PROJECT REPORT

Project Name: **Visualization tool for electric vehicle charge and range analysis**

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1. INTRODUCTION

1.1 Project Overview

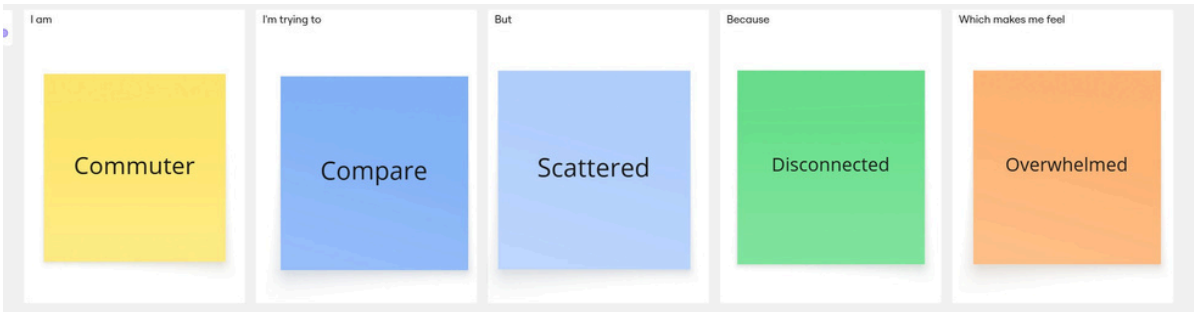
The project titled “Visualization Tool for Electric Vehicle Charge and Range Analysis” aims to build an interactive dashboard to analyze electric vehicle performance, efficiency, and pricing across various global markets. With the rapid rise in electric vehicle adoption, there is a growing demand for intuitive tools that allow users to compare EV specifications and infrastructure availability. This project consolidates data from multiple sources and provides visual insights through charts, graphs, and maps that help stakeholders — including consumers, analysts, and policymakers — better understand trends in EV technology and usage.

1.2 Purpose

The purpose of this project is to simplify complex EV-related data and deliver it through a user-friendly visualization interface. Consumers looking to purchase electric vehicles often face challenges in comparing models based on key parameters like range, acceleration, price, and efficiency. Similarly, decision-makers require a better understanding of EV adoption and charging infrastructure. By transforming raw data into meaningful visuals, this dashboard empowers users to make informed decisions and contributes to increased awareness and accessibility in the electric mobility sector.

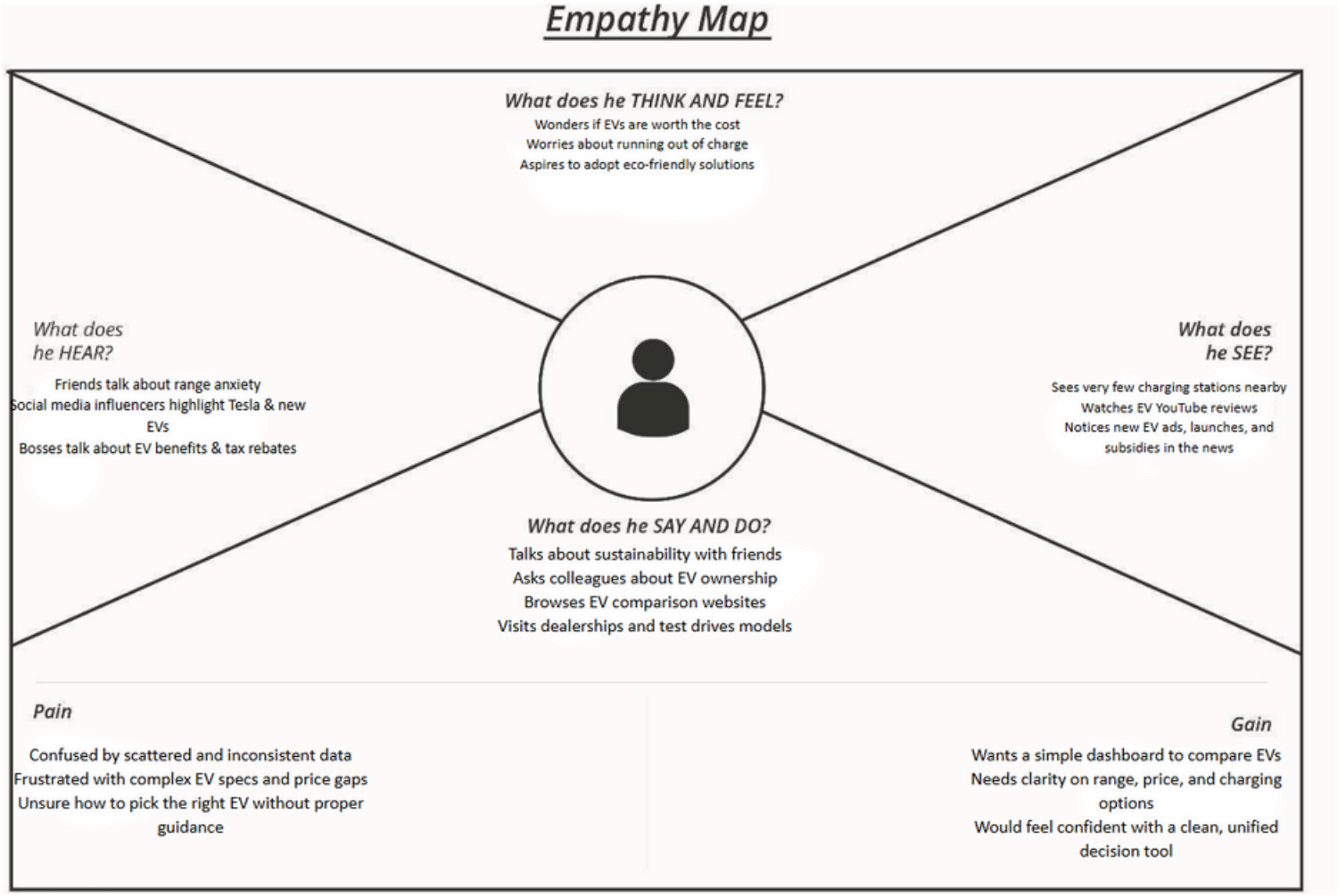
2. IDEATION PHASE

2.1 Problem Statement Electric vehicles face challenges such as range anxiety and uneven charging infrastructure distribution. The project seeks to address these issues by leveraging data analytics to provide actionable insights for optimizing EV charging networks and improving range efficiency.



2.2 Empathy Map Canvas

The empathy map focuses on key stakeholders such as EV manufacturers, charging station operators, and consumers. It captures their concerns, such as charging station availability, range optimization, and operational efficiency.

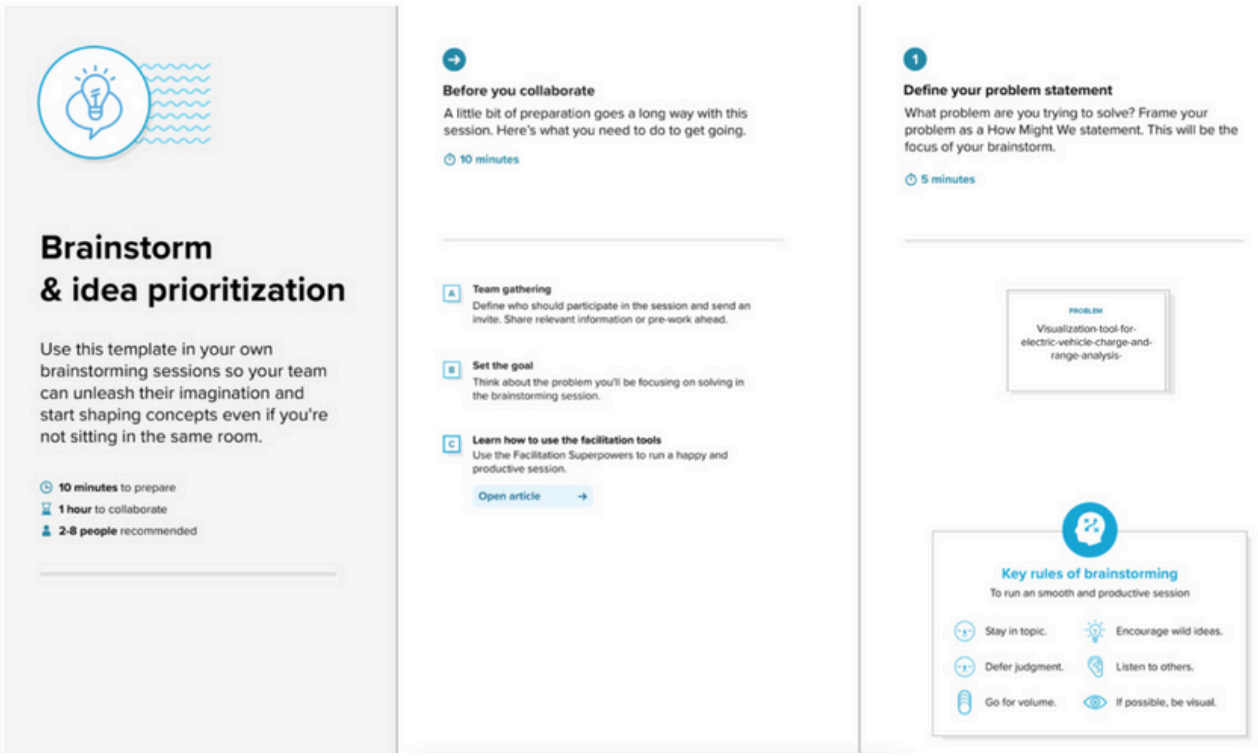


2.3 Brainstorming

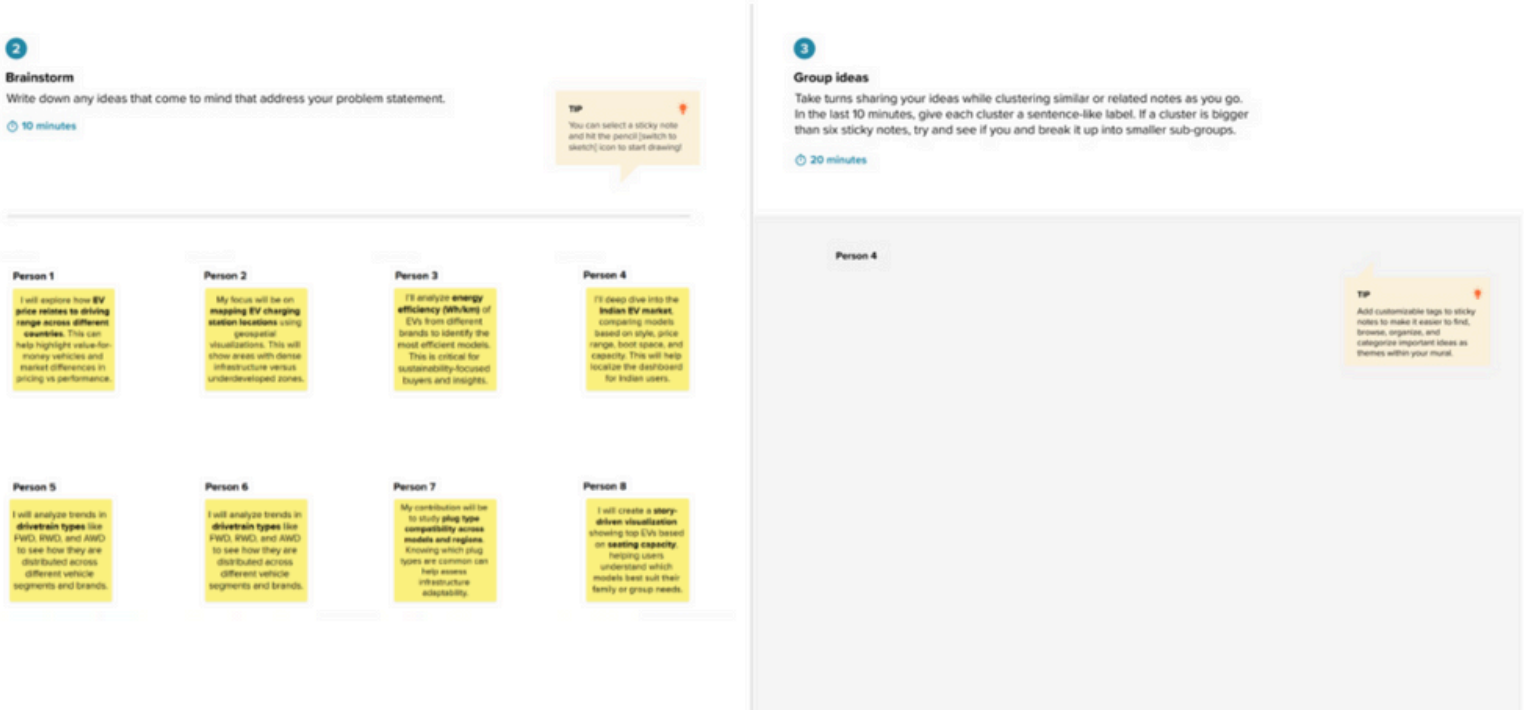
Brainstorming sessions focused on key areas of analysis, including:

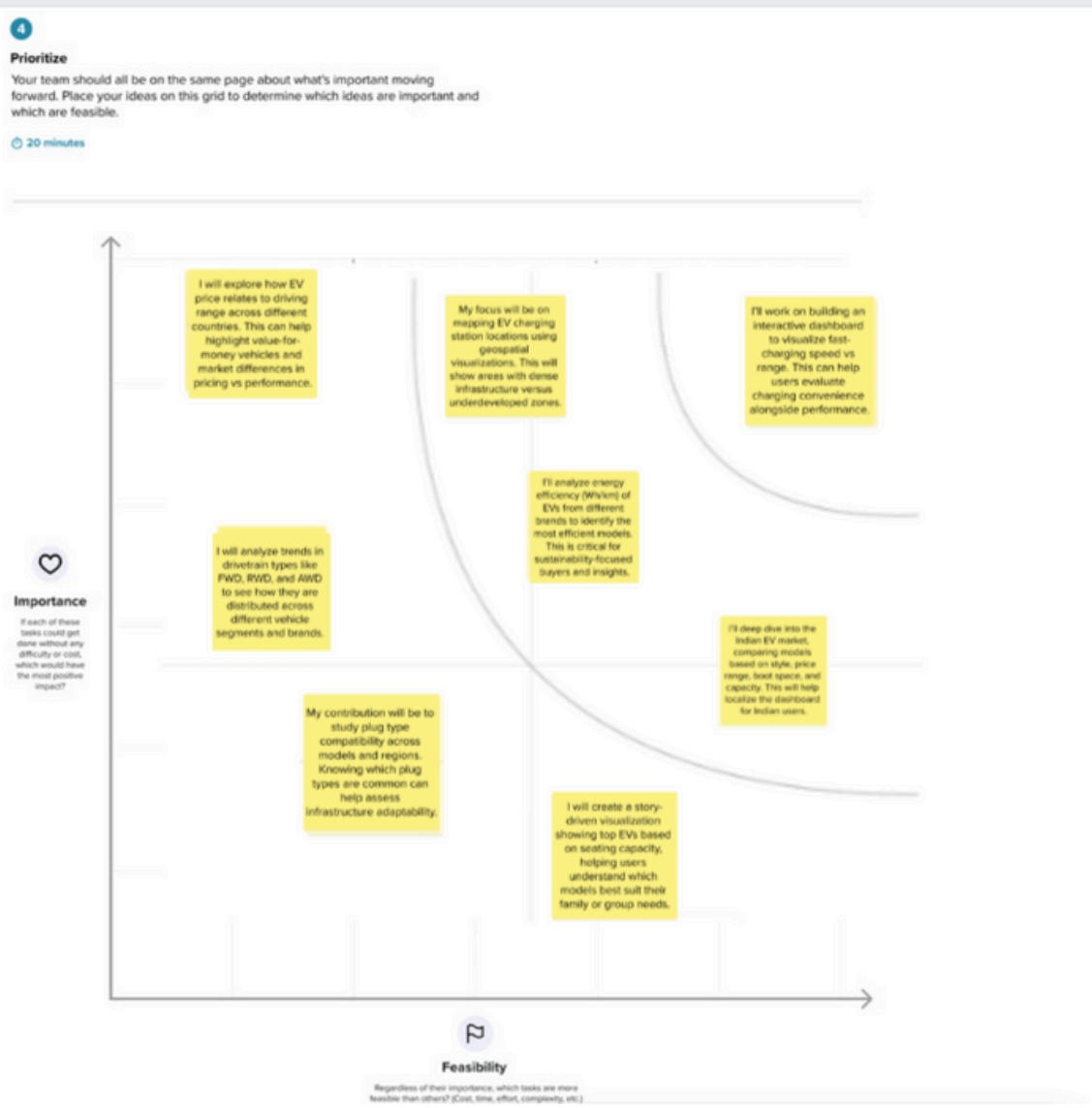
- Mapping charging station concentration
- Tracking trends in EV range performance
- Revealing regional gaps in charging infrastructure

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



Step-2: Brainstorm, Idea Listing and Grouping

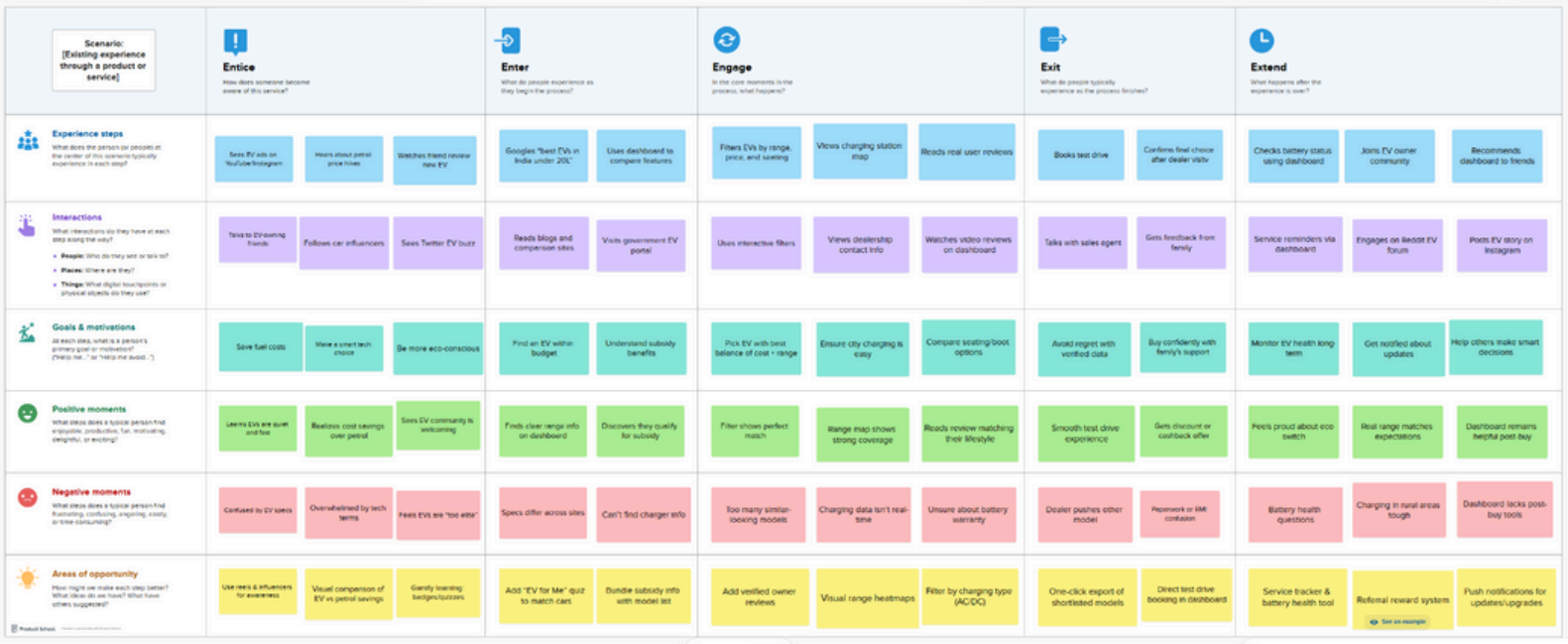




3. REQUIREMENT ANALYSIS

3.1 Customer Journey Map

The customer journey map visualizes steps from planning EV trips to using charging stations, highlighting pain points such as long waiting times and lack of charging options in remote areas.



3.2 Solution Requirements

Data sources: Charging station data, vehicle range performance metrics, and regional adoption statistics.
Tools: Tableau for visualization, Python for data processing.
Key metrics: Charging station utilization, range efficiency, regional coverage.

Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	- Registration through Form - Registration via Gmail
FR-2	User Confirmation	- Email Confirmation - OTP Verification
FR-3	EV Comparison Dashboard	- Filter EVs by range & price - Compare specifications
FR-4	Charging Station Insights	- View station map - Filter by location
FR-5	Data Visualization	- Display graphs - Export reports

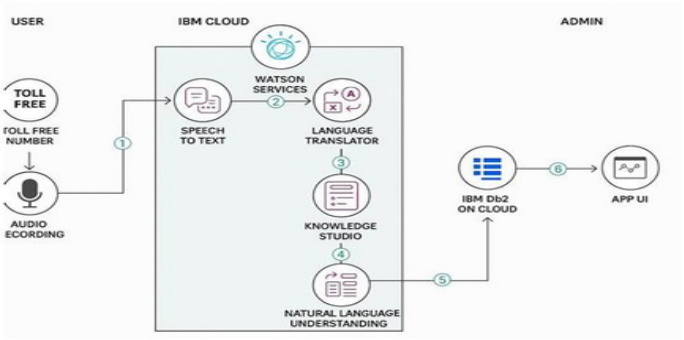
Non-functional Requirements:

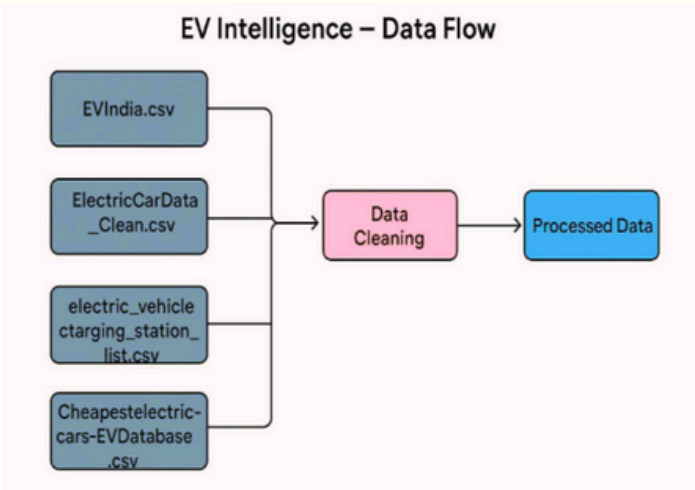
Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	The dashboard must be user-friendly with clear navigation and
NFR-2	Security	User data and login credentials must be securely encrypted and
NFR-3	Reliability	The system must consistently deliver accurate and valid data
NFR-4	Performance	Dashboard responses (filtering, loading maps) should occur within
NFR-5	Availability	The platform should be accessible 99.9% of the time with minimal
NFR-6	Scalability	The system must handle future increases in EV models and user

3.3 Data Flow Diagram

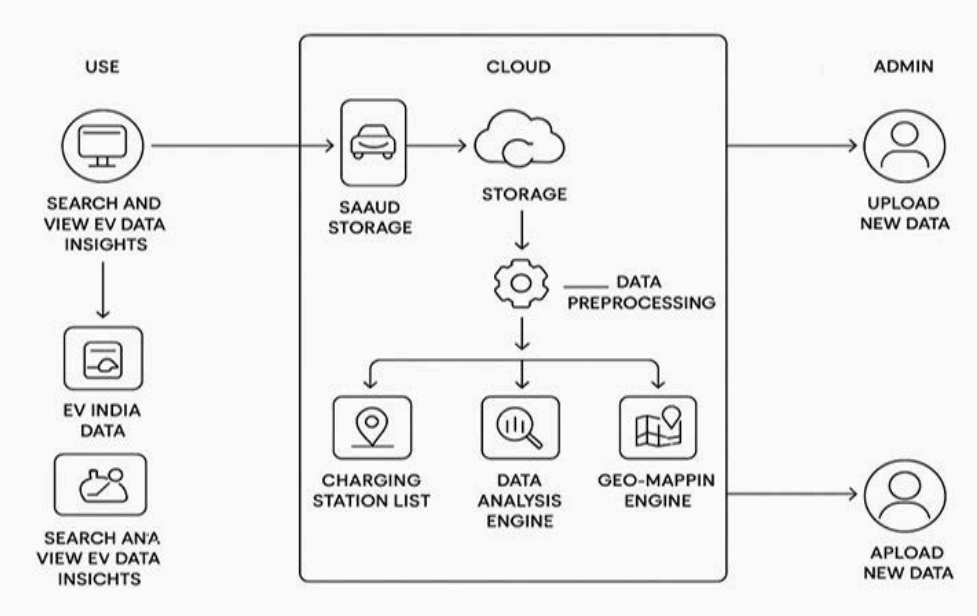
The data flow diagram outlines data collection, preprocessing, analysis, and visualization stages, ensuring a streamlined workflow from raw data to actionable insights.





3.4 Technology Stack

- Data Analytics: Tableau, Python (for ETL processes).
- Data Sources: Public EV datasets, manufacturer reports.
- Storage: Cloud-based solutions for scalability and accessibility.



4. PROJECT DESIGN

4.1 Problem-Solution Fit

The solution meets the needs of EV stakeholders by delivering actionable insights into charging patterns and range performance through clear and interactive visualizations.

Example: Visualization Tool for Electric Vehicle Charge and Range Analysis

Define CS, fit into CC

1. CUSTOMER SEGMENT(S) — CS

EV buyers (first-time and repeat), automotive data analysts, city infrastructure planners, EV showroom managers

6. CUSTOMER CONSTRAINTS — CC

→ Limited knowledge of EV specs
→ Scattered or outdated info online
→ No technical background
→ Budget limitations

5. AVAILABLE SOLUTIONS — AS

EV brand websites
→ Comparison blogs & YouTube
→ Government portals (not user-friendly)
→ Dealership brochures (incomplete)

Explore AS, differentiate

Focus on J&P, tap into BE, understand RC

2. JOBS-TO-BE-DONE / PROBLEMS — J&P

→ Compare EV specs like range, cost, efficiency
→ Find nearby charging stations
→ Identify cost-per-km or best model under budget
→ Track EV market trends in India & globally

9. PROBLEM ROOT CAUSE — RC

→ Lack of unified, interactive platform to explore EVs & infrastructure
→ Data exists, but isn't visual, filtered, or easy to use
→ Existing platforms aren't personalized or up-to-date

7. BEHAVIOUR — BE

→ Users google EV reviews
→ Visit multiple portals for specs
→ Ask friends or forums for help
→ Struggle with Excel sheets manually

Focus on J&P, tap into BE, understand RC

Identify strong TR & EM

3. TRIGGERS — TR

→ Rising petrol/diesel costs
→ Government subsidies for EVs
→ Social influence (friends buying EVs)
→ Need to reduce carbon footprint

4. EMOTIONS: BEFORE / AFTER — EM

Before: confused, overwhelmed, unsure which EV is worth it
After: informed, confident, in control, satisfied with their decision

10. YOUR SOLUTION — SL

→ A centralized dashboard that:
- Filters and compares EV specs
- Maps charging stations
- Calculates cost per km
- Combines 4 global+Indian datasets in one clean UI

→ Helps users make smart, confident EV decisions

8. CHANNELS of BEHAVIOUR — CH

8.1 ONLINE
Google search, YouTube, EV sites, gov dashboards, comparison tools

8.2 OFFLINE
- Dealership visits, consulting friends, test drives, printed brochures

Extract online & offline CH of BE

AMALTAMA

4.2 Proposed Solution

A Tableau dashboard featuring:

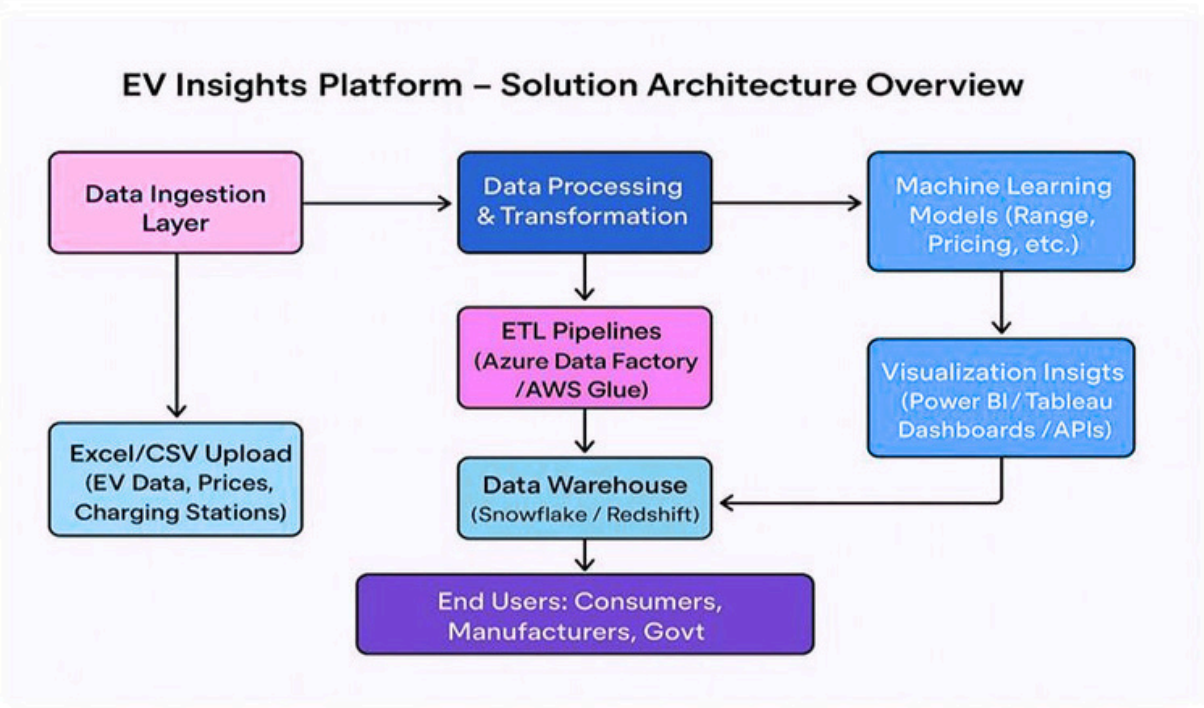
Charging station usage heatmaps.
Range efficiency trend analysis.
Regional comparisons of EV adoption.

S.No.	Parameter	Description
1	**Problem Statement** (Problem to be solved)	EV buyers, analysts, and managers struggle with scattered, inconsistent EV data across different sources — making decision-making difficult and inefficient.
2	**Idea / Solution Description**	A centralized interactive dashboard that integrates EV specifications, charging station maps, pricing filters, and personalized recommendations using multiple global + Indian datasets.
3	**Novelty / Uniqueness**	Unlike EV brand websites or review blogs, this tool provides real-time visual comparison, cross-dataset filtering, and map-based charging insights in one place.
4	**Social Impact / Customer Satisfaction**	Reduces confusion in EV adoption, promotes green mobility, improves user trust, and speeds up EV purchase decisions—especially for first-time buyers.
5	**Business Model (Revenue Model)**	Freemium dashboard with premium features for auto retailers, analytics reports for manufacturers, data APIs for third-party apps, and optional in-dashboard ads.
6	**Scalability of the Solution**	Easily scalable with new datasets (e.g. international EV models, charging networks), supports integration into mobile/web platforms, and expandable for government/enterprise use.

4.3 Solution Architecture

The architecture integrates data ingestion, preprocessing, and visualization components. Tableau dashboards present insights for decision-making and strategic planning.

Solution Architecture Diagram:



5. PROJECT PLANNING & SCHEDULING

5.1 Project Planning

The project followed an agile methodology with defined milestones:

Week 1: Data collection and cleaning.
Week 2: Dashboard design and initial visualizations.
Week 3: Refinement and final presentation.

6. FUNCTIONAL AND PERFORMANCE TESTING

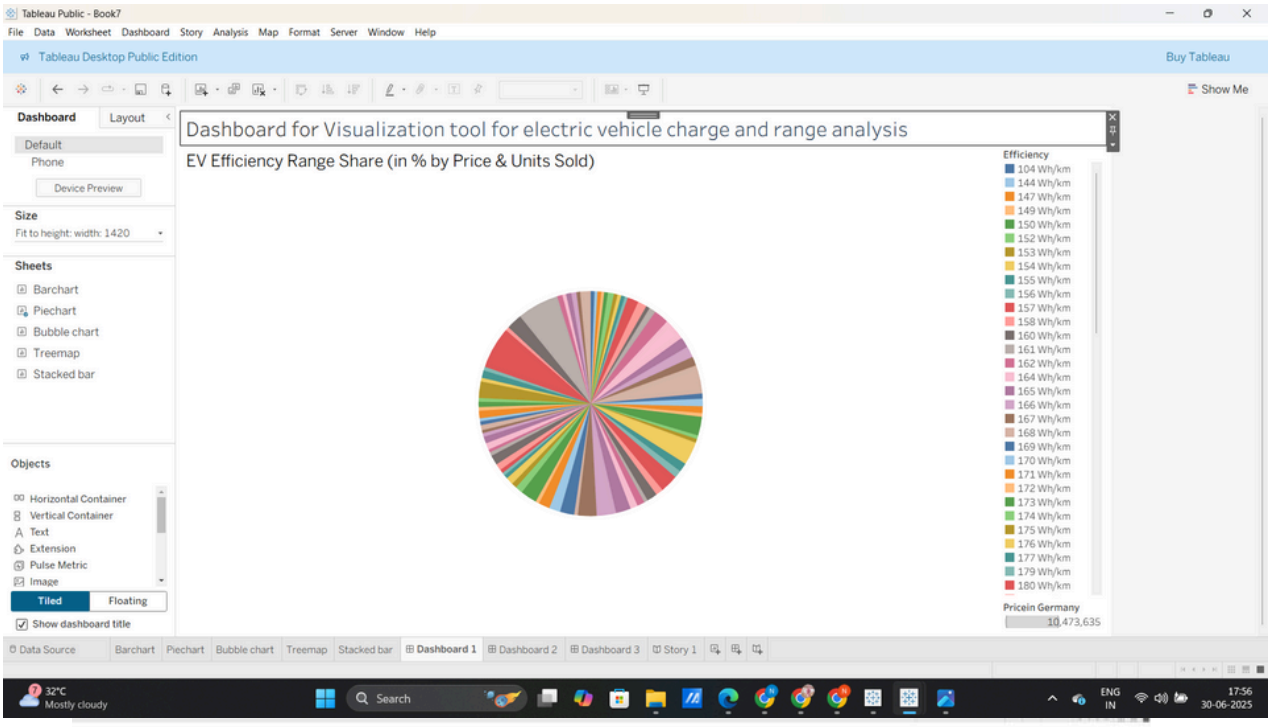
6.1 Performance Testing Testing ensured efficient dashboard performance with

quick load times and accurate
representation of data, even with large datasets.

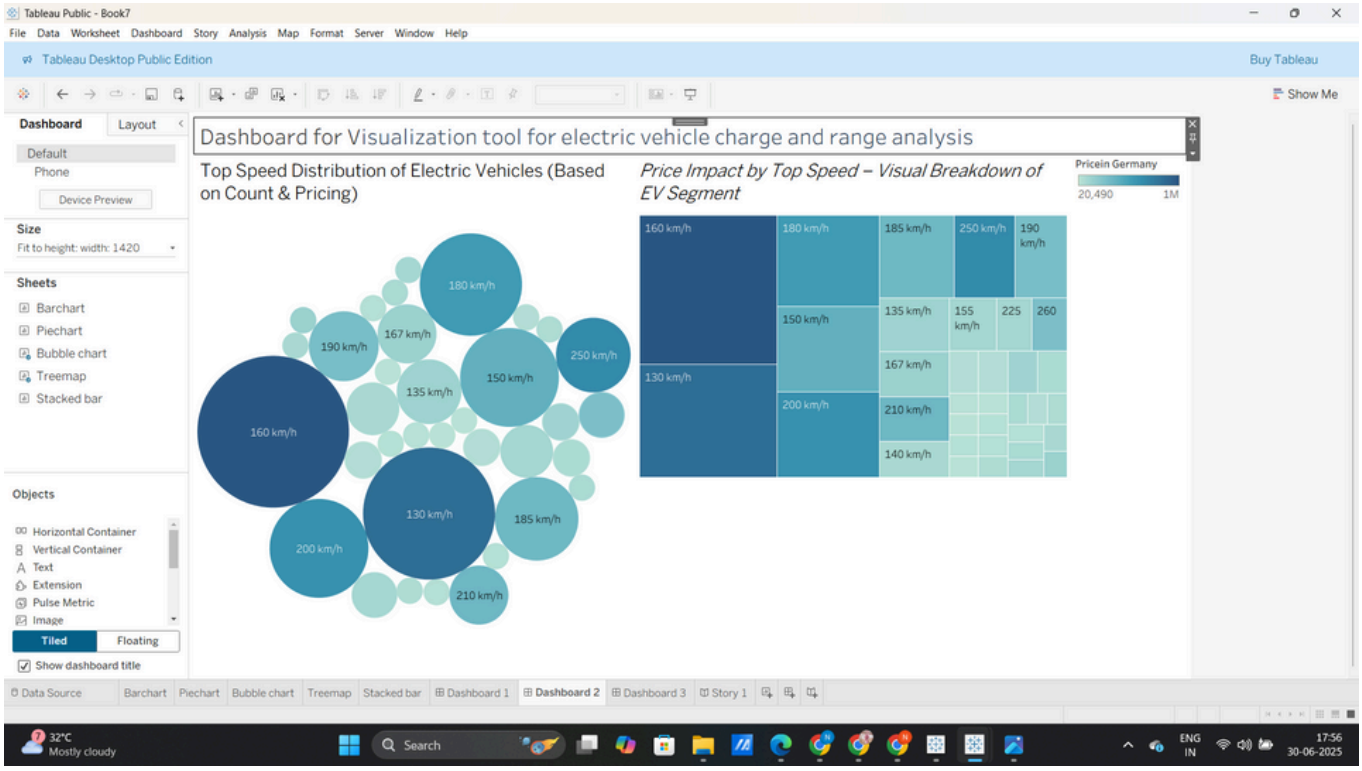
7. RESULTS

7.1 Output Screenshots

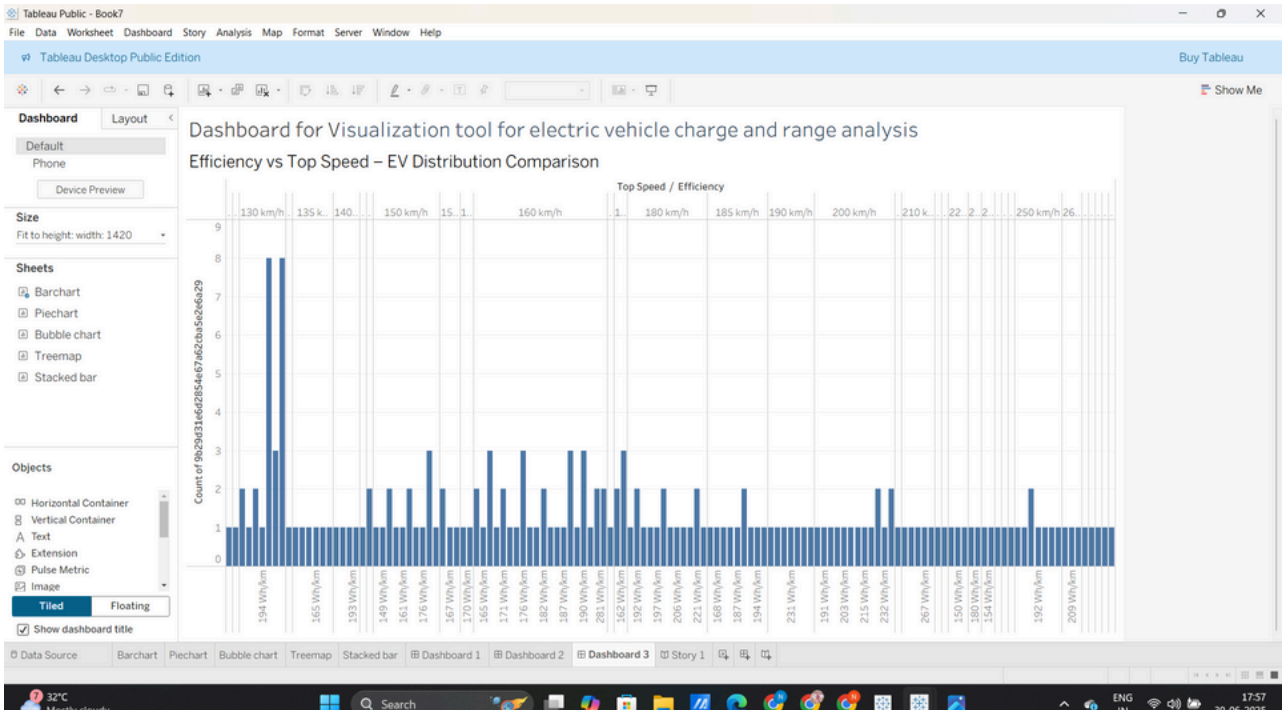
Dashboard-1



Dashboard-2



Dashboard-3



8. ADVANTAGES & DISADVANTAGES

Advantages: Enhanced visualization of EV data, real-time insights for stakeholders, and user-friendly interface.
Disadvantages: Dependence on data accuracy and limitations in proprietary data availability.

9. CONCLUSION

The project demonstrates the value of Tableau in analyzing EV data, offering actionable insights to improve charging infrastructure and range efficiency. It provides a framework for stakeholders to address key challenges in EV adoption.

10. FUTURE SCOPE

Future work includes integrating predictive analytics for EV range, expanding data sources to include real-time telemetry, and exploring global EV adoption trends.

11. APPENDIX

Dataset Link:

https://docs.google.com/spreadsheets/d/1ay6ETJrKJoAwKpLeYSiFbe_0QLyBRPK2/edit?usp=drive_link&ouid=107508531184614501038&rtpof=true&sd=true

GitHub Link:

https://github.com/Nikitha13-tech/visualization-tool-for-electric-vehicle-charge-and-range-analysis

Project Demo Link:

https://drive.google.com/file/d/1UTu-XOkqoT0ok6J0ScQRPO2hdA0Du3Qs/view?usp=drive_link