

Project Report

Visualization tool for electric vehicle charge and range analysis.

Date	12 February 2026
Team ID	LTVIP2026TMIDS53912
Project Name	Visualization tool for electric vehicle charge and range analysis.
Maximum Marks	

1. INTRODUCTION

1.1 Project Overview

The Electric Car Analytics Dashboard project focuses on analysing global and Indian electric vehicle data to identify trends in brands, efficiency, pricing, body styles, and performance. The project uses data preprocessing techniques and Tableau visualizations to provide meaningful insights through interactive dashboards and stories.

1.2 Purpose

The purpose of this project is to analyse and visualize electric vehicle data to support better understanding of market trends, brand performance, and efficiency comparisons. It helps users make data-driven decisions through interactive filters, dashboards, and visual storytelling.

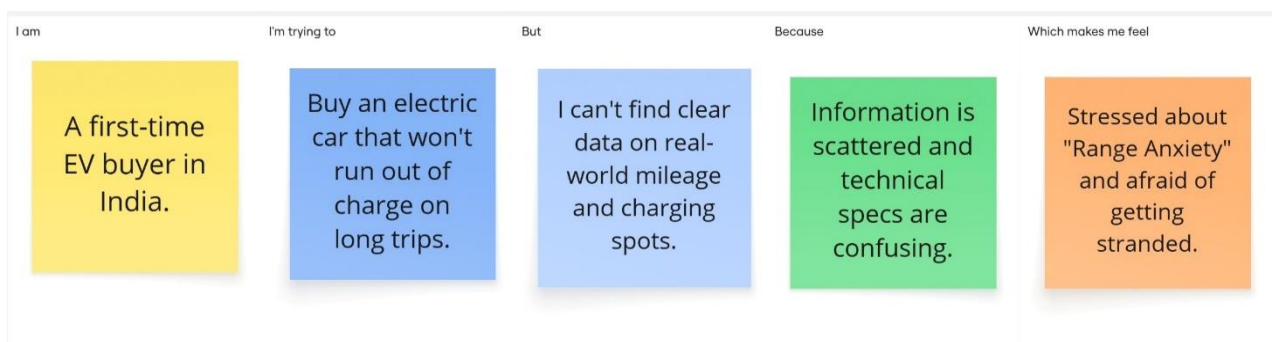
2. IDEATION PHASE

2.1 Problem Statement

The Electric Car Analytics project addresses challenges faced by first-time EV buyers and EV infrastructure investors in India. Buyers struggle with unclear real-world range data and scattered charging station information, leading to range anxiety and confusion. At the same time, investors lack integrated insights into EV sales trends and charging infrastructure gaps. This creates uncertainty in decision-making and highlights the need for a unified, data-driven analytical dashboard.

Customer Problem Statement Template:

Problem Statement – 1: **THE CAR BUYER**



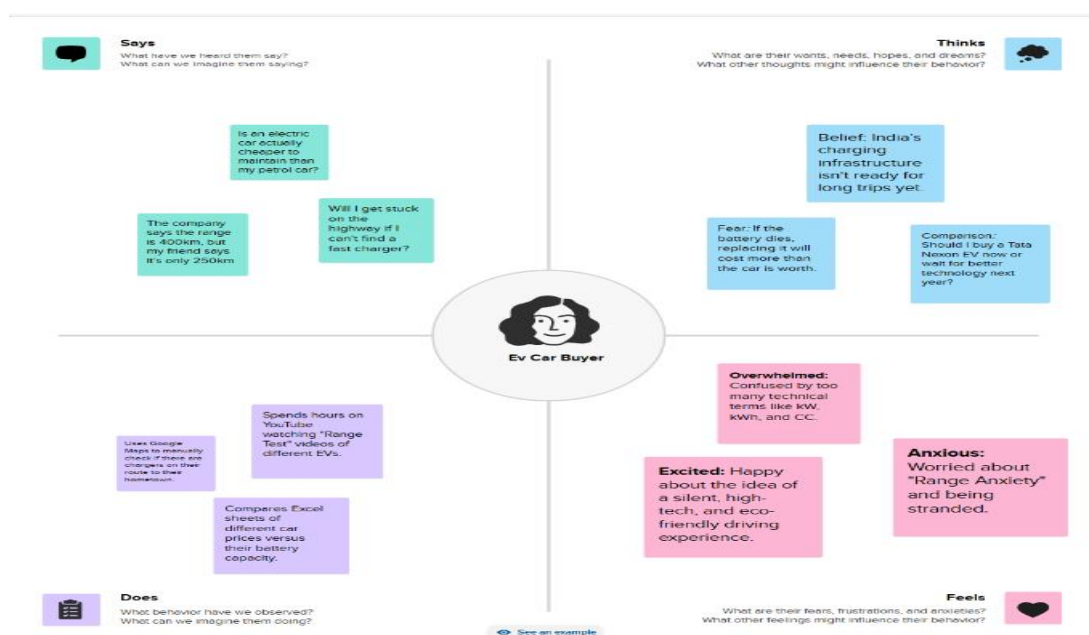
Problem Statement – 2: THE BUSINESS PLANNER




Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
The Car Buyer	A first-time EV buyer in India.	Buy an electric car that won't run out of charge on long trips.	I can't find clear data on real-world mileage and charging spots.	Information is scattered and technical specs are confusing.	Stressed about "Range Anxiety" and afraid of getting stranded.
The Business Planner	An EV charging station investor.	Find the best spots in India to build new fast-chargers.	I don't know where the "charging gaps" are compared to car sales.	Sales data and charger locations are in separate.	Worried about wasting money on the wrong locations.

2.2 Empathy Map Canvas

The Mind of an EV Enthusiast





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




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 for preparation




 1 hour for collaboration


 3-5 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

-  **Team gathering**
Gather who should participate in the session and send an invite with relevant information (or prepare alone)
-  **Set the goal**
Write down the problem you're focusing on solving in the brainstorming session
-  **Learn how to use the facilitation tools**
Take the Facilitation Experiments to run a happy and productive session

[Open article](#) 

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


How might we...
 How might we identify customer needs?
 How might we create a new service?
 How might we improve our business?
 How might we help an existing customer?


Key rules of brainstorming


To run an creative and productive session


 Stay on topic


 Encourage wild ideas


 Don't judge

 Go for volume

 Quantity is better

 Encourage wild ideas

 Don't judge

 Go for volume

Step-2: Brainstorm, Idea Listing and Grouping

1

Brainstorm

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

10 minutes

Person 1

- Create a SQL data pipeline to bring together data with changing battery life for a "Safety Net" score.

Person 2

- Automate data cleaning scripts to handle inconsistencies in state-wise charging station data.

Person 3

- Implement a cost-benefit analysis tool to determine if EV rates coming from charging stations.

Person 4

- Design a map visualization tool for displaying EV rates across different states.

Person 5

- Build a responsive Bootstrap portal to host the Safety Net dashboard in a single view.

Person 6

- Develop an interactive tool for users to explore EV rates and charging station locations.

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 number on the label. If a cluster is larger than six sticky notes, try and see if you can break it up into smaller sub-groups.

20 minutes

Cluster 1: Geographic & Regional Infrastructure Analysis

Issues Included:

- Clean and automate state-wise charging station datasets.
- Create heatmaps of EV rates vs. charging station density.
- Map and differentiate between Fast and Slow chargers.
- Add filters for regional/home state infrastructure views.

Label: We will map regional data to show infrastructure gaps and charger types across India.

Cluster 2: Performance & Value Comparison

Ideas:

- Tableau scatter plots for EV Price vs. Real-World Range.
- Interactive bar charts showing brand growth in India.
- "Top 5 Budget EVs" panel based on mileage data.
- Charts showing impact of speed and AC on battery life.
- Comparison tool for Home vs. Public charging times.
- **Label:** We will use interactive charts to help buyers compare EV value and performance.

Cluster 3: Data Strategy & Platform Architecture

Ideas:

- MySQL database linking range data for "Safety Net" scores.
- Responsive Bootstrap portal to host all dashboards.
- **Label:** We will build a MySQL and Bootstrap foundation for a seamless user experience.

Cluster 4: User Engagement & Analytics

Ideas:

- Develop a user feedback loop system to improve EV rates.
- Create a dashboard for user engagement metrics.
- Implement a recommendation engine for EV models.
- **Label:** We will use analytics to track user behavior and optimize the user experience.

Step-3: Idea Prioritization

4. Prioritize

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.

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Tip

Brainstorming ideas can often generate too many ideas to evaluate. Consider the ideas that you like best and place them on the grid. For each idea, consider whether it's important and whether it's feasible.

Cluster 1: Infrastructure Heatmaps

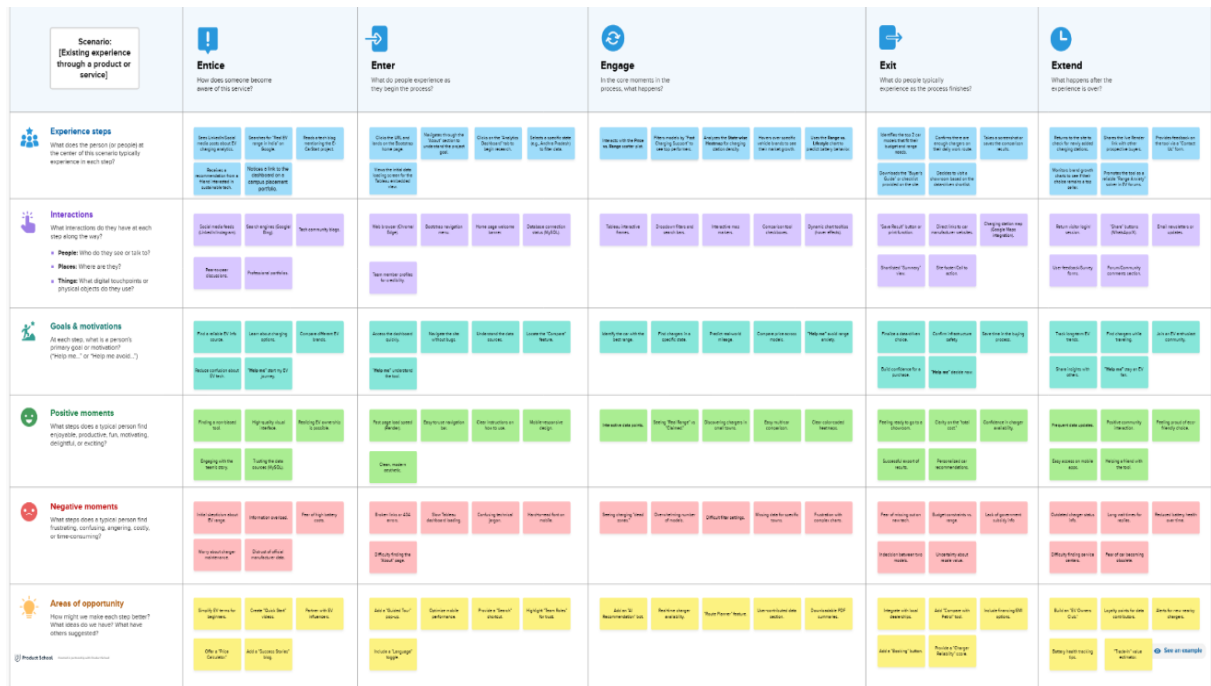
Cluster 2: Performance & Value Analysis

Cluster 3: Web Platform (Bootstrap)

3. REQUIREMENT ANALYSIS

3.1 Customer Journey Map

The customer journey map outlines the experience of EV buyers and business planners while interacting with electric vehicle data. It identifies pain points such as range anxiety, scattered charging information, and lack of infrastructure insights. The journey highlights decision-making challenges and information gaps. This analysis helps define the exact needs of users. It ensures the dashboard is built to solve real-world problems effectively.



3.2 Solution Requirement

The solution requires an interactive dashboard that integrates EV sales, efficiency, pricing, and charging station data. It must provide clear visualizations and filtering options for easy analysis. The system should support comparative insights between brands and regions. Data accuracy and preprocessing are essential. The solution must be user-friendly and visually intuitive.

Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	View Website	Access Home, About, Team & Contact sections
FR-2	View EV Dashboard	Load EV Charging & Range Tableau Dashboard Display interactive charts Responsive dashboard view
FR-3	View EV Story	Load Tableau Story Navigate between story tabs
FR-4	Contact Form	Submit user details Validate required fields Display submission confirmation
FR-5	Admin Data Management	Upload EV dataset to Tableau Update dashboard visuals Publish dashboard

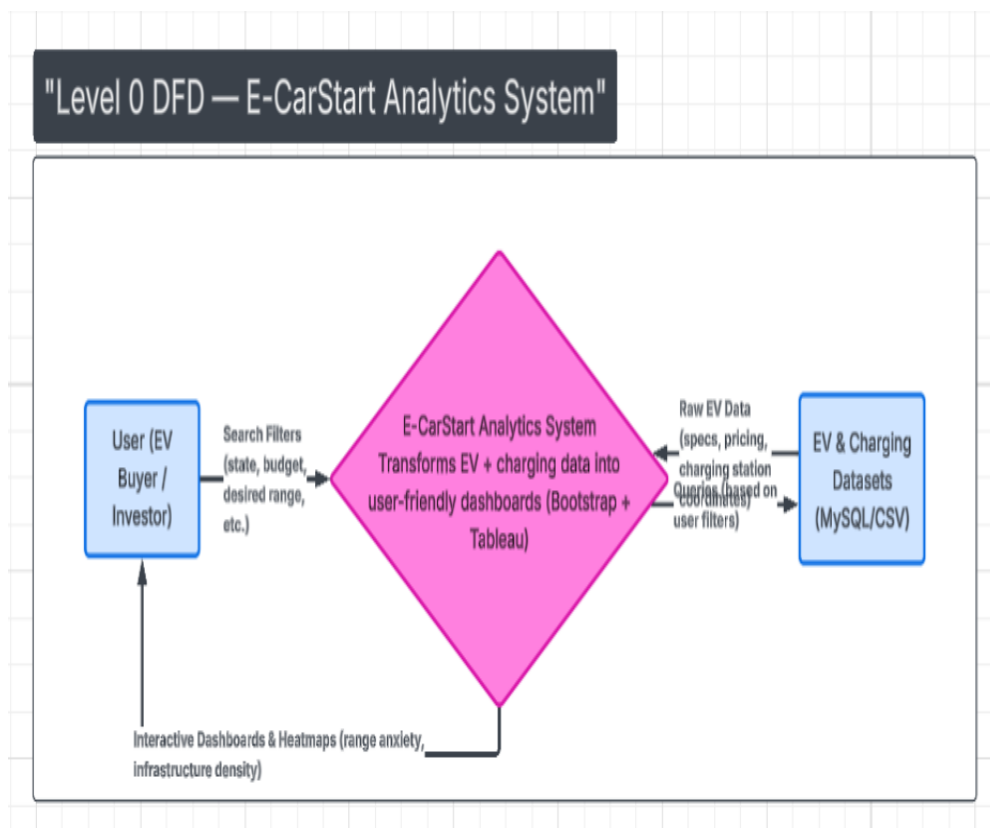
Non-functional Requirements:

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

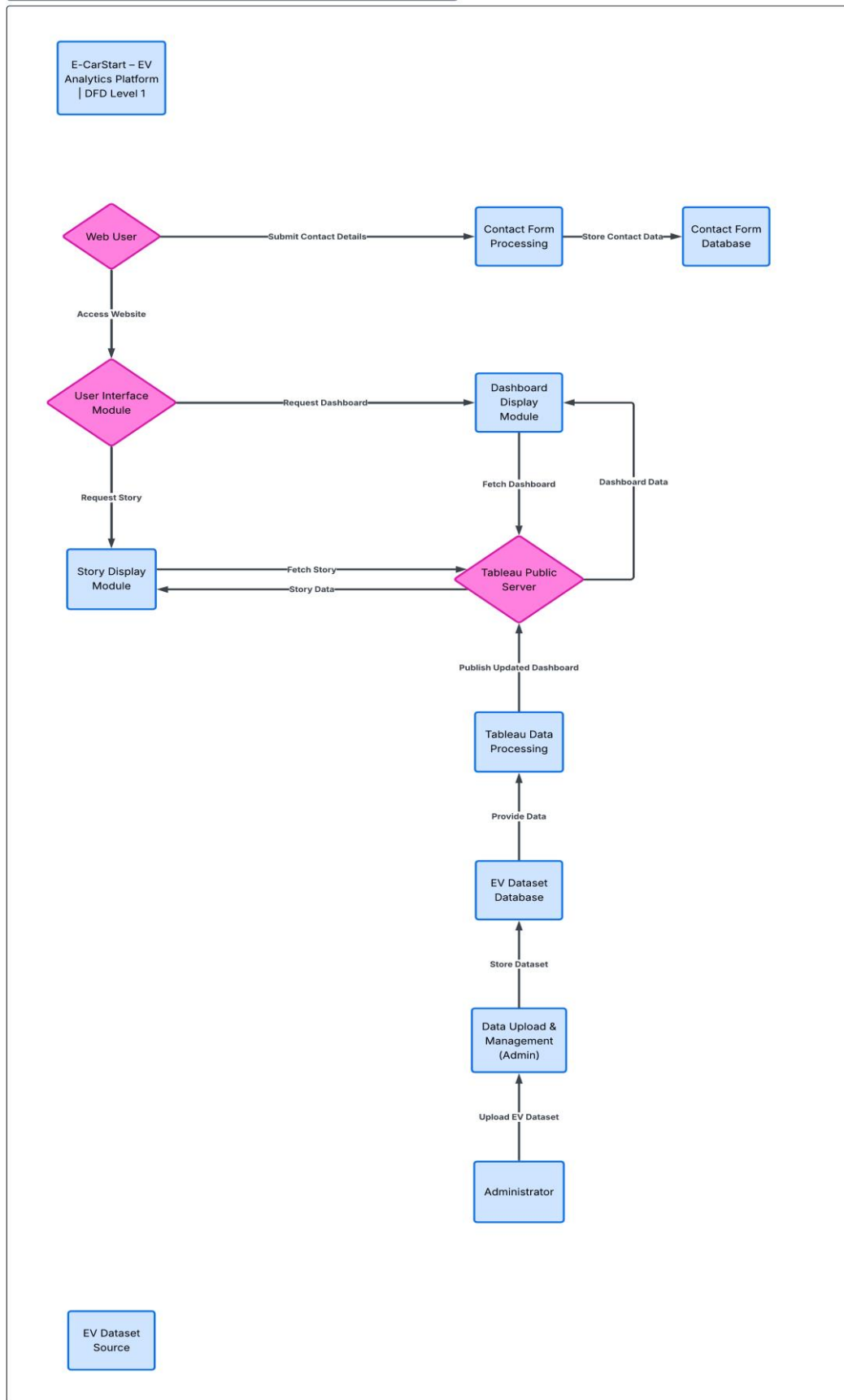
FR No.	Non-Functional Requirement	Description
NFR-1	Usability	The website should be user-friendly, easy to navigate, and visually clear with proper section alignment.
NFR-2	Security	User contact data must be protected and not publicly exposed. Tableau dashboards should be securely embedded.
NFR-3	Reliability	The system should consistently load dashboards and story without failure.
NFR-4	Performance	The website should load within 3–5 seconds and dashboard rendering should be responsive.
NFR-5	Availability	The system should be available 24/7 through web browsers.
NFR-6	Scalability	The system should support addition of new datasets and future dashboard extensions.

3.3 Data Flow Diagram

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.



E-CarStart – EV Analytics Platform DFD Level 1



3.4 Technology Stack

The project uses Excel/CSV datasets for data storage. MySQL is used for database management and structured data storage. Tableau Desktop is used for data visualization and dashboard creation. Basic data preprocessing techniques are applied before visualization. These tools together ensure efficient data handling and presentation.

Table-1: Components & Technologies:

S. No	Component	Description	Technology
1.	User Interface	Web-based interface where users view EV dashboard, story and submit contact form	HTML, CSS, JavaScript, Bootstrap 5
2.	Application Logic – Dashboard Integration	Handles embedding and rendering of Tableau Dashboard inside the website.	JavaScript, Tableau Embed API
3.	Application Logic – Story Integration	Embeds Tableau Story and manages responsive display	JavaScript, Tableau Public
4.	Dataset Storage	EV dataset stored and processed within Tableau environment	Tableau Data Extract (TDE)
5.	File Storage	EV dataset files stored locally before upload to Tableau	Tableau Data Extract (TDE)
6.	Tableau Public API	Used to embed and display dashboard and story in website	Tableau Public Embed API
7.	Infrastructure (Web Hosting)	Website hosted on web server, dashboards hosted on Tableau Public Cloud:	Local Hosting / GitHub Pages / Render, Tableau Public Cloud

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	Website built using open-source front-end frameworks	Bootstrap 5, HTML5, CSS3
2.	Security Implementations	Secure embedding of Tableau dashboards and form validation	HTTPS Protocol, Input Validation
3.	Scalable Architecture	Web-based modular structure allows addition of new dashboards and datasets	Modular Web Architecture, Cloud Hosting
4.	Availability	Dashboard available 24/7 via Tableau Public cloud	Tableau Public Cloud
5.	Performance	Optimized responsive UI and embedded dashboard loading	Bootstrap Grid System, Optimized Tableau Embed

4. PROJECT DESIGN

4.1 Problem Solution Fit

The dashboard directly addresses range anxiety and infrastructure planning issues. It combines EV sales data with charging station insights. Buyers can compare efficiency and range, while investors can identify infrastructure gaps. The solution aligns with user pain points identified in requirement analysis. It ensures informed, data-driven decision-making.

Define CS, fit into CC	1. CUSTOMER SEGMENT(S) CS Primary Segment: First-time EV buyers in metropolitan and tier-2 cities in India. Working professionals and middle-class families exploring EV purchase. Environment-conscious consumers. Secondary Segment: Infrastructure investors. EV charging network planners. Government policymakers. EV market researchers.	6. CUSTOMER CONSTRAINTS CC Limited technical knowledge about EVs. Difficulty interpreting raw data. Lack of centralized EV data source. Time constraints for deep research. Budget concerns for vehicle purchase.	5. AVAILABLE SOLUTIONS AS EV brand websites. Government EV policy reports (PDF). YouTube reviews. EV blogs. News articles.	Explore AS, differentiate
Focus on J&P, tap into BE, understand RC	2. JOBS-TO-BE-DONE / PROBLEMS J&P For EV Buyers: Understand EV range and battery performance. Check charging availability. Compare brands and models. Reduce range anxiety before purchasing. For Investors: Identify regional EV growth patterns. Detect charging infrastructure gaps. Analyze adoption trends.	9. PROBLEM ROOT CAUSE RC Lack of centralized EV analytics platform in India. Fragmented data across multiple sources. Poor visualization of charging and range data. Limited data-driven decision tools for EV buyers. Inadequate infrastructure planning visibility.	7. BEHAVIOUR BE Online Behaviour: Searching "Best EV in India" Watching YouTube EV reviews Comparing models on Google Reading EV news articles Investor Behaviour: Downloading industry reports Reviewing government EV data Studying regional infrastructure trends	Focus on J&P, tap into BE, understand RC
Identify strong TR & EM	3. TRIGGERS TR Rising fuel prices. Government EV subsidies. Climate change awareness. Social influence (neighbors switching to EVs). News about EV growth in India. Planning to buy a new vehicle.	10. YOUR SOLUTION SL E-CarStart is a web-based EV analytics platform that: Provides interactive EV charging & range dashboard. Visualizes EV adoption trends in India. Centralizes EV data into one platform. Helps first-time buyers make informed decisions. Assists investors in identifying charging infrastructure gaps. Reduces confusion and range anxiety through data visualization.	8. CHANNELS of BEHAVIOUR CH Online: Google Search YouTube EV blogs Government websites Social media (LinkedIn, Twitter)	Extract online & offline CH of BE
	4. EMOTIONS: BEFORE / AFTER EM Before Using E-CarStart: Confusion about EV performance. Fear of running out of charge. After Using E-CarStart: Confidence in EV purchase decision. Clarity about charging & range.		Offline: Visiting EV showrooms Talking to dealers Discussions with friends/family Industry seminars	

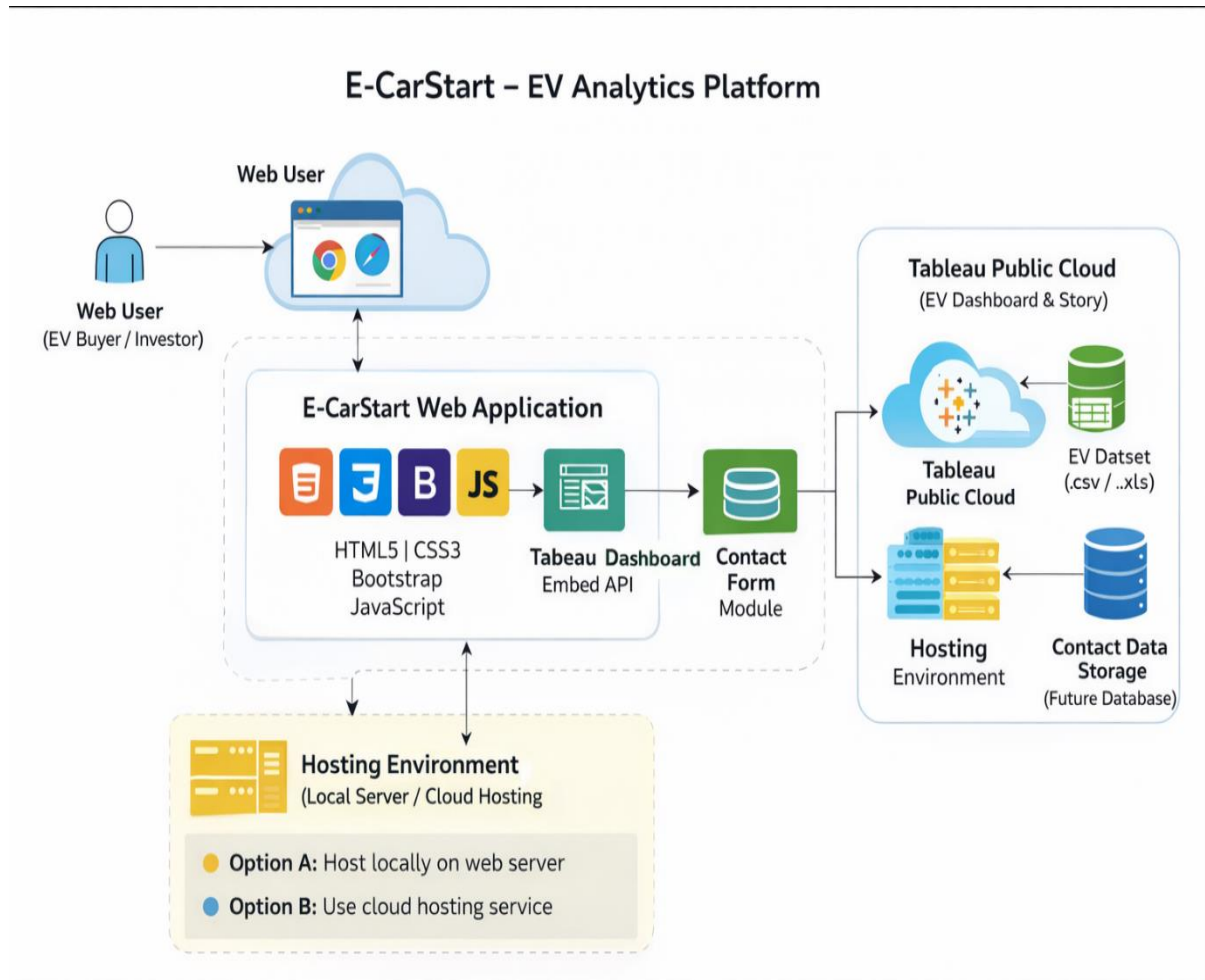
4.2 Proposed Solution

The proposed solution is an Electric Car Analytics Dashboard with multiple visualizations. It includes brand comparison charts, efficiency rankings, body style analysis, and summary cards. Interactive filters enhance user exploration. The dashboard is designed for clarity and simplicity. It transforms raw data into actionable insights.

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	First-time EV buyers in India lack centralized and reliable data about charging infrastructure and vehicle range, leading to confusion and range anxiety. Infrastructure investors also struggle to identify regional charging gaps due to fragmented information sources.
2.	Idea / Solution description	E-CarStart is a web-based EV analytics platform that provides interactive dashboards and visual stories about EV charging, range, and adoption trends. It centralizes data into an easy-to-understand format using Tableau and a responsive web interface.
3.	Novelty / Uniqueness	The platform combines EV charging, range, and market adoption insights into one interactive system focused on the Indian market. Unlike static reports or blogs, it offers real-time visual comparison and centralized analytics.
4.	Social Impact / Customer Satisfaction	E-CarStart promotes informed EV adoption, reducing range anxiety and increasing customer confidence. It also supports sustainable mobility by providing transparency in EV infrastructure growth.
5.	Business Model (Revenue Model)	The platform can adopt a freemium model with basic dashboards free and premium analytics for investors. Additional revenue can come from partnerships, advertisements, and data insight reports.
6.	Scalability of the Solution	The web-based modular architecture allows easy addition of new datasets and dashboards. It can scale to include real-time APIs, more regions, and advanced analytics features in the future.

4.3 Solution Architecture

The architecture follows a simple data pipeline structure. Raw EV datasets are collected and cleaned. Cleaned data is stored in a database. Tableau connects to the database to create visual dashboards. Users interact with the dashboard to generate insights.



5. PROJECT PLANNING & SCHEDULING

5.1 Project Planning

The project was planned in stages: data collection, preprocessing, database integration, visualization, and testing. Each phase was executed sequentially. Timelines were set to ensure proper completion of tasks. Dashboard design and refinement were done iteratively. Proper planning ensured smooth execution.

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Data Collection	USN-1	Download EV dataset from reliable source	3	High	P Jeevan
Sprint-1	Data Understanding	USN-2	Analyse and understand dataset attributes	3	High	K Dinesh
Sprint-1	Database Setup	USN-3	Import dataset into database	4	High	R Srikanth
Sprint-1	Tableau Connection	USN-4	Connect Tableau Desktop to database	4	High	N Akhila
Sprint-1	Data Preparation	USN-5	Clean and prepare dataset for visualization	6	High	M Manasa
Sprint-2	Data Visualization	USN-6	Create charts & EV analysis visuals	5	High	K Dinesh
Sprint-2	Dashboard Creation	USN-7	Design interactive dashboard	5	High	N Akhila
Sprint-2	Story Creation	USN-8	Create EV analytics story in Tableau	3	High	M Manasa
Sprint-2	Publishing	USN-9	Publish dashboard to Tableau Public	3	High	P Jeevan
Sprint-2	Website Integration	USN-10	Embed dashboard into website	4	High	R Srikanth
Sprint-3	Website Navigation	USN-11	Develop website sections	4	High	M Manasa
Sprint-3	Contact Form	USN-12	Implement form validation	4	High	R Srikanth
Sprint-3	Responsive Design	USN-13	Make website mobile responsive	5	Medium	K Dinesh
Sprint-3	Testing	USN-14	Cross-browser testing	3	Medium	P Jeevan
Sprint-3	Final Review	USN-15	Final deployment & bug fixing	4	High	All

Project Tracker, Velocity & Burndown Chart:

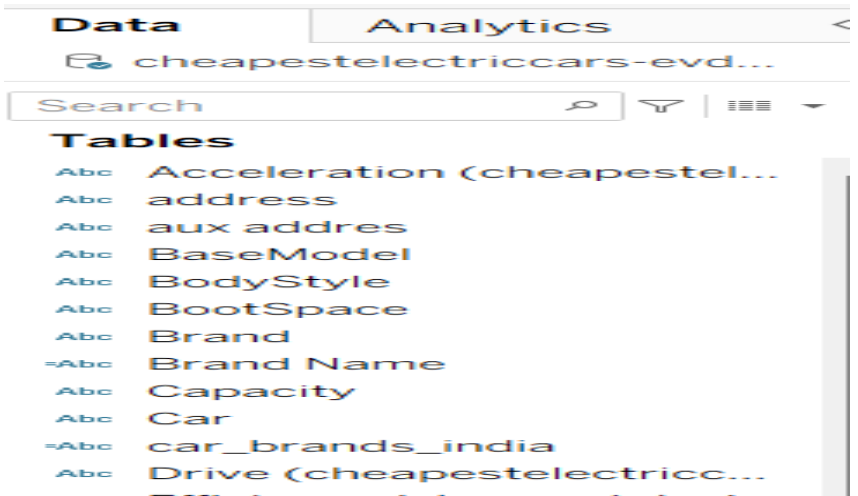
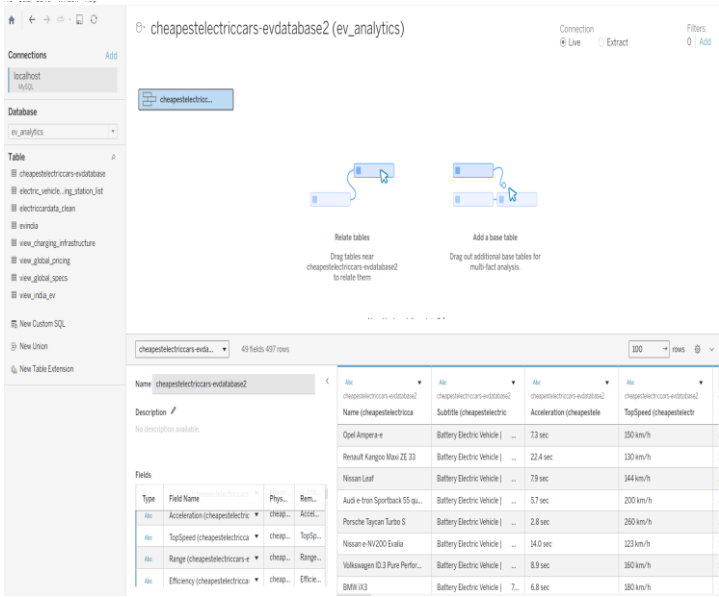
Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	7 Days	28 Jan 2026	03 Feb 2026	20	03 Feb 2026
Sprint-2	20	7 Days	04 Feb 2026	10 Feb 2026	20	10 Feb 2026
Sprint-3	20	7 Days	11 Feb 2026	14 Feb 2026	20	14 Feb 2026

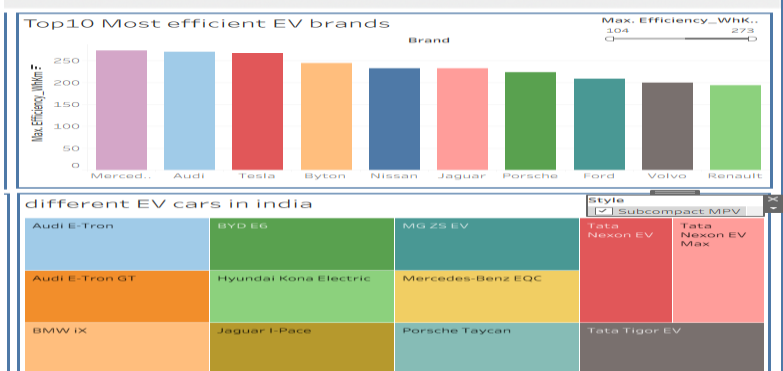
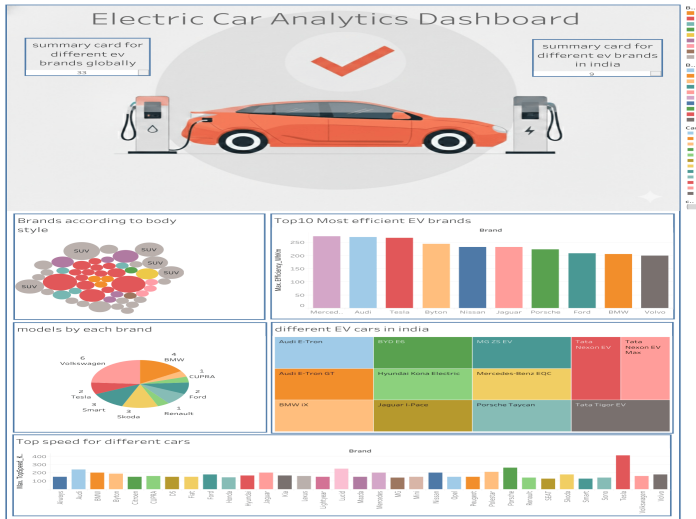
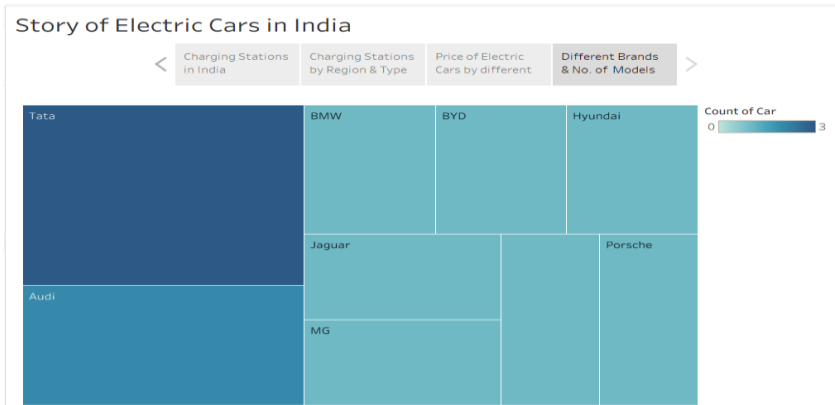
$$AV = \text{Sprint duration/velocity} = 20/7 = 2.85 \sim 3 \text{ story points per day}$$

6. FUNCTIONAL AND PERFORMANCE TESTING

6.1 Performance Testing

The dashboard was tested for responsiveness and accuracy. Filters and interactive features were validated. Data consistency between database and visualizations was checked. Performance was monitored for loading time and smooth interaction. The system performs efficiently for the given dataset size.

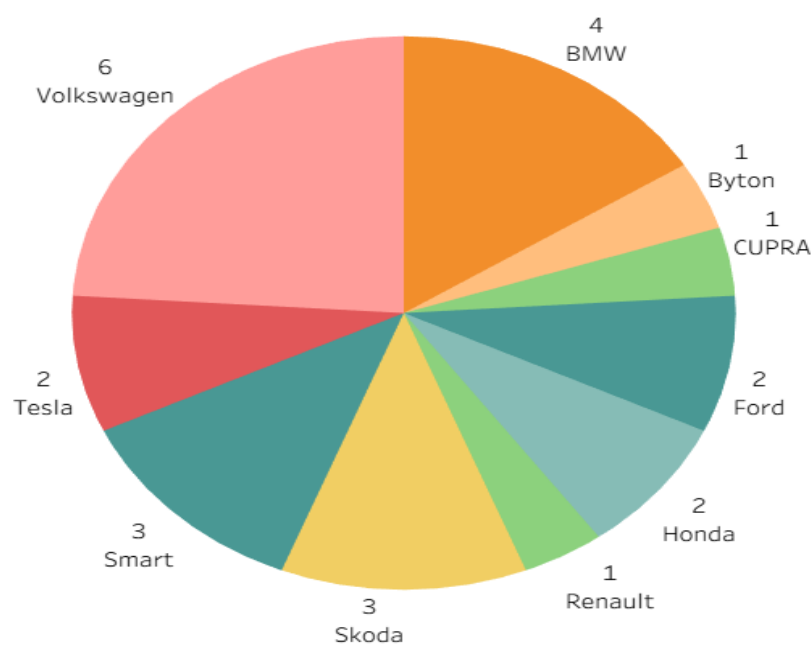
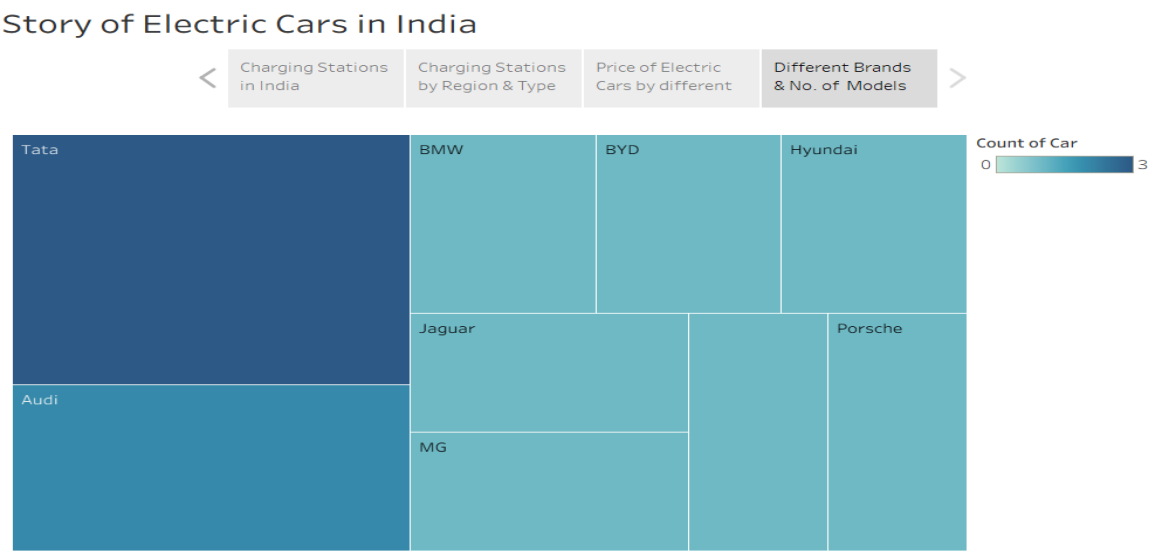
S.No.	Parameter	Screenshot / Values
1.	Data Rendered	<p>The EV dataset was successfully rendered in Tableau Desktop. All fields including vehicle type, charging time, range, state, and price were loaded correctly without errors.</p> 
2.	Data Preprocessing	<p>Data preprocessing was performed by handling missing values, removing duplicate records, correcting data types, and creating calculated fields. Units were standardized and unnecessary columns were removed before visualization.</p> 

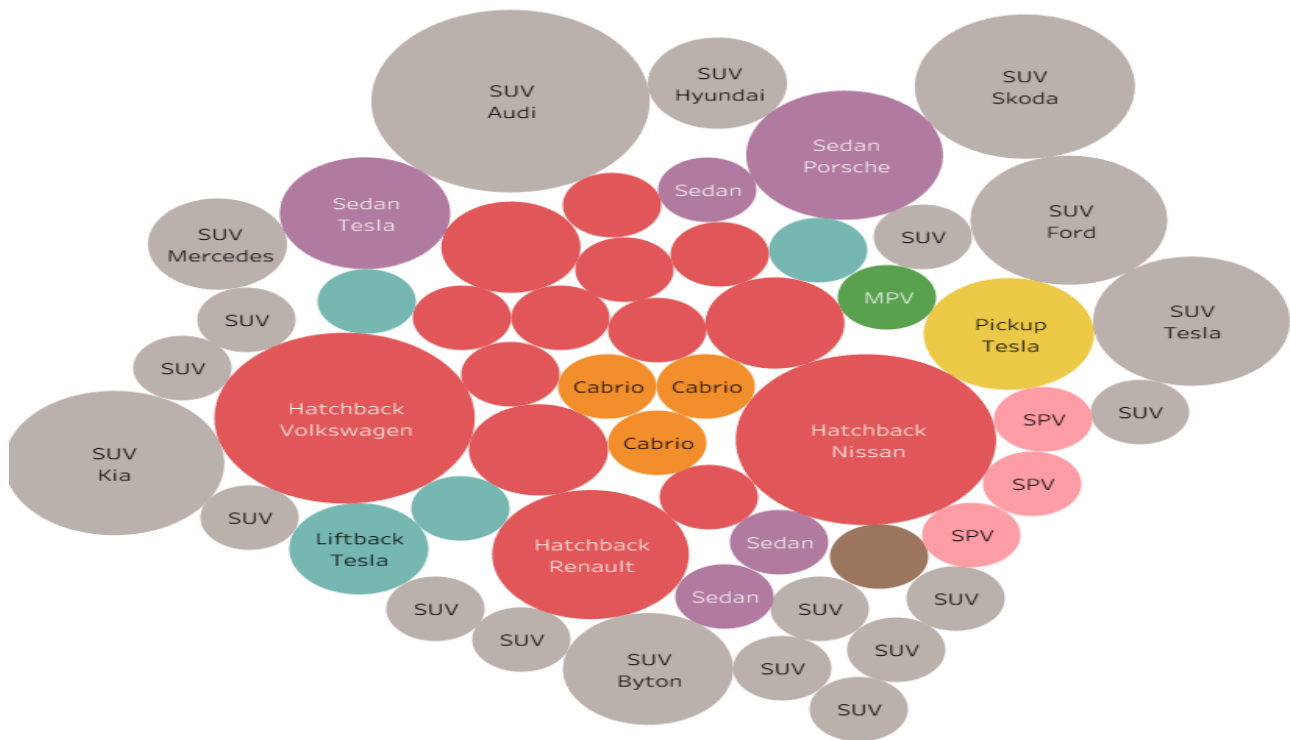
3.	Utilization of Filters	<p>Filters such as Style, Vehicle Type, Charging Type, and Range were applied to enable dynamic interaction in the dashboard.</p>  <p>The screenshot shows two main visualizations. The top one is a bar chart titled 'Top10 Most efficient EV brands' with 'Brand' on the x-axis and 'Max. Efficiency_Whk.' on the y-axis. The brands listed are Mercedes, Audi, Tesla, Byton, Nissan, Jaguar, Porsche, Ford, Volvo, and Renault. The bottom visualization is a grid titled 'different EV cars in India' showing various models like Audi E-Tron, BYD EQ, MG ZS EV, Tata Nexon EV, etc., with a filter for 'Style' set to 'Subcompact MPV'.</p>
4.	Calculation fields Used	<p>AVG([Range])</p> <p>COUNT([Vehicle Type])</p>
5.	Dashboard design	<p>No of Visualizations / Graphs – 5</p>  <p>The screenshot shows a comprehensive dashboard titled 'Electric Car Analytics Dashboard'. It features a central illustration of a red sports car. Surrounding it are several charts: 'summary card for different ev brands globally', 'summary card for different ev brands in India', 'Brands according to body style' (a bubble chart), 'Top10 Most efficient EV brands' (a bar chart), 'models by each brand' (a pie chart), 'different EV cars in India' (a grid), and 'Top speed for different cars' (a bar chart). A color legend on the right indicates the count of cars.</p>
6	Story Design	<p>No of Visualizations / Graphs – 4</p>  <p>The screenshot shows a dashboard titled 'Story of Electric Cars in India'. It includes navigation tabs for 'Charging Stations in India', 'Charging Stations by Region & Type', 'Price of Electric Cars by different', and 'Different Brands & No. of Models'. The main visualization is a treemap showing the distribution of car brands, with Tata and Audi being the largest categories. A color legend on the right indicates the 'Count of Car' from 0 to 3.</p>

7. RESULTS

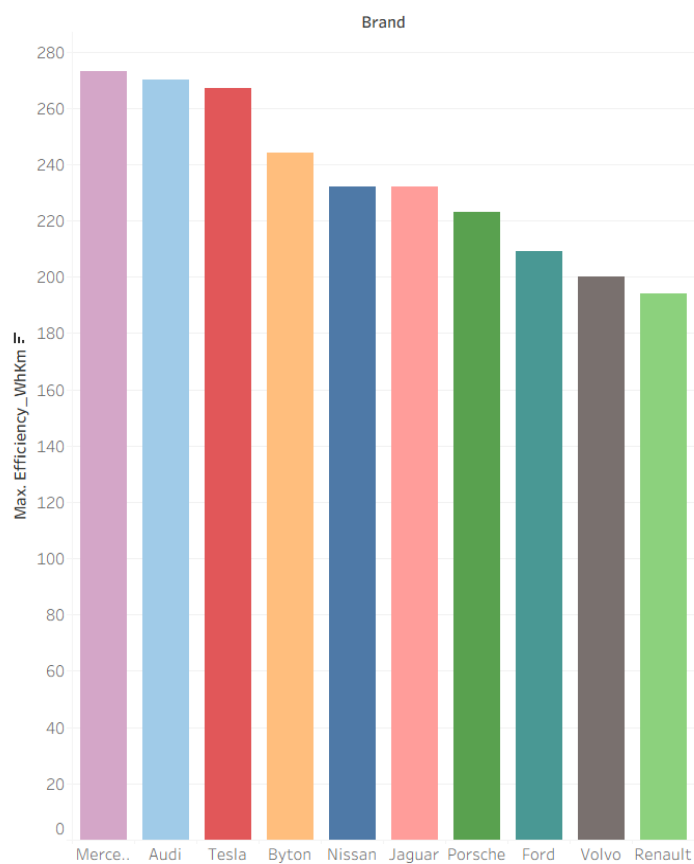
7.1 Output Screenshots

The final dashboard displays EV brand analysis, efficiency comparisons, and body style distribution. Summary cards highlight key metrics. Filters allow dynamic exploration of data. Visualizations provide clear and actionable insights. The results demonstrate successful implementation of the project objectives.

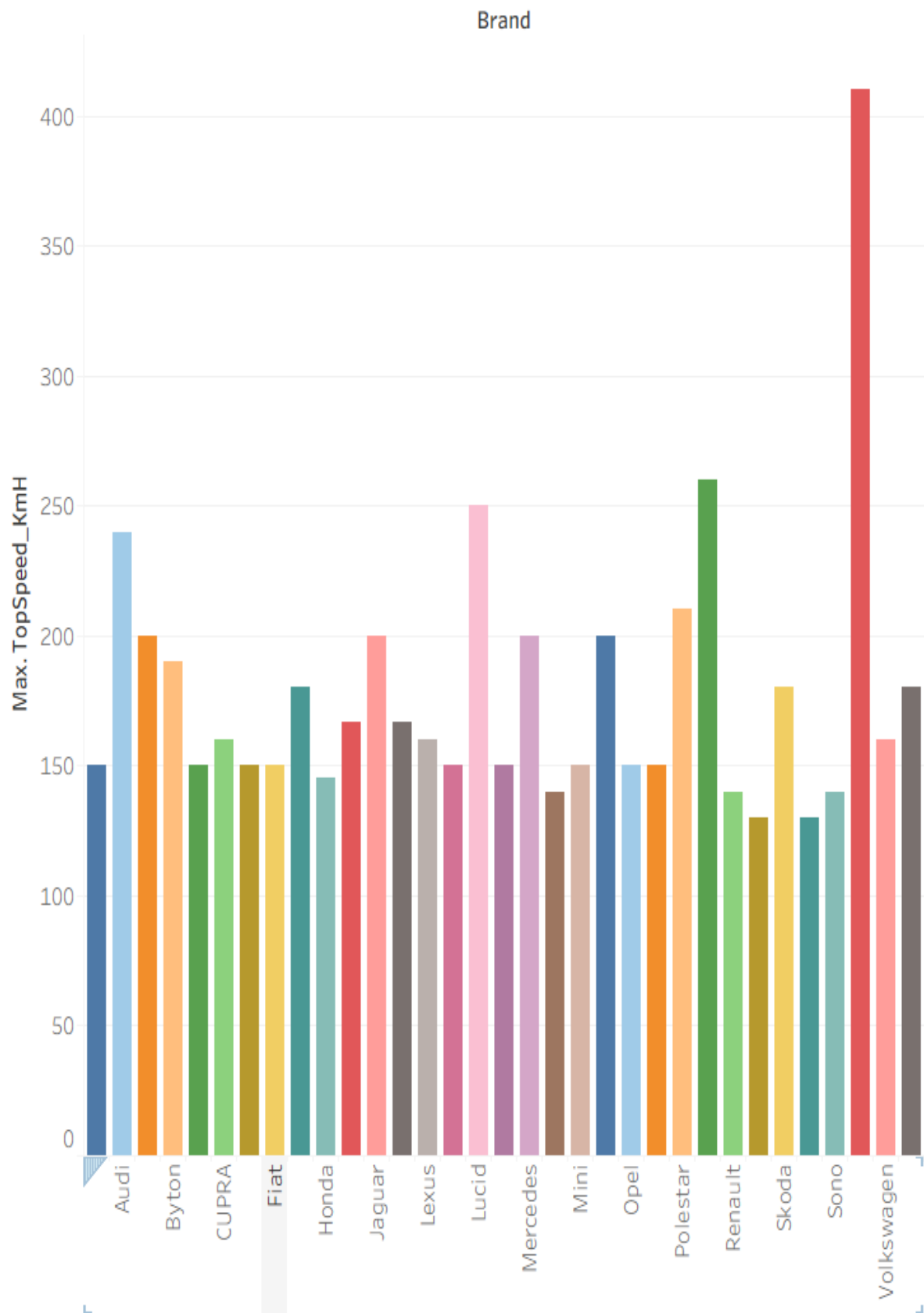


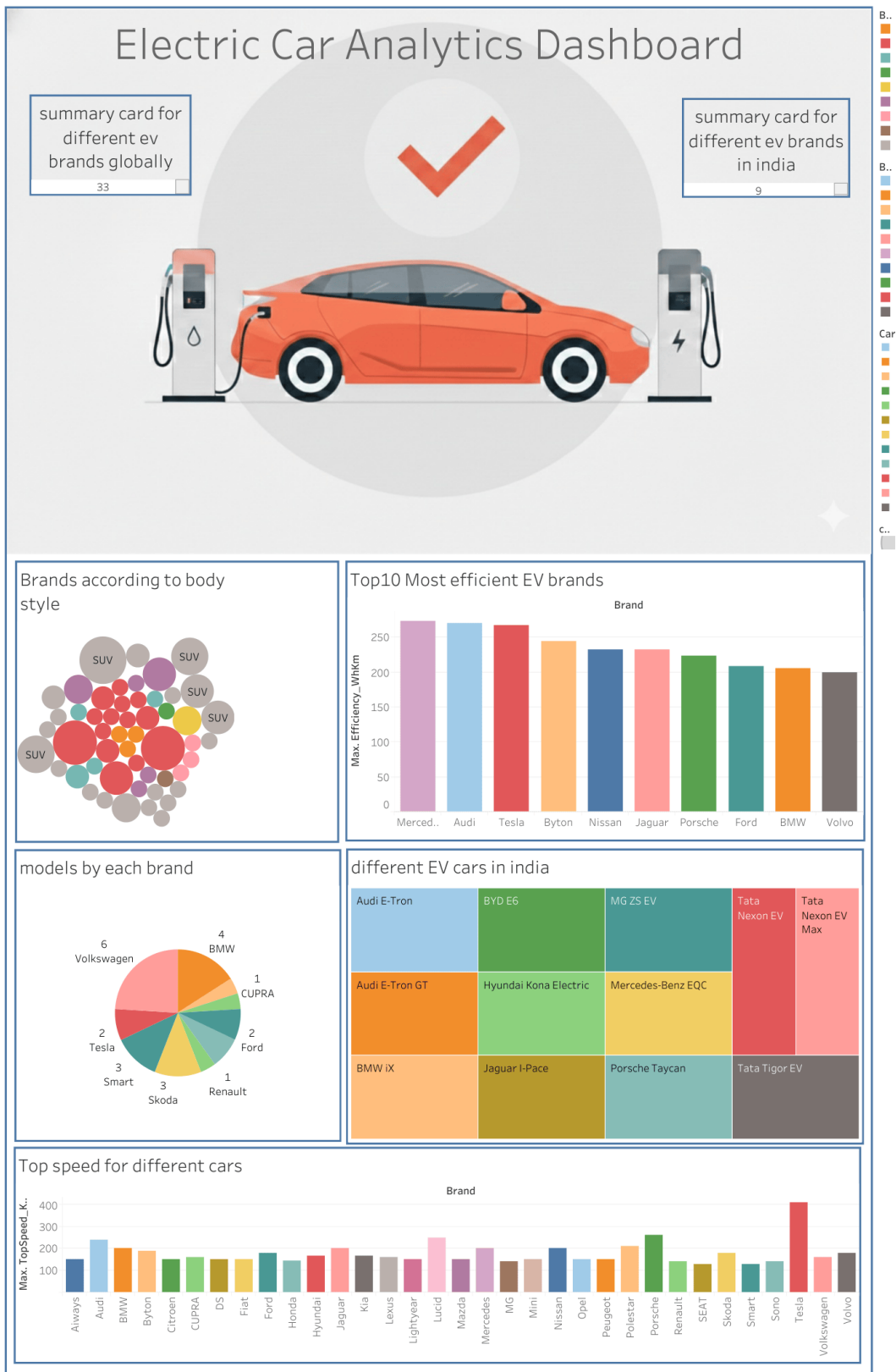


Top10 Most efficient EV brands



Top speed for different cars





⚡ Next-Gen EV Analytics

We offer modern Analytics solutions for Electric Vehicles

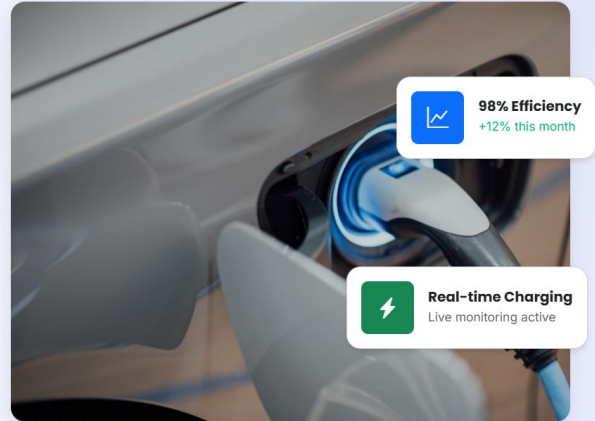
Transform your electric vehicle fleet management with real-time analytics, comprehensive charging insights, and predictive range optimization.

[Get Started](#) →

50K+
Vehicles Tracked

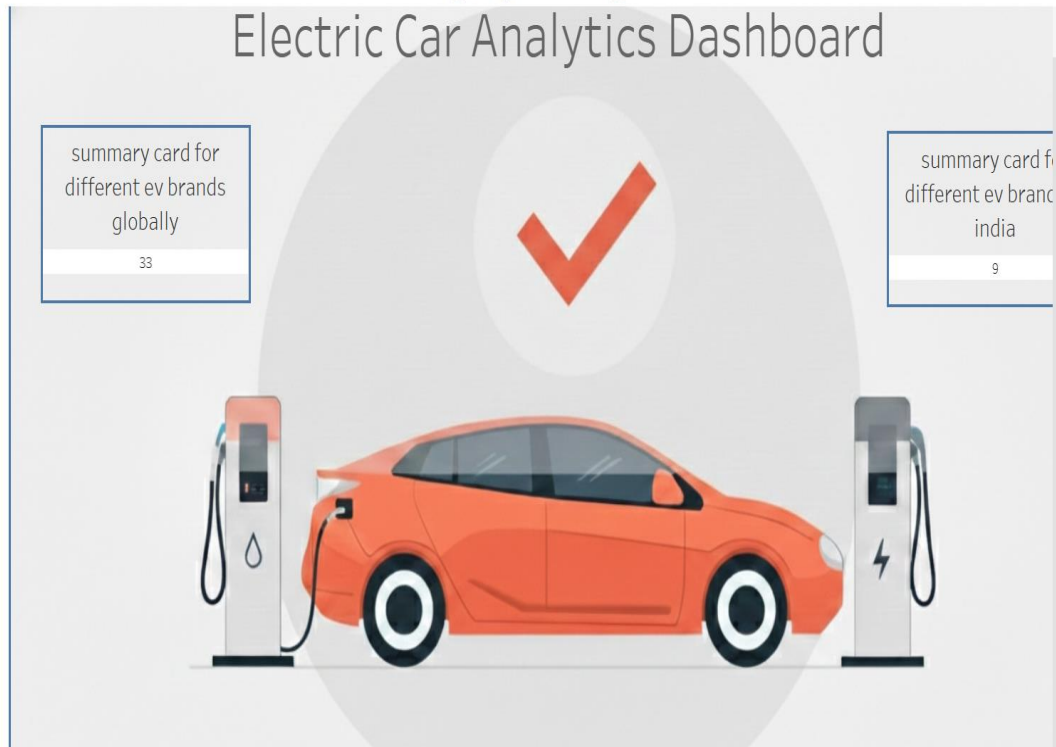
98%
Accuracy Rate

24/7
Live Monitoring



EV Charging & Range Dashboard

Electric Car Analytics Dashboard

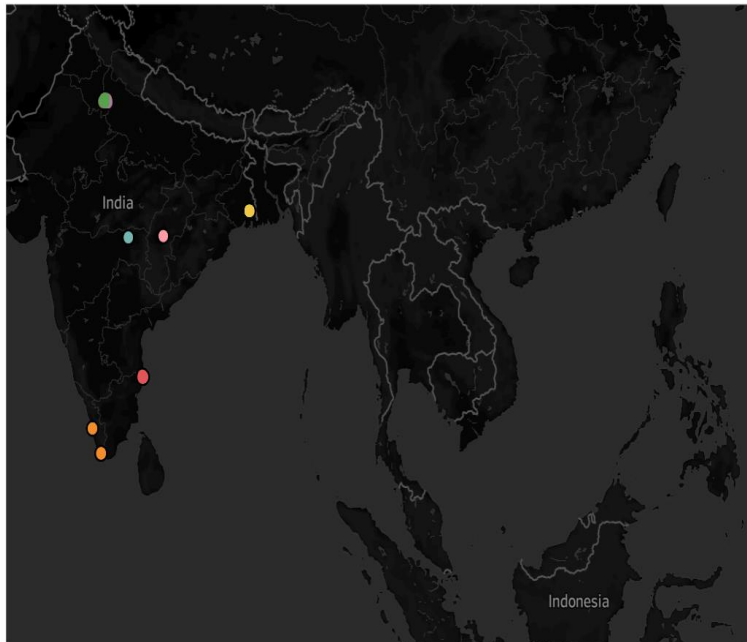


Charging Stations in India

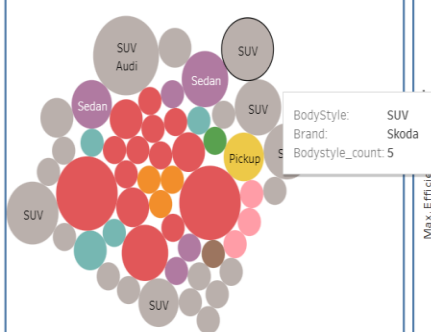
Charging Stations by Region & Type

Price of Electric Cars by different Brands

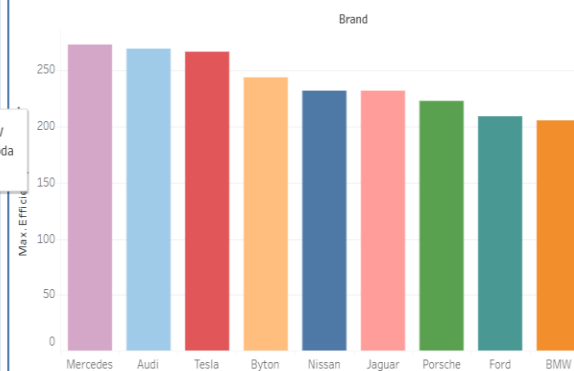
Different Brands & No. of Models



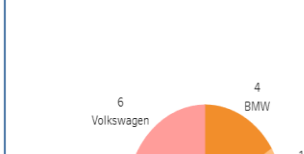
Brands according to body style



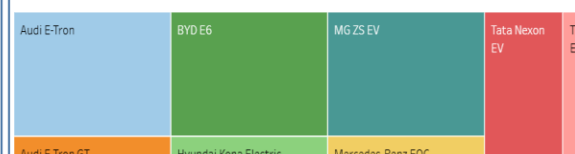
Top10 Most efficient EV brands



models by each brand



different EV cars in india



8. ADVANTAGES & DISADVANTAGES

Advantages:

The dashboard provides centralized EV insights. It simplifies complex technical data. Interactive filters improve usability. It supports data-driven decisions for buyers and investors.

Disadvantages:

The project depends on dataset accuracy. Real-time data updates are not included. Limited to available dataset scope. Large datasets may affect performance.

9. CONCLUSION

The Electric Car Analytics Dashboard successfully integrates EV data into meaningful visual insights. It addresses both consumer and investor challenges. The project demonstrates effective data preprocessing, database integration, and visualization techniques. It enhances decision-making through interactive dashboards. Overall, it meets the intended objectives efficiently.

10. FUTURE SCOPE

The project can be extended with real-time EV and charging station data. Predictive analytics can be added for future sales forecasting. Integration with live APIs can improve accuracy. Geographic map visualizations can enhance infrastructure planning. The system can also be deployed as a web-based analytics platform

11. APPENDIX

Dataset Link:

<https://drive.google.com/drive/folders/1SNwXwNYZChq9XMDXov6h27F7kahHqVb3?usp=sharing>

Github Link:

<https://github.com/manasa1311/E-Carstart-Analytics>

Project Demo Link:

<https://drive.google.com/file/d/1XRkd2hdjN9kOECps7lR4f6Pb8kqiESl-/view?usp=sharing>