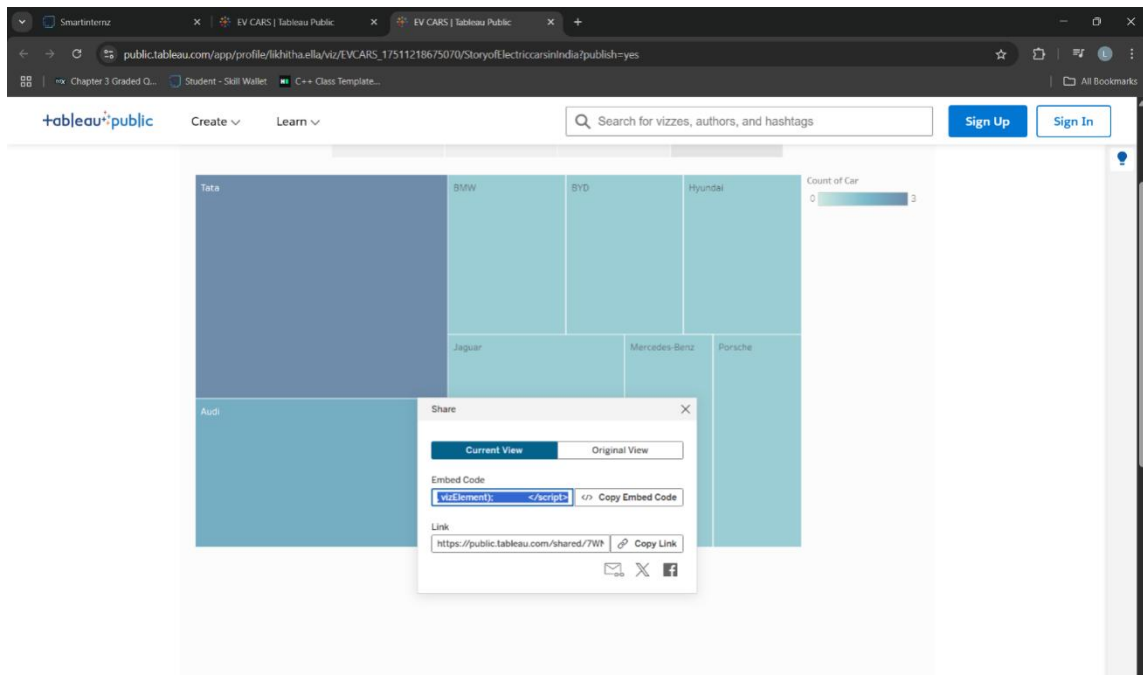


STORY





STORY EMBED CODE



8. ADVANTAGES AND DISADVANTAGES

8.1 Advantages

1. **Data-Driven Insights:** Helps users understand EV usage, charging behavior, and efficiency through powerful visualizations.
2. **Improved Planning:** Assists EV owners in planning routes and charging stops efficiently.
3. **Web Integration:** Makes the dashboard easily accessible via browsers for a wider audience.
4. **Supports EV Growth:** Encourages informed EV adoption by making data transparent and actionable.
5. **Real-Time Connectivity:** Live database connection enables dynamic updates for ongoing decision-making.

8.2 Disadvantages

1. **Data Dependency:** The accuracy of insights depends on data quality and frequency of updates.
2. **Tool Familiarity Needed:** Users need basic Tableau skills to modify or extend dashboards.
3. **Regional Limitations:** Limited access to real-time data from all geographical areas.
4. **Maintenance Overhead:** Requires continuous database management and monitoring to ensure performance.

9. CONCLUSION

This project showcases how data analytics can transform raw EV datasets into meaningful insights. By combining MySQL, Tableau, and web technologies, we developed an intuitive dashboard and story to help users make informed decisions. The solution bridges the gap between raw data and user action, paving the way for smarter and cleaner transportation systems.

10. FUTURE SCOPE

1. **Live IoT Integration:** Connect to real-time EV sensors and smart charging stations.

2. **Predictive Analytics:** Use machine learning to forecast charging needs and range.
3. **Mobile Application:** Deploy the dashboard as a responsive app for on-the-go access.
4. **Geospatial Analysis:** Add map-based visualizations for global charging station distribution.
5. **Vehicle Diversity:** Support analytics for multiple EV models and brands.

11. APPENDIX

Data Set : <https://drive.google.com/drive/folders/1Rkzdks6Us1Uq2SRB4nxMAb83jN5bpHl>

Github : <https://github.com/LIKITHAADADI/Visualization-Tool-for-Electric-Vehicle-Charge-and-Range-Analysis.git>

Video Demo Link : <https://drive.google.com/file/d/1vucdayr9EoDq4apSsSLE3-PO1d5wxZUG/view?usp=drivesdk>