

Visualization tool for electric vehicle charge and range analysis



A Report submitted by

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1. INTRODUCTION

1.1. PROJECT OVERVIEW

The **Visualization Tool for EV Charge and Range Analysis** is a data-driven web application designed to empower electric vehicle (EV) users, enthusiasts, and researchers with actionable insights. Built using **Tableau Public** for advanced data visualization and **HTML/CSS** for web integration, the platform aims to bridge the information gap in the EV ecosystem.

This tool provides an interactive dashboard where users can:

- Compare different EV brands and models based on efficiency, price, powertrain type, and range.
- Visualize the availability and distribution of EV charging stations across regions.
- Analyze the number of EV models available from each brand.
- Access EV statistics filtered by body style and powertrain types.

By transforming raw datasets into meaningful visual stories, the solution simplifies complex EV data, helping users make better, faster, and environmentally responsible decisions. The project is designed to be **scalable**, **user-friendly**, and **insightful**, serving both general consumers and policy-level stakeholders.

1.2. PURPOSE

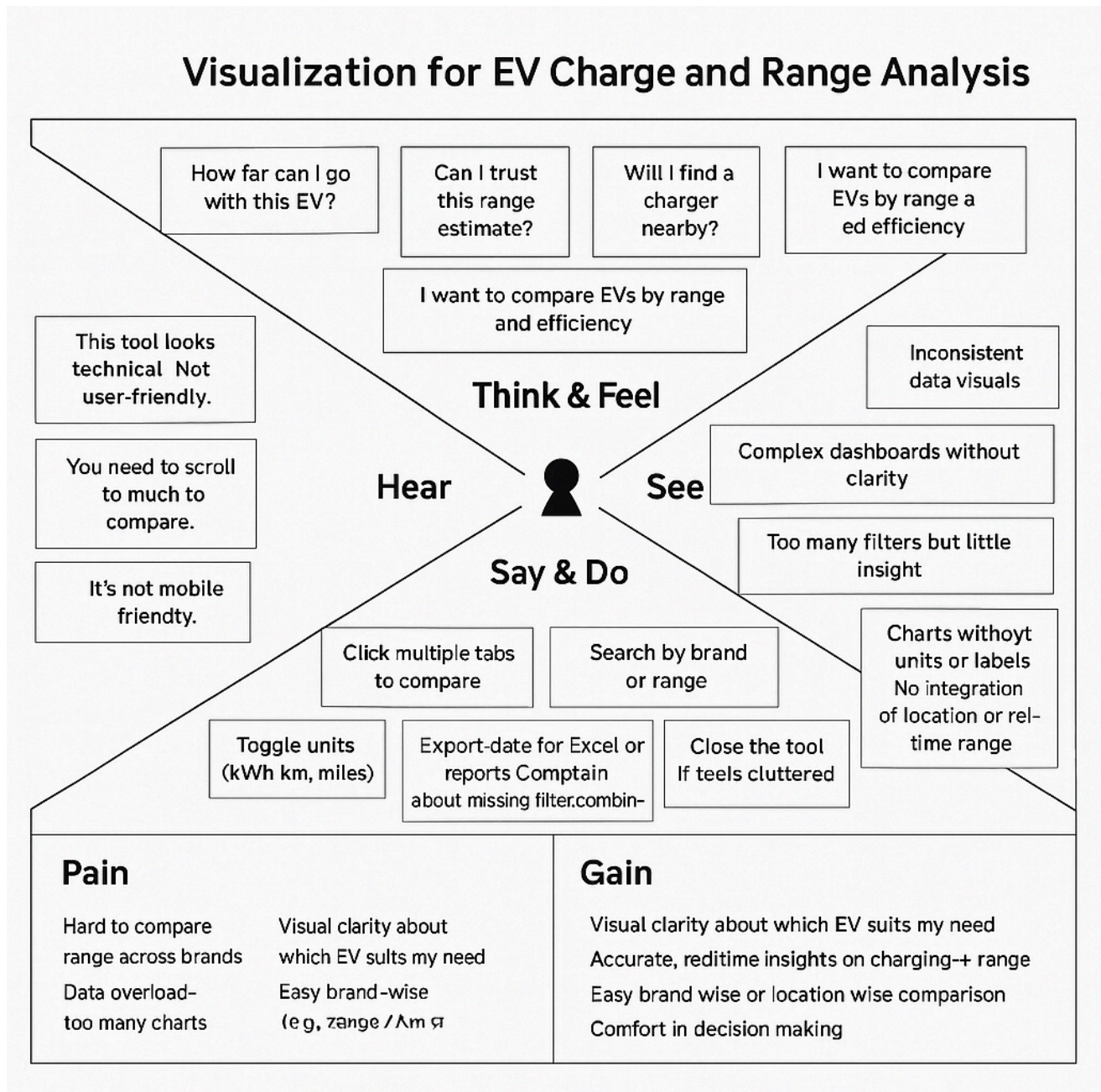
The purpose of the **Visualization Tool for EV Charge and Range Analysis** is to **simplify the understanding of electric vehicle data** for users by transforming complex datasets into visually interactive dashboards. This tool empowers users—ranging from potential EV buyers to policy makers—with insights about EV efficiency, cost, availability, and charging infrastructure. By making data more accessible and actionable, the project promotes **informed decision-making**, supports the **adoption of sustainable transportation**, and contributes to **India's green mobility vision**.

2. IDEATION PHASE

2.1. PROBLEM STATEMENT

Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	A 30-year-old working professional, tech-savvy but not an auto expert, living in an urban city with limited EV exposure.	Compare EV models based on range and charging station availability near my workplace and home.	I find the dashboard is cluttered and hard to navigate; I can't filter by my city or see nearby stations easily.	The tool lacks location-based filtering and isn't personalized to user needs or preferences.	Frustrated, confused, and discouraged from switching to an EV.
PS-2	A 25-year-old male, EV enthusiast, early adopter, detail-driven, and interested in performance metrics and technical comparisons.	Analyze battery efficiency across brands and compare top speeds, range-to-cost ratio, and charging speeds.	The visualizations are basic, lack calculated metrics like km/kWh or price/km, and don't support export for analysis.	The tool is designed more for general audiences and lacks advanced analytical features.	Restricted and disappointed, as I can't explore the data at the depth I want.

2.2. EMPATHY MAP CANVAS



3. REQUIREMENT ANALYSIS

3.1. SOLUTION REQUIREMENT

Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Dataset Integration	<p>Upload and prepare multiple datasets (e.g., EV specs, charging stations, India-specific EV data) in Tableau.</p> <p>Clean and preprocess data (e.g., filter null values, rename headers for clarity).</p> <p>Join or blend datasets if necessary in Tableau.</p>
FR-2	Data Visualization	<p>Create visualizations for EV cars based on price, brand, body style, powertrain, and efficiency.</p> <p>Create maps for charging stations by region and type.</p> <p>Build visualizations showing top speed vs. range for each brand.</p> <p>Filter data dynamically based on user input (e.g., dropdowns for brand, powertrain, etc.)</p>
FR-3	Dashboard Development	<p>Combine all visualizations into one interactive dashboard.</p> <p>Add filters and action controls to the dashboard.</p> <p>Ensure responsiveness for both desktop and mobile view.</p>
FR-4	Story creation in Tableau	Create Tableau Story to guide users through a sequence (e.g., problem overview → data insights → conclusion)
FR-5	Web Application UI	<p>Design the front-end web page using HTML and CSS.</p> <p>Embed Tableau dashboards/stories into the HTML page.</p>

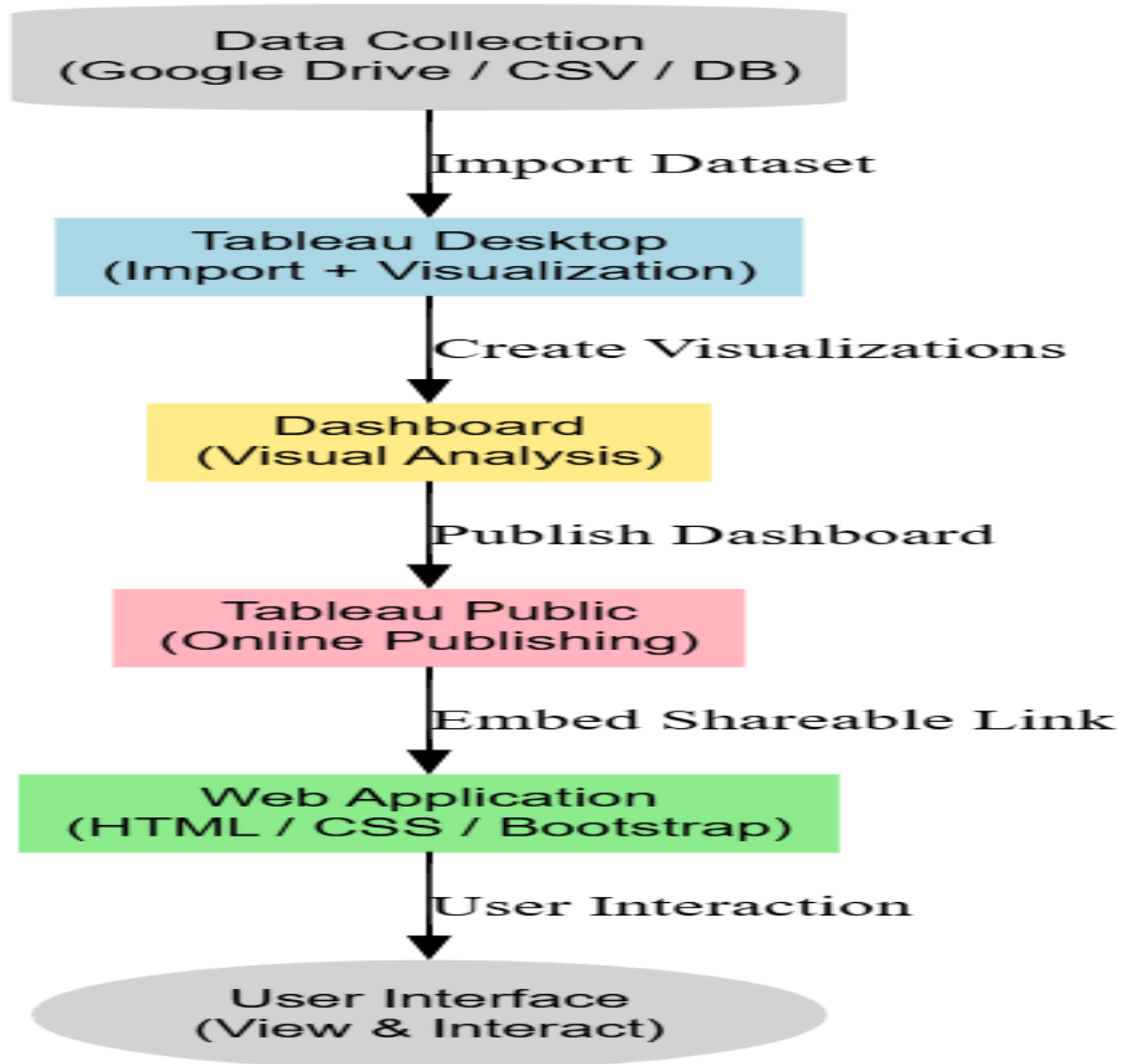
		Ensure layout and styles are user-friendly and mobile compatible.
FR-6	Deployment & Sharing	Publish Tableau dashboard/story to Tableau Public. Generate shareable embed links. Deploy the HTML/CSS web application with Tableau embeds to a local or shared hosting platform.

Non-functional Requirements:

Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	The visualizations should be easy to understand and interactive for users with basic digital skills.
NFR-2	Security	Only public data is used, but the hosted HTML/CSS pages should not expose personal or sensitive info.
NFR-3	Reliability	Visualizations and embedded dashboards must consistently display correct and updated information with minimal errors.
NFR-4	Performance	The dashboard and visualizations should load within 3–5 seconds under normal network conditions.
NFR-5	Availability	The Tableau dashboards published on Tableau Public should be accessible 24/7 without downtime.
NFR-6	Scalability	The system should be able to integrate additional EV datasets, visualizations, or dashboard filters without major rework.

3.2. DATA FLOW DIAGRAM



3.3. TECHNOLOGY STACK

Technical Architecture

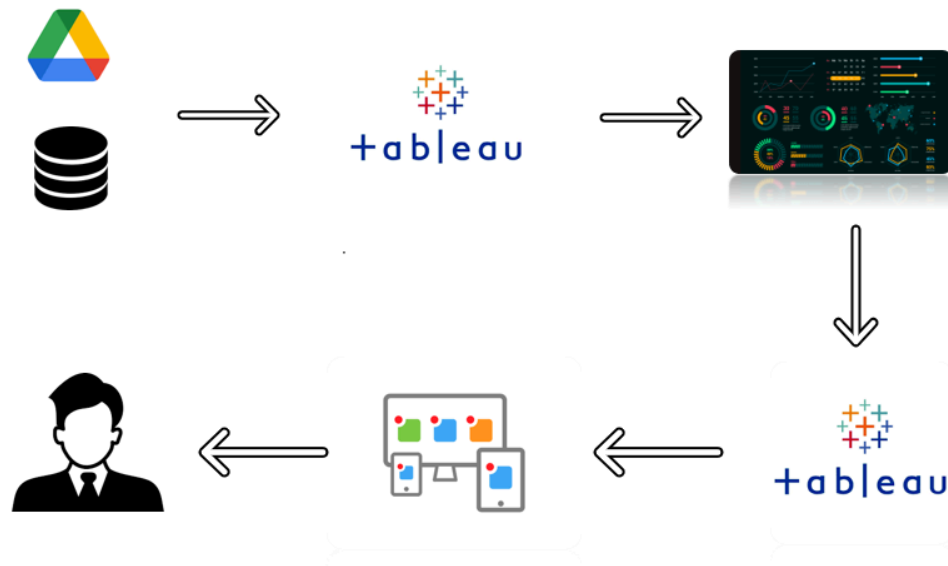


Table-1 : Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	Web UI to display visualizations using embedded Tableau dashboards	HTML, CSS,
2.	Application Logic-1	Embedding Tableau visualizations into the web application	Javascript (for embedding logic)
3.	Database	Data Type, Configurations etc.	MySQL
4.	File Storage	Storing datasets in database before uploading to Tableau	SQL Database
5.	Machine Learning Model	Not used in this project	—
6.	Infrastructure (Server / Cloud)	Hosted via Tableau Public and accessible via shared links	Tableau Public, Local Hosting


Table-2: Application Characteristics:


S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	Used for developing the frontend of the application	Technology of Opensource framework
2.	Security Implementations	Tableau Public handles content security; basic HTML/CSS website without sensitive user data	N/A
3.	Scalable Architecture	Tableau dashboards scale well for multiple users; embedding works on mobile and desktop	Tableau Public
4.	Availability	Tableau Public ensures high availability and uptime for visualizations	Tableau Server (Public)
5.	Performance	Dashboards are pre-rendered and embedded, so loading is quick and efficient	Tableau rendering engine

4. PROJECT DESIGN

4.1. PROBLEM SOLUTION FIT

Problem-Solution fit canvas 2.0		Purpose / Vision	
Define CS, fit into CC	1. CUSTOMER SEGMENT(S) <small>Who is your customer? I.e. working parents of 0-5 y.o. kids</small> Prospective EV buyers Current EV owners EV enthusiasts & researchers Urban planners and sustainability advocates	6. CUSTOMER CONSTRAINTS <small>What constraints prevent your customers from taking action or limit their choices of solutions? I.e. spending power, budget, no cash, network connection, available devices.</small> Lack of technical expertise to interpret raw data Limited time to research various sources No central source for unbiased EV comparisons Poor mobile network in remote areas	5. AVAILABLE SOLUTIONS <small>Which solutions are available to the customers when they face the problem or need to get the job done? What have they tried in the past? What pros & cons do these solutions have? I.e. pen and paper is an alternative to digital notetaking</small> Government EV portals (text-based) Car brand websites (limited data, biased) Static maps (non-interactive, outdated) Forums or blogs (inconsistent)
	9. PROBLEM ROOT CAUSE <small>What is the real reason that this problem exists? What is the back story behind the need to do this job? I.e. customers have to do it because of the change in regulations.</small> EV ecosystem in India is still evolving Data is fragmented across brands, apps, and portals Lack of real-time, user-friendly visualization tools Consumers aren't equipped to synthesize scattered technical data		
Focus on J&P, tap into BE, understand RC	2. JOBS-TO-BE-DONE / PROBLEMS <small>Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one, explore different sides.</small> Find charging stations near their location or on planned routes Compare EV brands by range, efficiency, speed Understand cost and infrastructure availability Choose the right EV model based on usage needs	7. BEHAVIOUR <small>What does your customer do to address the problem and get the job done? I.e. directly related: find the right solar panel installer, calculate usage and benefits, indirectly associated: customers spend free time on volunteering work (I.e. Greenpeace)</small> Google search "best EVs under 15 lakh" or "EV charging station near me" Scroll through multiple forums, YouTube reviews Ask peers/communities Use official brand sites or apps	Focus on J&P, tap into BE, understand RC
	10. YOUR SOLUTION <small>If you are working on an existing business, write down your current solution first, fill in the canvas, and check how much it fits reality. If you are working on a new business proposition, then keep it blank until you fill in the canvas and come up with a solution that fits within customer limitations, solves a problem and matches customer behaviour.</small> Interactive EV Dashboard with Tableau Public embedded in a web app Map of charging stations with filters by region/type EV comparison by range, speed, efficiency, and price Filter by powertrain, body style, and brand Accessible UI via HTML/CSS website		
Identify strong TR & EM	3. TRIGGERS <small>What triggers customers to act? I.e. seeing their neighbour installing solar panels, reading about a more efficient solution in the news.</small> Rising fuel prices and interest in sustainable transport, Government EV incentives, Lack of charging awareness, Frustration due to unexpected EV battery drain or lack of stations	8. CHANNELS of BEHAVIOUR 8.1 ONLINE <small>What kind of actions do customers take online? Extract online channels from #7</small> Dashboard link shared via social media Google search for EV insights Access via personal computer or phone browser 8.2 OFFLINE <small>What kind of actions do customers take offline? Extract offline channels from #7 and use them for customer development.</small> Word-of-mouth recommendations from users Shared during EV community meetups Referred by showroom staff or workshops	Extract online & offline CH of BE
	4. EMOTIONS: BEFORE / AFTER <small>How do customers feel when they face a problem or a job and afterwards? I.e. lost, insecure > confident, in control - use it in your communication strategy & design.</small> Before: Confused, anxious, unsure, overwhelmed After: Informed, confident, relieved, ready to decide or act		


 Problem-Solution fit canvas is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 license
 Created by Daria Nepriakhina / Amaltama.com

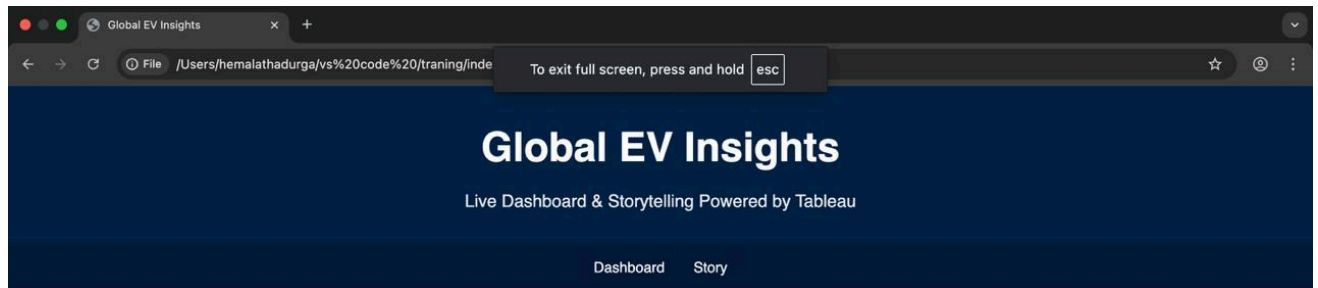

AMALTAMA

4.2. PROPOSED SOLUTION

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	EV users, buyers, and researchers lack a centralized, user-friendly, and visual platform to compare EV models, assess range, and locate charging infrastructure effectively.
2.	Idea / Solution description	The solution is a web-based dashboard that integrates Tableau visualizations to present interactive EV data, including charging station locations, EV brand comparisons, model counts, and efficiency rankings.
3.	Novelty / Uniqueness	Combines open datasets with powerful Tableau visuals embedded in a custom web application. Unlike static websites or blogs, this provides dynamic filtering and intuitive visual comparisons in one platform.
4.	Social Impact / Customer Satisfaction	Increases EV adoption confidence by helping users make informed decisions. Promotes environmental awareness, simplifies planning for EV travel, and supports smart urban mobility decisions.
5.	Business Model (Revenue Model)	Potential monetization through ad placements, premium analytics for enterprises, affiliate marketing with EV manufacturers, and API access to government/third-party mobility planners.
6.	Scalability of the Solution	Highly scalable by integrating new datasets (e.g., real-time charging availability, vehicle telematics) and expanding to cover global EV markets. Built with open tools, enabling easy feature extension.

5. RESULTS

5.1. OUTPUT SCREENSHOTS



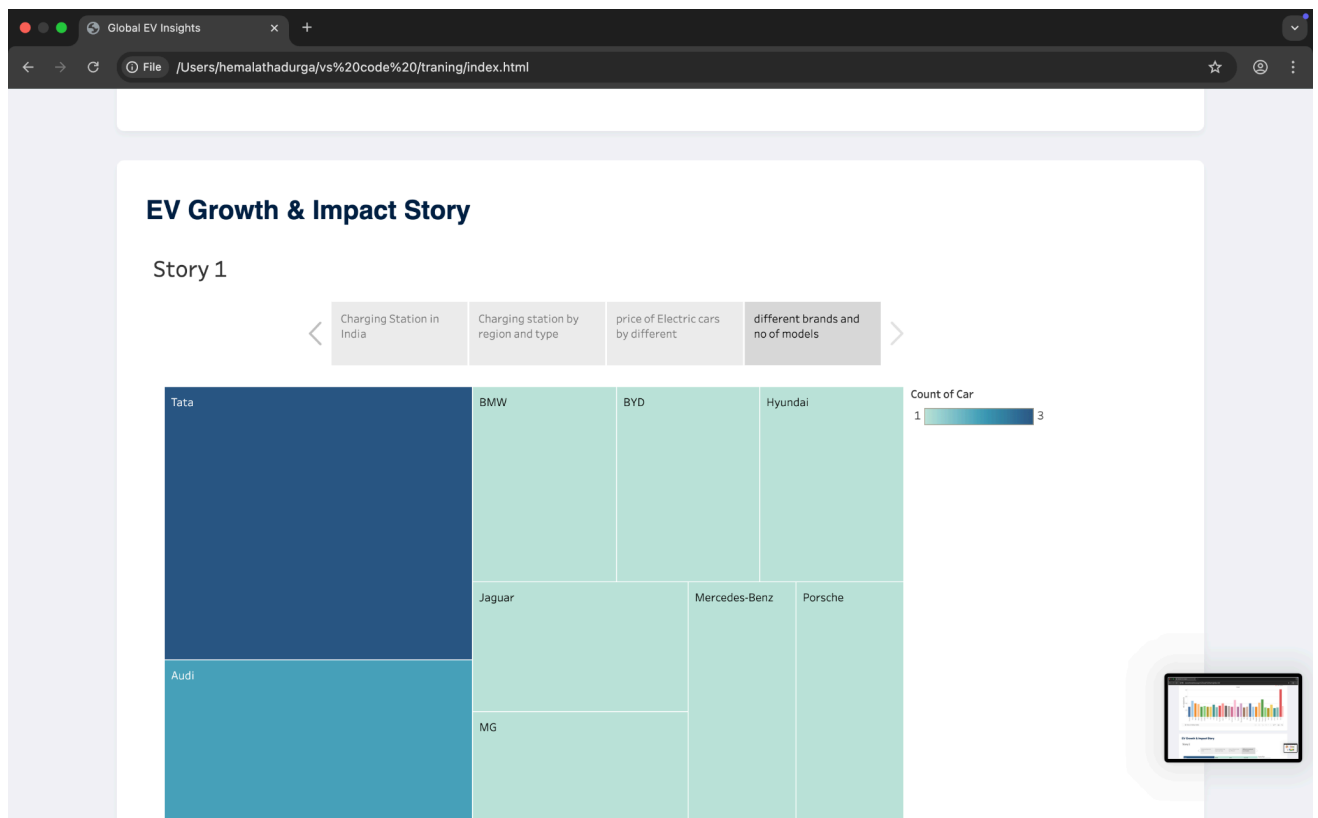
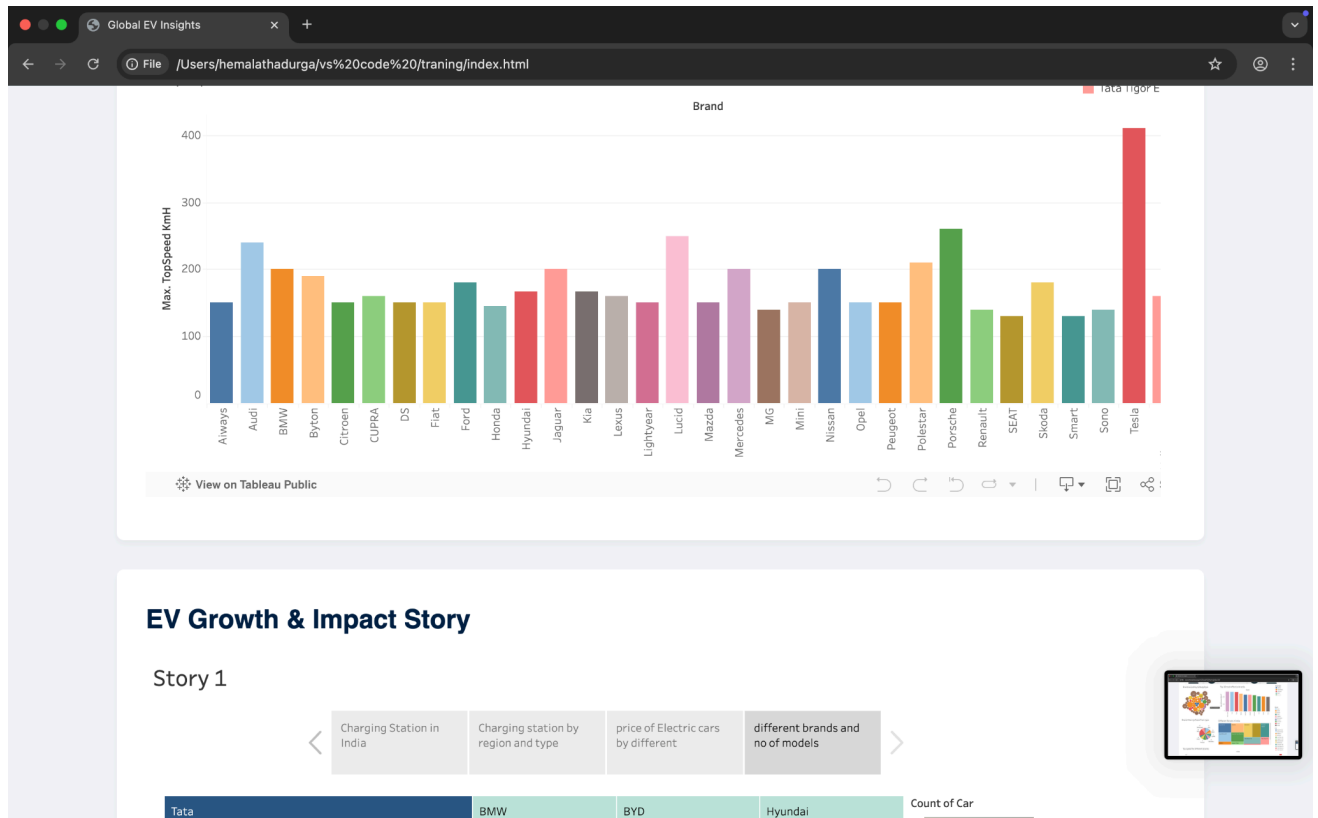
Live Electric Vehicle Dashboard

Electric Cars Analysis DashBoard

Different brands of EV cars globally

Different brands of EV cars in India





6. PROS & CONS

6.1. PROS

- **User-Friendly Interface**

Easy-to-navigate dashboards built with Tableau and integrated into a simple HTML/CSS web app.

- **Data-Driven Decision Making**

Helps users choose the right EV based on efficiency, range, price, and availability—reducing guesswork.

- **Promotes Sustainability**

Encourages EV adoption by highlighting cost-saving and environmental benefits visually.

- **Open-Source & Cost-Efficient**

Built using free tools (Tableau Public, HTML/CSS), making it ideal for scalable deployment without high costs.

- **Real-Time Updates Possible**

Can be enhanced to support real-time data feeds from charging stations and manufacturers.

6.2. CONS

- **Dependent on Data Accuracy**

The quality of insights relies on how updated and accurate the input dataset is.

- **Limited Interactivity in Tableau Public**

Some advanced interactions are restricted unless using paid Tableau or more complex integrations.

- **Lacks Offline Functionality**

Requires internet connectivity for access, especially since Tableau Public is web-based.

7. CONCLUSION

The Visualization Tool for EV Charge and Range Analysis is a powerful, intuitive solution designed to bridge the information gap in the growing electric vehicle (EV) market. By leveraging Tableau Public and a simple HTML/CSS web interface, the tool empowers users—especially first-time EV buyers and researchers—to make informed decisions based on range, efficiency, price, and brand. It provides interactive and comparative insights, encourages eco-friendly transportation choices, and fosters data-driven awareness.

Despite some limitations like dependence on static datasets and Tableau Public constraints, the project offers great potential for future scalability, personalization, and real-time data integration. With its strong foundation and social relevance, this tool can evolve into a go-to platform for EV analysis, promoting smarter and more sustainable mobility decisions.

8. FUTURE SCOPE

- **Integration of Real-Time Data**
Incorporate live updates for EV charging station availability, battery status, and traffic data using APIs.
- **User Personalization**
Allow users to input their preferences (e.g., daily travel distance, budget, location) and receive customized EV recommendations.
- **Mobile App Development**
Develop a dedicated mobile application with interactive maps and offline support for EV users on the go.
- **Machine Learning Insights**
Implement predictive analytics to recommend EVs based on user behavior or market trends.
- **Pan-India Coverage Expansion**
Broaden the dataset to include regional EV adoption rates, city-level incentives, and state-specific charging infrastructure.
- **Multi-language Support**
Add regional language options to make the tool more accessible to a wider Indian audience.

9. APPENDIX

9.1. SOURCE CODE

```
<!DOCTYPE html>

<html lang="en">

<head>

  <meta charset="UTF-8" />

  <meta name="viewport" content="width=device-width, initial-scale=1.0" />

  <title>Global EV Insights</title>

  <style>

    * {

      box-sizing: border-box;

      margin: 0;

      padding: 0;

    }

    body {

      font-family: 'Segoe UI', sans-serif;

      background: #f2f4f8;

      color: #333;

      line-height: 1.6;

    }

    header {

      background: #002244;

      color: white;

      padding: 2rem 1rem;

      text-align: center;
```

```
}

header h1 {

  font-size: 2.8rem;

  margin-bottom: 0.5rem;

}

header p {

  font-size: 1.2rem;

  opacity: 0.9;

}

nav {

  background: #021a38;

  display: flex;

  justify-content: center;

  padding: 0.8rem;

}

nav a {

  color: white;

  text-decoration: none;

  margin: 0 1rem;

  font-weight: 500;

  font-size: 1rem;

}
```

```
nav a:hover {  
  
  text-decoration: underline;  
  
}  
  
section {  
  
  max-width: 1200px;  
  
  margin: 2rem auto;  
  
  background: white;  
  
  padding: 2rem;  
  
  border-radius: 8px;  
  
  box-shadow: 0 4px 8px rgba(0, 0, 0, 0.05);  
  
}  
  
section h2 {  
  
  color: #002244;  
  
  font-size: 1.8rem;  
  
  margin-bottom: 1rem;  
  
}  
  
.tableauPlaceholder {  
  
  width: 100%;  
  
  margin: auto;  
  
  border-radius: 6px;  
  
  overflow: hidden;  
  
}  
  
footer {
```

```
background: #002244;

color: white;

text-align: center;

padding: 1.2rem;

margin-top: 3rem;

}


@media (max-width: 768px) {

  header h1 {

    font-size: 2rem;

  }

  section {

    padding: 1rem;

    margin: 1rem;

  }

  nav {

    flex-direction: column;

  }

}

</style>

</head>

<body>

<header>

  <h1>Global EV Insights</h1>

  <p>Live Dashboard & Storytelling Powered by Tableau</p>

</header>
```

```

<nav>

  <a href="#dashboard">Dashboard</a>

  <a href="#story">Story</a>

</nav>

<!-- EV Dashboard Section -->

<section id="dashboard">

  <h2>Live Electric Vehicle Dashboard</h2>

  <div class='tableauPlaceholder' id='vizDashboard' style='position: relative'>

    <noscript>

      <a href='#'>

        <img alt='Dashboard 1'

src='https://public.tableau.com/static/images/Bo/Book1_17510053561980/Dashboard1/1_rss.png'

style='border: none' />

      </a>

    </noscript>

    <object class='tableauViz' style='display:none;'>

      <param name='host_url' value='https%3A%2F%2Fpublic.tableau.com%2F' />

      <param name='embed_code_version' value='3' />

      <param name='site_root' value='' />

      <param name='name' value='Book1_17510053561980/Dashboard1' />

      <param name='tabs' value='no' />

      <param name='toolbar' value='yes' />

      <param name='static_image'

value='https://public.tableau.com/static/images/Bo/Book1_17510053561980/Dashboard1/1.png' />

      <param name='animate_transition' value='yes' />

      <param name='display_static_image' value='yes' />

```

```

<param name='display_spinner' value='yes' />

<param name='display_overlay' value='yes' />

<param name='display_count' value='yes' />

<param name='language' value='en-GB' />

<param name='filter' value='publish=yes' />

</object>

</div>

</section>

<!-- EV Story Section -->

<section id="story">

<h2>EV Growth & Impact Story</h2>

<div class='tableauPlaceholder' id='vizStory' style='position: relative'>

<noscript>

<a href='#'>

<img alt='Story 1'
src='https://public.tableau.com/static/images/Bo/Book1_17510053561980/Story1/1_rss.png'
style='border: none' />

</a>

</noscript>

<object class='tableauViz' style='display:none;'>

<param name='host_url' value='https%3A%2F%2Fpublic.tableau.com%2F' />

<param name='embed_code_version' value='3' />

<param name='site_root' value='' />

<param name='name' value='Book1_17510053561980/Story1' />

<param name='tabs' value='no' />

<param name='toolbar' value='yes' />

```

```

        <param name='static_image'
value='https://public.tableau.com/static/images/Bo/Book1_17510053561980/Story1/1.png' />

        <param name='animate_transition' value='yes' />

        <param name='display_static_image' value='yes' />

        <param name='display_spinner' value='yes' />

        <param name='display_overlay' value='yes' />

        <param name='display_count' value='yes' />

        <param name='language' value='en-GB' />

        <param name='filter' value='publish=yes' />

    </object>

</div>

</section>

<footer>

    &copy; 2025 Global EV Insights | Powered by Tableau Public

</footer>

<!-- Tableau Script -->

<script type='text/javascript'>

    // Dashboard

    var div1 = document.getElementById('vizDashboard');

    var obj1 = div1.getElementsByTagName('object')[0];

    obj1.style.width = '100%';

    obj1.style.height = '1000px';

    var script1 = document.createElement('script');

    script1.src = 'https://public.tableau.com/javascripts/api/viz_v1.js';

    obj1.parentNode.insertBefore(script1, obj1);

```

```
// Story

var div2 = document.getElementById('vizStory');

var obj2 = div2.getElementsByTagName('object')[0];

obj2.style.width = '100%';

obj2.style.height = '800px';

var script2 = document.createElement('script');

script2.src = 'https://public.tableau.com/javascripts/api/viz_v1.js';

obj2.parentNode.insertBefore(script2, obj2);

</script>

</body>

</html>
```


9.2. DATASET LINK - [EVdata](#)

9.3. GITHUB & PROJECT DEMO LINK

9.3.1. GitLink

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<https://github.com/nvineela-0606/Visualization-Tool-for-Electric-Vehicle-Charge-and-Range-Analysis.git>

9.3.2. Project Demo Link - Demovideo.mp4