

Project Report

Visualization Tool for EV charge and Range Analysis

1.INTRODUCTION

1.1 Project Overview

This project delivers a comprehensive visualization platform to monitor, analyse, and optimize electric vehicle (EV) charging behaviour and range efficiency. It offers real-time insights for both individual users and fleet managers to make data-driven decisions

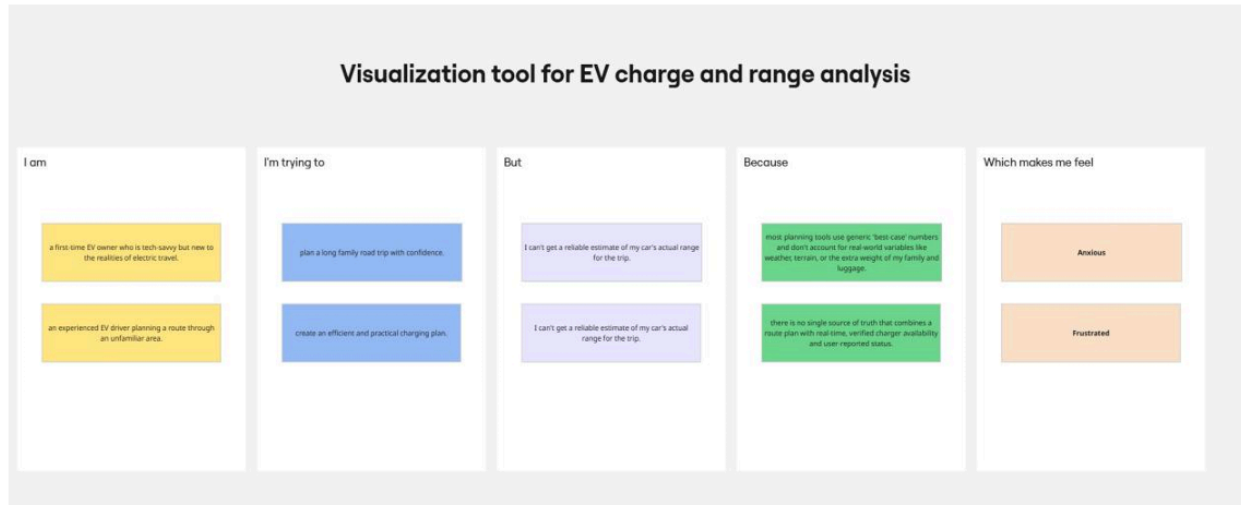
1.2 Purpose

The purpose of the EV Charge and Range Analysis Visualization Tool is to empower users with meaningful, real-time insights that improve electric vehicle usage, planning, and efficiency.

2.IDEATION PHASE

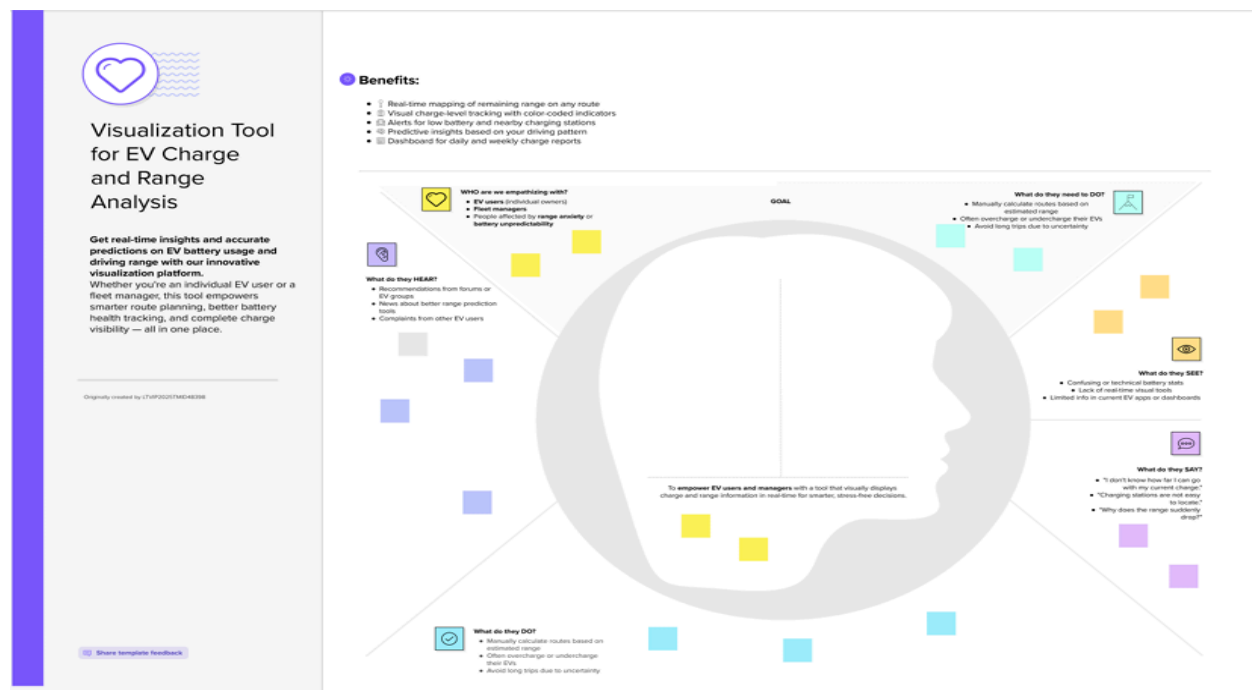
2.1 Problem Statement

Analysing different data from Multiple sources for Electric cars in India and Globally. We have 4 Different datasets that we need to analyse the data and create a Dashboard and story that can represent the data and show the Visuals for the data.



2.2 Empathy Map Canvas


It transforms complex data from battery sensors, driving behavior, and environmental factors into clear, interactive visual dashboards. With features like charge state tracking, real-time range estimation maps, and energy consumption analytics, the tool enables EV owners and fleet operators to monitor performance, predict range, and plan efficient routes.



2.3 Brainstroming

Step-1: Team Gathering, Collaboration and Select the Problem Statement

Explored various datasets



Brainstorm & idea prioritization

Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

🕒 10 minutes to prepare
👥 1 hour to collaborate
👤 2-8 people recommended

➔

Before you collaborate

A little bit of preparation goes a long way with this session. Here's what you need to do to get going.

🕒 10 minutes

A Team gathering
Define who should participate in the session and send an invite. Share relevant information or pre-work ahead.

B Set the goal
Think about the problem you'll be focusing on solving in the brainstorming session.

C Learn how to use the facilitation tools
Use the Facilitation Superpowers to run a happy and productive session.

[Open article](#) ➔

1


Define your problem statement

What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.

🕒 5 minutes

PROBLEM

How might we [your problem statement]?



Key rules of brainstorming

To run an smooth and productive session

- 🗣️ Stay in topic.
- 💡 Encourage wild ideas.
- ⏸️ Defer judgment.
- 👂 Listen to others.
- 🗣️ Go for volume.
- 👁️ If possible, be visual.

Step-2: Brainstorm, Idea Listing and Grouping

1

Brainstorm

Write down any ideas that come to mind that address your problem statement.

🕒 10 minutes

TIP There are no silly or stupid ideas here! The point is to generate as many ideas as possible. Don't worry about quality yet.

Person 1

1. I want to see a lot of people.

2. I want to see a lot of people.

3. I want to see a lot of people.

Person 2

1. I want to see a lot of people.

2. I want to see a lot of people.

3. I want to see a lot of people.

Person 3

1. I want to see a lot of people.

2. I want to see a lot of people.

3. I want to see a lot of people.

Person 4

1. I want to see a lot of people.

2. I want to see a lot of people.

3. I want to see a lot of people.

Person 5

1. I want to see a lot of people.

2. I want to see a lot of people.

3. I want to see a lot of people.

Person 6

1. I want to see a lot of people.

2. I want to see a lot of people.

3. I want to see a lot of people.

Person 7

1. I want to see a lot of people.

2. I want to see a lot of people.

3. I want to see a lot of people.

Person 8

1. I want to see a lot of people.

2. I want to see a lot of people.

3. I want to see a lot of people.

2

Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and break it up into smaller sub-groups.

🕒 20 minutes

TIP Make sure to include a label or title for each cluster to make it easier to find. Brainstorming is a process, not a product. It's about the ideas, not the final result.

How have they grown?

1. I want to see a lot of people.

2. I want to see a lot of people.

3. I want to see a lot of people.

where are they?

1. I want to see a lot of people.

2. I want to see a lot of people.

3. I want to see a lot of people.

what kind are they?

1. I want to see a lot of people.

2. I want to see a lot of people.

3. I want to see a lot of people.

WHAT'S AT RISK?

1. I want to see a lot of people.

2. I want to see a lot of people.

3. I want to see a lot of people.

Step-3: Idea Prioritization

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

3.REQUIREMENT ANALYSIS

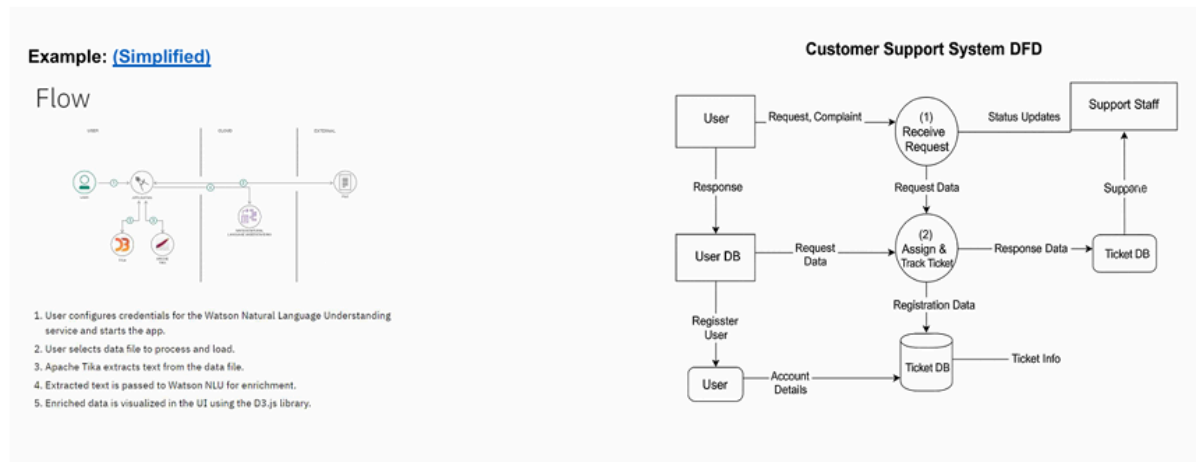
Scenario: EV Data Visualization and Insight Exploration	Entrée	Enter	Engage	Exit
 Scenario: EV Data Visualization and Insight Exploration	 Entrée How does someone become aware of this process?	 Enter What do people experience as they begin the process?	 Engage In the core moments in the process, what happens?	 Exit What do people typically experience as the process finishes?
 Experience steps What does the person (or people) at the center of this scenario typically experience in each step?	<div>User sees ad or article on EV insights</div> <div>User sees targeted ads or LinkedIn posts about EV data insights</div> <div>User stumbles upon the tool via Google Search or a blog about electric vehicle trends</div> <div>Visits the dashboard login page</div>	<div>Visits the dashboard login page</div>	<div>Interacts with charts, filters data views</div> <div>Uses comparison tools to analyze EV metrics by region or manufacturer</div> <div>Downloads specific datasets or exports charts as PDF/CSV</div> <div>Logs out or completes exploration</div>	
 Interactions What interactions do they have at each step along the way? <ul style="list-style-type: none">People: Who do they see or talk to?Places: Where are they?	<div>Google search, social media, blogs</div> <div>LinkedIn, Twitter, EV forums</div> <div>Smartphone, social media apps</div> <div>Signup form, email confirmation</div>	<div>Signup form, email confirmation</div>	<div>Self-service via UI</div> <div>Dashboard UI, map visualization, filters</div> <div>Dashboard, data view page</div> <div>Logout, survey, save/share option</div>	
 Goals & motivations At each step, what is a person's primary goal or motivation? ("Help me..." or "Help me avoid...")	<div>"Help me learn more about EV trends."</div> <div>"Help me find a reliable tool to analyze EV data effortlessly"</div> <div>"Help me understand how EVs are performing in my region (compared to global benchmarks)"</div>	<div>"Help me sign up and get started easily"</div>	<div>"Help me explore meaningful EV insights."</div> <div>"Help me identify EV performance trends quickly"</div> <div>"Help me compare datasets to make data-driven recommendations"</div>	<div>"Let me finish and save/share my findings."</div>
 Positive moments What steps does a typical person find enjoyable, productive, fun, motivating, delightful, or exciting?	<div>Discovering useful content via trusted source</div> <div>Landing page clearly communicates the value of the tool</div> <div>Sample dashboard previews spark interest</div>	<div>Smooth signup and visually appealing UI</div>	<div>Interactive filters, smooth performance, insightful data</div> <div>Charts respond smoothly to filter selections</div> <div>Tooltips and legends clarify complex visuals</div> <div>Able to save report or share findings</div>	
 Negative moments What steps does a typical person find frustrating, confusing, angering, costly, or time-consuming?	<div>Misleading content or spam-like ads</div> <div>No clear call-to-action (e.g., "Try Demo" or "Explore Dashboard")</div> <div>Confusing or cluttered landing page</div>	<div>Complicated signup or failed verification</div>	<div>Slow loading, too many options, data overload</div> <div>Visual clutter or overlapping chart elements</div> <div>Lag or delay in loading large datasets</div>	<div>Confusion on how to save/share findings</div>
 Areas of opportunity How might we make each step better? What ideas do we have? What have others suggested?	<div>Collaborate with EV influencers and blogs for credible promotion</div> <div>Add competing use cases on homepage (e.g., "Compare EV charging efficiency across states")</div> <div>Include testimonials or success stories from early users</div>	<div>Add Google/Gmail/LinkedIn one-click login</div>	<div>Add tutorial or guided tour, enable user-specific dashboards</div> <div>Introduce guided insights or summary highlights</div> <div>Optimize performance for large dataset handling</div> <div>Auto-save session, ask for feedback gently</div>	

3.2 Solution Requirement

Functional: Data filtering, dashboards, stories, maps, charts

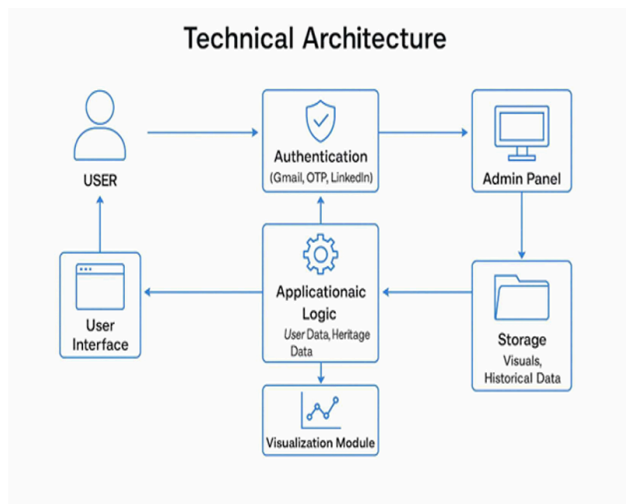
Non-functional: Performance, usability, responsiveness, accessibility

3.3 Data Flow Diagram



3.4 Technology Stack

- **Tableau Public** for visualization and publishing
- **Kaggle** dataset (CSV)
- Optional: Flask for web integration (if used)



4. PROJECT DESIGN

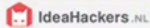
4.1 Problem-Solution Fit

Problem-Solution Fit canvas

Purpose / Vision: _____ Version: _____

Define CS, fit into CL	1. CUSTOMER SEGMENT(S) CS <ul style="list-style-type: none">- Individual EV owners- EV fleet managers- Urban commuters	6. CUSTOMER LIMITATIONS CL <small>EG. BUDGET, DEVICES</small> <ul style="list-style-type: none">- Budget constraints- Varying tech-savviness- Older EV models with limited	5. AVAILABLE SOLUTIONS AS <small>PROS & CONS</small> <ul style="list-style-type: none">- Google Maps with limited EV info- EV manufacturer apps (but not customizable)	Explore AS, differentiate
	2. PROBLEMS / PAINS PR <small>+ ITS FREQUENCY</small> <ul style="list-style-type: none">- Users struggle to estimate how far they can drive with current battery levels- Uncertainty about charging station locations- Anxiety during long trips due to range limitations	9. PROBLEM ROOT / CAUSE RC <ul style="list-style-type: none">- Lack of visual and predictive tools tailored for EV users- Insufficient integration between GPS and real-time battery data	7. BEHAVIOR BE <small>+ ITS INTENSITY</small> <ul style="list-style-type: none">- Users frequently overcharge or avoid long trips- Fleet managers create manual tracking logs- High dependence on charging stations' availability	
Focus on PR, tap into BE, understand RC	3. TRIGGERS TO ACT TR <ul style="list-style-type: none">- Trip planning failures- Unexpected battery drain	10. YOUR SOLUTION SL A visual and predictive tool that maps EV battery charge with real-time route planning and range estimation.	8. CHANNELS of BEHAVIOR CH	
	4. EMOTIONS EM <small>BEFORE / AFTER</small> Before: Anxious, unsure, frustrated After: Confident, informed, stress-free charge management		<div>ONLINE</div> <div>EV apps, dashboards, maps</div> <div>OFFLINE</div> <div>Route planning, manual logs</div>	
Identify strong TR & EM			Extract online & offline CH of BE	

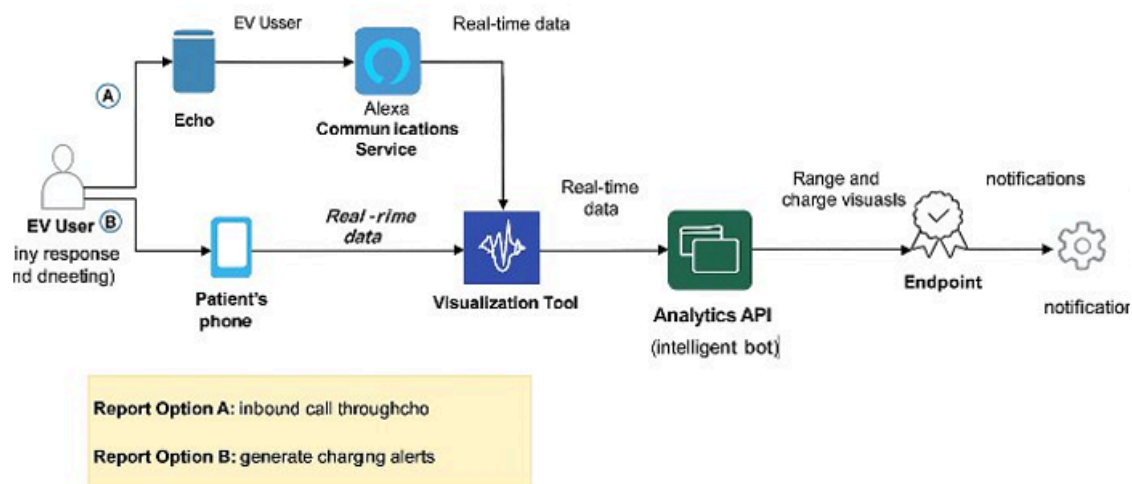
Problem-Solution fit canvas is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License. Designed by Daria Nepriakhina / ideahackers.nl - we tailor ideas to customer behaviour and increase solution adoption probability.

 **IdeaHackers**.NL

4.2 Proposed Solution : Two dashboards and a Tableau story showcasing endangered sites, global distribution, and trend forecasting.

S.No.	Parameter	Description
	Problem Statement (Problem to be solved)	EV users lack clear, real-time visibility into charging patterns, range predictions, and optimal usage routes based on charge data.
	Idea / Solution description	A web-based visualization tool that processes EV data to display charge levels, consumption trends, and estimated range using interactive dashboards.
	Novelty / Uniqueness	Combines real-time charge analytics with predictive range estimation and route insights tailored to different EV models and driving behaviors.
	Social Impact / Customer Satisfaction	Enhances user confidence in EVs, reduces range anxiety, and promotes smarter, energy-efficient travel decisions.
	Business Model (Revenue Model)	Freemium model for users, with premium features for OEMs, fleet operators, and integration partners via licensing or subscription.
	Scalability of the Solution	Highly scalable to accommodate various EV brands, geographies, and fleet sizes through cloud-based data integration and modular analytics.

4.3 Solution Architecture



5. PROJECT PLANNING & SCHEDULING

Activity	Duration
Dataset Download	0.5 Hrs
Data Preparation	0.5 Hrs
Visualizations	1.0 Hrs
Filters and Interactions	1.0 Hrs
Dashboard Design	1.0 Hrs
Story Creation	1.0 Hrs
Publishing & Web Integration	1.0 Hrs

6. FUNCTIONAL AND PERFORMANCE TESTING

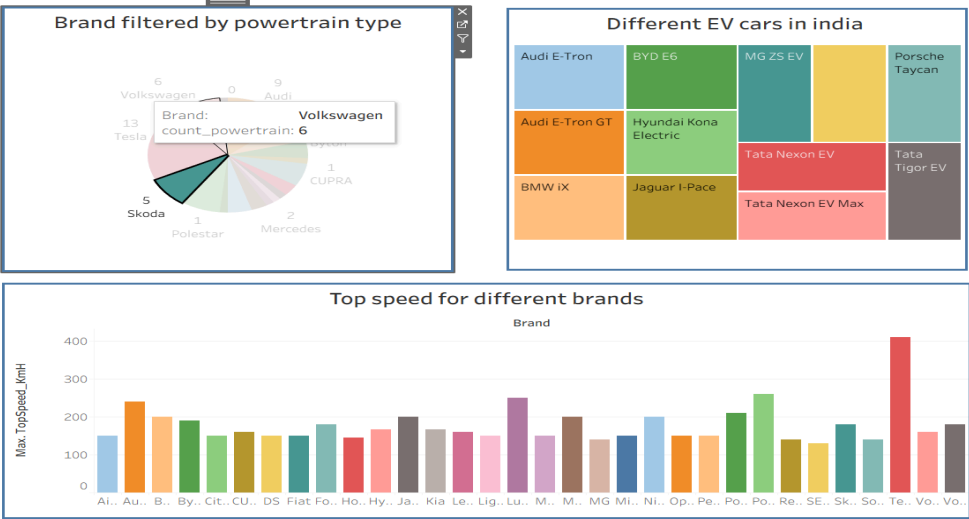
6.1 Performance Testing

Processed and visualized 1100+ records without lag. Filters and dashboards loaded instantly.

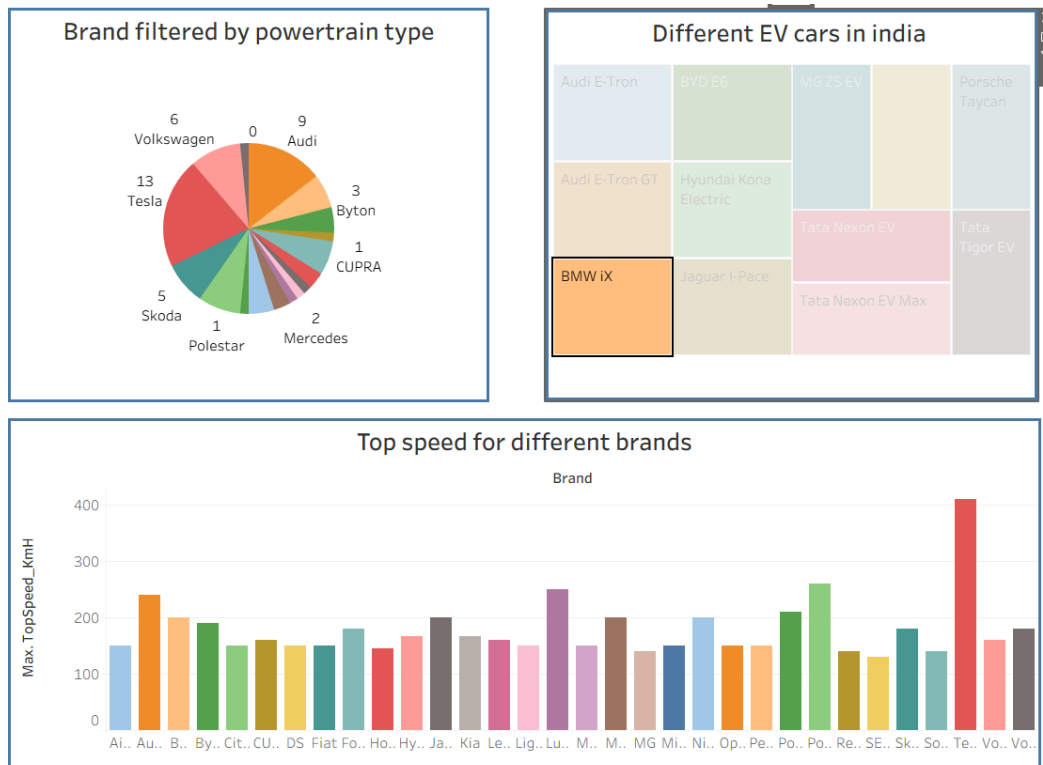
Conclusion: The performance across visualizations, dashboards, and filters was consistently smooth, ensuring usability and responsiveness for end users.

6.2 Utilization of Data Filters

- Activity 2.1: Filtered "Tesla"



● Activity 2.2: Filtered "BMW iX"



6.3 Web Integration and Publishing

- Connected to Tableau Public
- Published dashboards using share option
- Required Tableau Public login for upload

Steps:

1. Open dashboard/story > Click Share
2. Enter Tableau Public credentials
3. Click Connect and publish the selected sheet/dashboard

7. RESULTS

7.1 Output Screenshots

- Dashboard 1: Electric Car Dashboard and Overview

Electric Car Dashboard

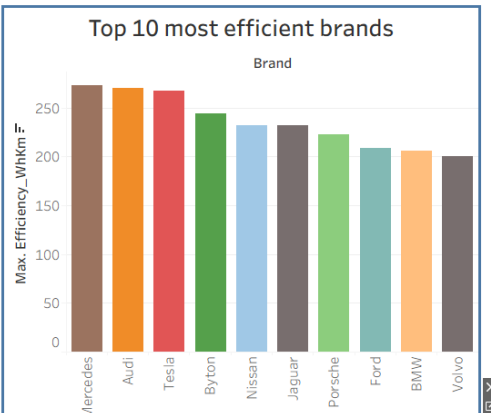
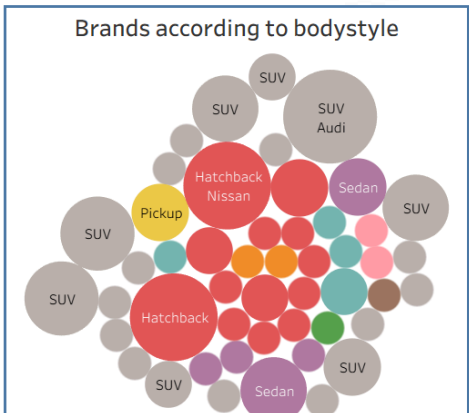
Different types of electric cars globally

98



Different electric brands in india

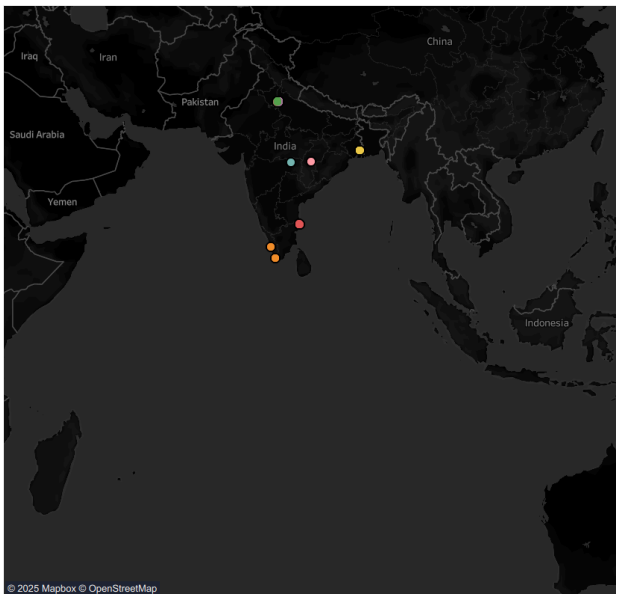
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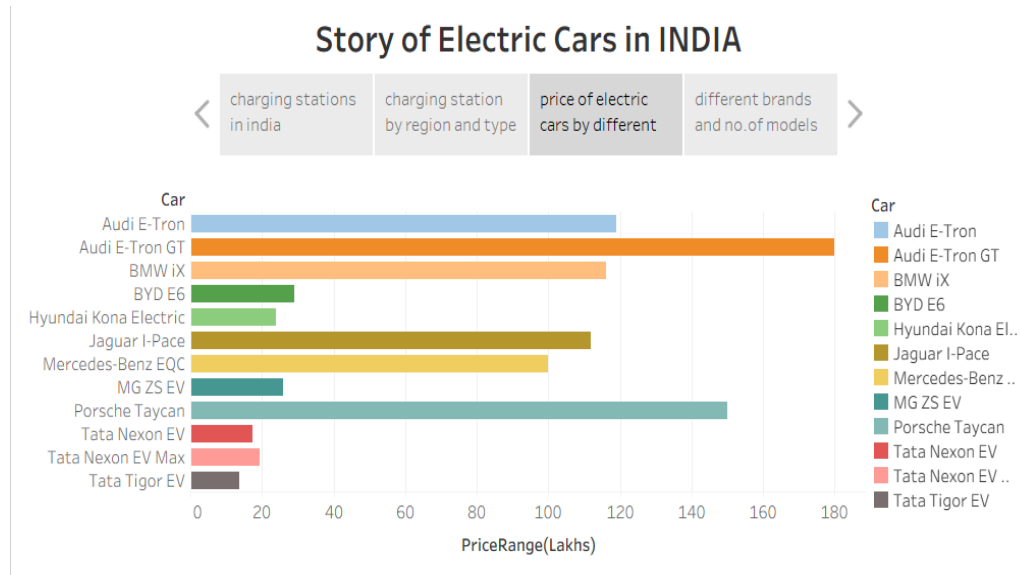
- Story Scenes with interactive flow story1

Story of Electric Cars in INDIA

< charging stations in india charging station by region and type price of electric cars by different different brands and no. of models >



Story 1



8. ADVANTAGES & DISADVANTAGES

Advantages

- Real-time filtering
- Clear visual storytelling
- Easy publishing on Tableau Public







Disadvantages

- Static dataset (2019 only)
- Public version lacks backend connectivity

9. CONCLUSION

The EV Charge and Range Analysis Visualization Tool successfully bridges the gap between raw EV data and meaningful decision-making. By offering an intuitive, interactive platform, it empowers users to monitor charge levels, predict vehicle range, and optimize energy consumption with ease and clarity.

10. FUTURE SCOPE

-  Integration with real-time charging station networks
-  Range prediction improvements using live weather and traffic feeds
-  Multi-vehicle and fleet comparison dashboards
-  Mobile app with location-based charge alerts and range estimation
-  AI-driven energy optimization suggestions for drivers
-  Cross-region route planning with smart charging stops

11. APPENDIX

• DatasetLink: <https://drive.google.com/drive/folders/1Rkzdk6Us1Uq2SRB4nxMAb83jN5bpHII>

• GitHubLink:

<https://github.com/Reshma-Narayanasetty/-EV-charge-and-Range-Analysis>

• TableauPublicLink:

<https://public.tableau.com/app/profile/narayanasetty.reshma/vizzes>

• VideoDemoLink:

https://drive.google.com/file/d/1V1zsqlJrmPO7lpvq3x4mOOZNqXzJyz_aY/view?usp=sharing