Data Analytics using Tableau

Project Documentation Format

1. INTRODUCTION

Project Title: Visualization Tool for Electric Vehicle Charge and Range Analysis

Project members : 1. Moturu Lakshmi Tulasi
2. Sandhya Gamidi
3. Upendra Sanagala

1.1 Project Overview

The Electric Vehicle (EV) is not new, but it has been receiving significantly more attention in recent years. Advances in both EV analytics and battery technologies have led to increased automotive market share. However, this growth is not attributed to hardware alone. The modern mechatronic vehicle marries electrical storage and propulsion systems with electronic sensors, controls, and actuators, integrated closely with software, secure data transfer, and data analysis, to form a comprehensive transportation solution. Advances in all these areas have contributed to the overall rise of EV's, but the common thread that runs through all these elements is data analytics.

1.2 Purpose

The purpose of this project is to develop an interactive visualization tool that provides deep insights into electric vehicle (EV) charge and range data. With the rising adoption of EVs, users face challenges in understanding battery performance, predicting vehicle range, and planning charging schedules efficiently. This tool leverages data analytics and visualization to assist users in making informed decisions, enhancing their confidence and convenience in EV usage. The project aims to simplify complex EV data into accessible dashboards using Tableau, enabling clearer interpretation and improved user experience

2. IDEATION PHASE

2.1 Problem Statement

- Analysing different data from Multiple sources for Electric cars in India and Globally

2.2 Empathy Map Canvas

- I wish I had more clarity on charging station locations**.**
- Anxious about range limitations (range anxiety)
- Frustrated by inconsistent data or unclear visualizations
- Relieved when a dashboard clearly shows range/charge trends

2.3 Brainstorming

- During the brainstorming phase, the following ideas were considered:
- Create dashboards showing EV charge level trends over time
- Visualize driving range based on different charging levels
- Compare range differences between vehicle models or battery types
- Display charging session frequency and duration
- Identify peak hours for charging

- Add filters for location, temperature, and vehicle type to analyze how they affect battery performance

3. REQUIREMENT ANALYSIS

3.1 Customer Journey map

A typical EV user journey includes the following steps:

- Needs Awareness: The user wants to monitor EV charge and range.
- Data Access: The user accesses EV data from onboard systems or logs.
- Visualization Tool Usage: The user opens the visualization tool to explore data.
- Analysis: The user examines charge cycles, range patterns, and charging behavior.
- Decision-Making: Based on insights, the user plans trips or adjusts charging habits.

This journey highlights the need for a simple, intuitive, and informative dashboard.

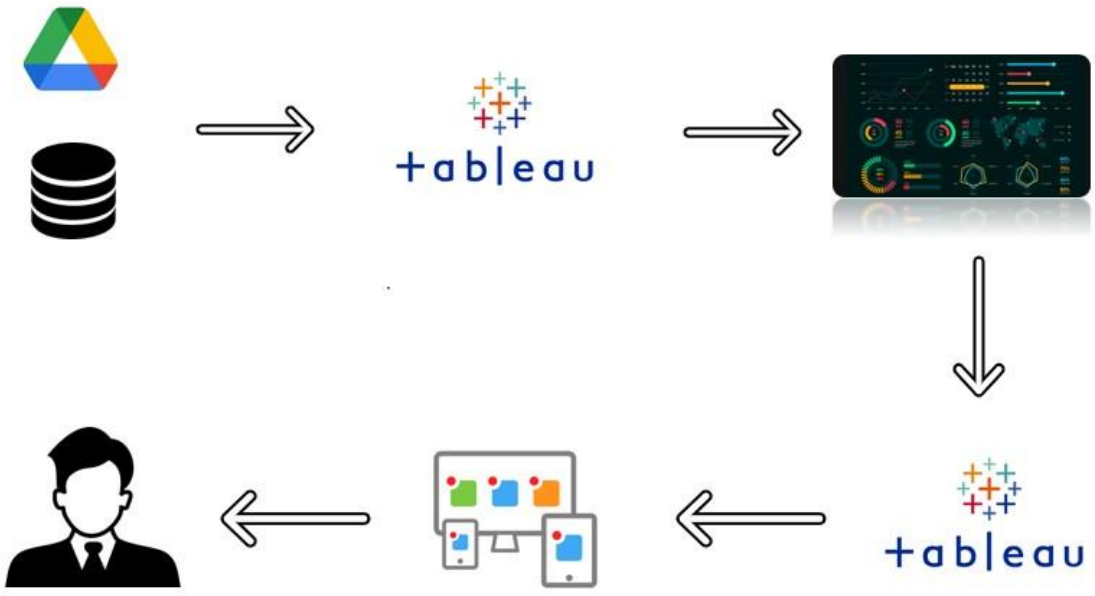
3.2 Solution Requirement

Functional Requirements:

- Visualize EV charge levels over time
- Display average and max driving range
- Filter data by vehicle, temperature, date, or usage pattern
- Compare range across different vehicle categories

Non-functional Requirements:

- User-friendly interface
- Fast and interactive visualizations
- Responsive filters and clear data labels 3.3 **Data Flow Diagram**



3.4 **Technology Stack**

- Tableau: For creating interactive dashboards and visualizations
- Microsoft Excel (optional)**:** Used for preprocessing or formatting data
- Dataset: EV charge and range data from reliable sources

4. PROJECT DESIGN

4.1 **Problem Solution Fit**

EV users struggle to interpret raw data related to charge cycles, range variability, and usage patterns. Our solution addresses this by converting complex EV data into easy-to-understand visualizations using Tableau. This fit ensures that users can monitor trends, optimize charging behavior, and make informed decisions without requiring technical expertise

4.2 **Proposed Solution** hi We developed a visualization tool in Tableau that:

- Shows EV battery charge levels over time
- Displays average and maximum range based on usage
- Highlights charging frequency and patterns
- Allows users to filter data by vehicle type, date, and temperature
- This tool helps users, analysts, and manufacturers to analyze electric vehicle performance effectively.

4.3 **Solution Architecture**

Dataset (EV Charge & Range Data)
↓
Data Cleaning (if needed, in Excel)
↓
Data Import into Tableau
↓
Dashboard Design (Bar Charts, Line Graphs, Filters)
↓
Final Visualization Tool for User Analysis

5. PROJECT PLANNING & SCHEDULING

5.1 **Project Planning**

The project was planned and executed in the following phases:

1. Phase 1: Project Understanding & Team Formation • Defined project goals and deliverables
    - Assigned roles among the 3 team members
2. Phase 2: Dataset Collection & Analysis
    - Acquired dataset related to EV charge and range
    - Explored data structure and key attributes
3. Phase 3: Data Preprocessing
    - Cleaned and formatted data using Excel (if necessary)
    - Ensured data consistency and removed invalid entries

4. Phase 4: Dashboard Development
    - Imported data into Tableau
    - Created interactive dashboards including charge level trends, range analysis, and comparison charts
5. Phase 5: Testing & Refinement
    - Verified visual accuracy
    - Improved filter functionality and visual clarity
6. Phase 6: Documentation & Report Finalization
    - Prepared final report and presentation material
    - Collected screenshots and documented key insights

6. FUNCTIONAL AND PERFORMANCE TESTING

6.1 **Performance Testing**

We conducted manual testing to ensure that each visualization and filter worked as expected:

- Verified that all dashboards loaded correctly in Tableau
- Tested filtering by vehicle type, date, and temperature range
- Checked that each chart displayed accurate and relevant data
- Ensured users could navigate between dashboard views easily

All core functionalities performed as intended and met the project's functional requirements.

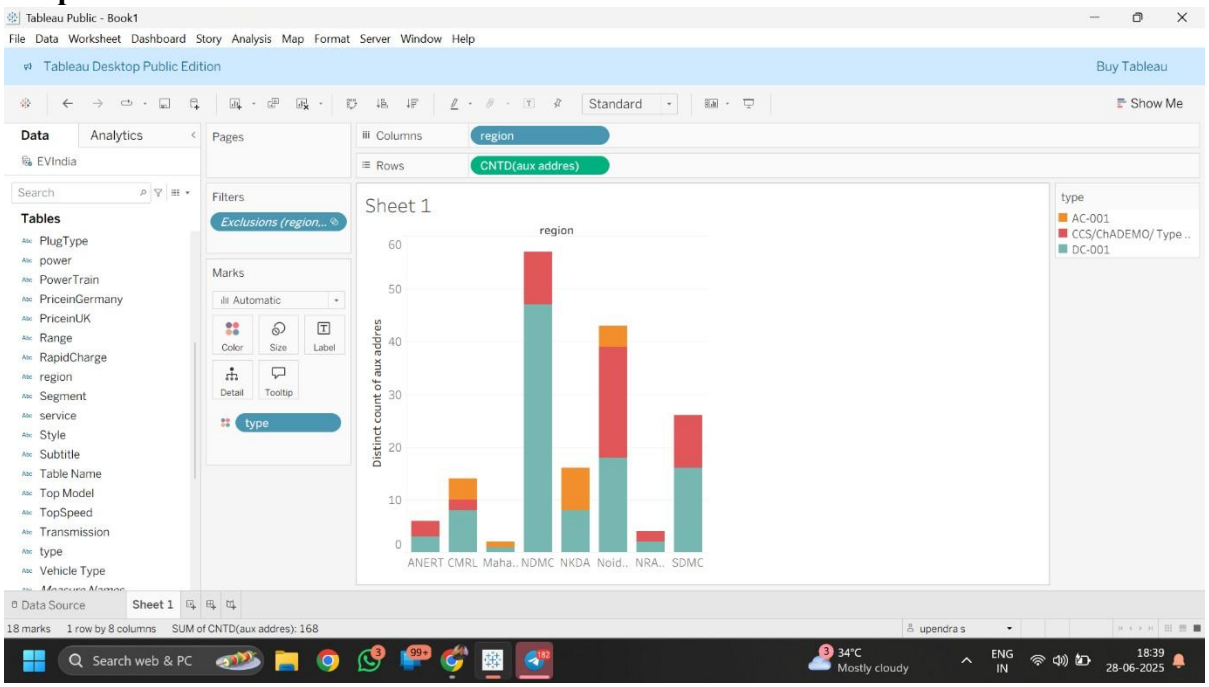
Although Tableau is highly optimized, we assessed performance based on:

- **Load Time:** Dashboards loaded within 3–5 seconds, even with filters applied
- **Responsiveness:** Visuals and interactions were smooth with no lag
- **Scalability:** The tool remained effective with increasing data rows (tested with larger mock data)

The visualization tool demonstrated good performance, suitable for both small and medium-sized datasets.

7. RESULTS

7.1 **Output Screenshots**



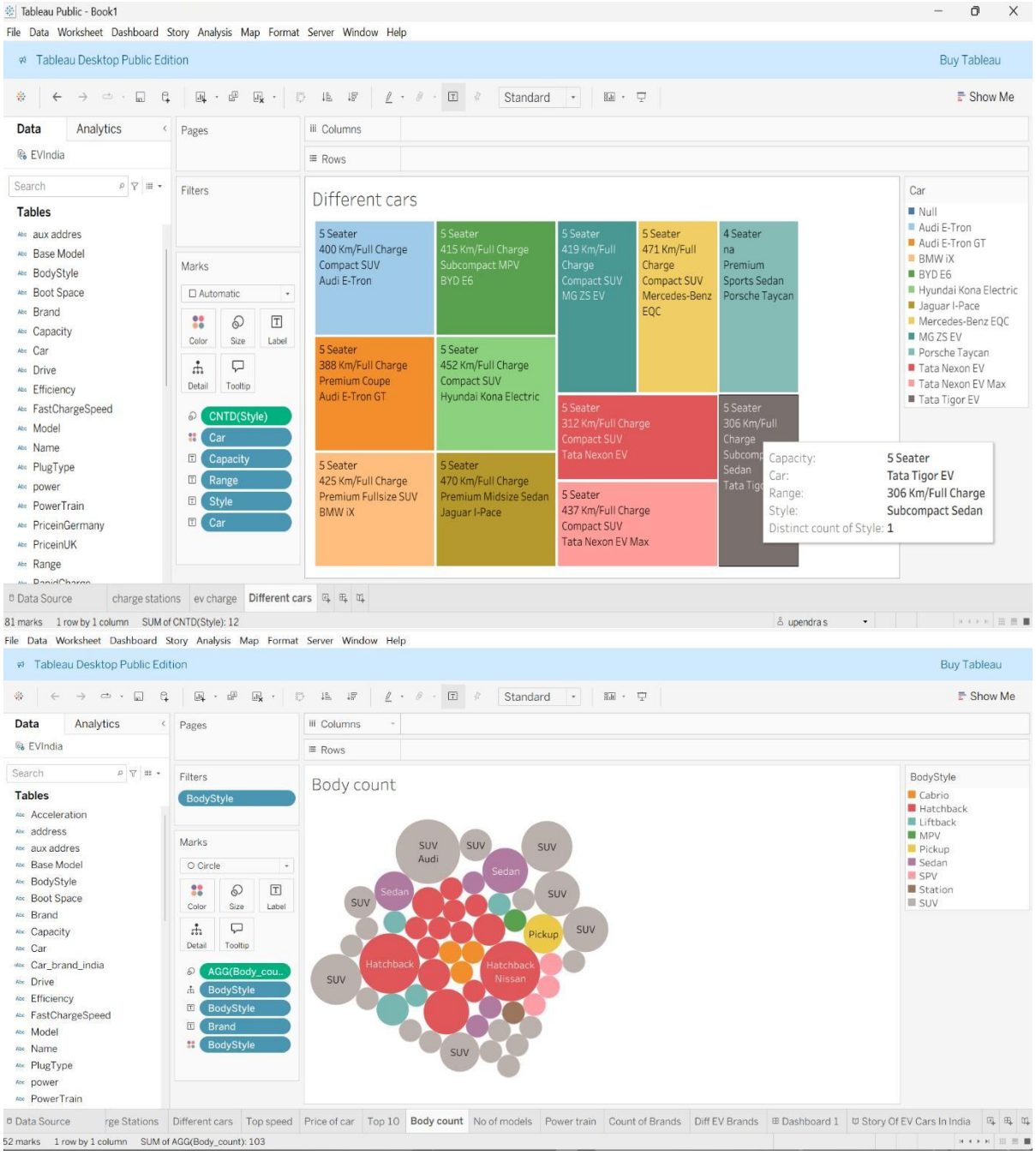
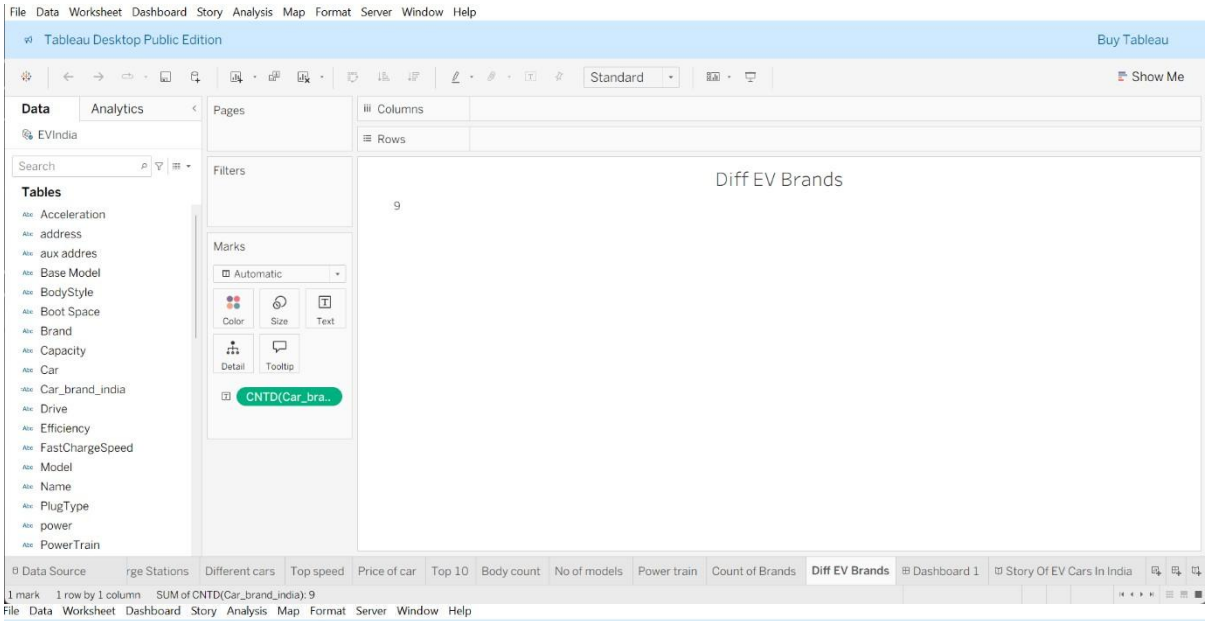
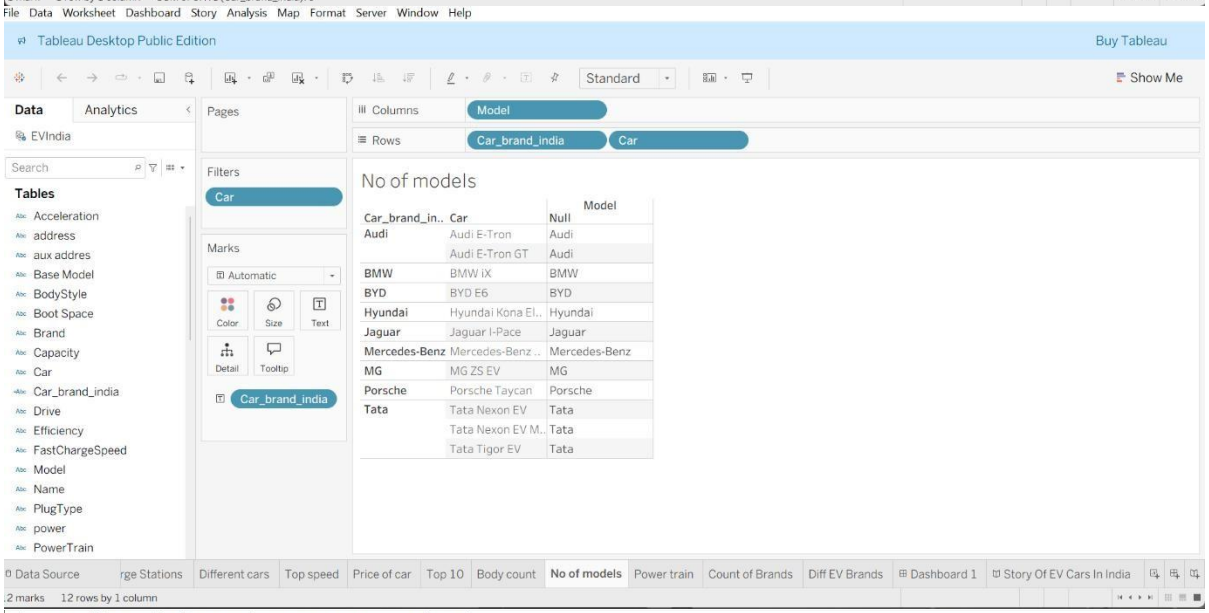
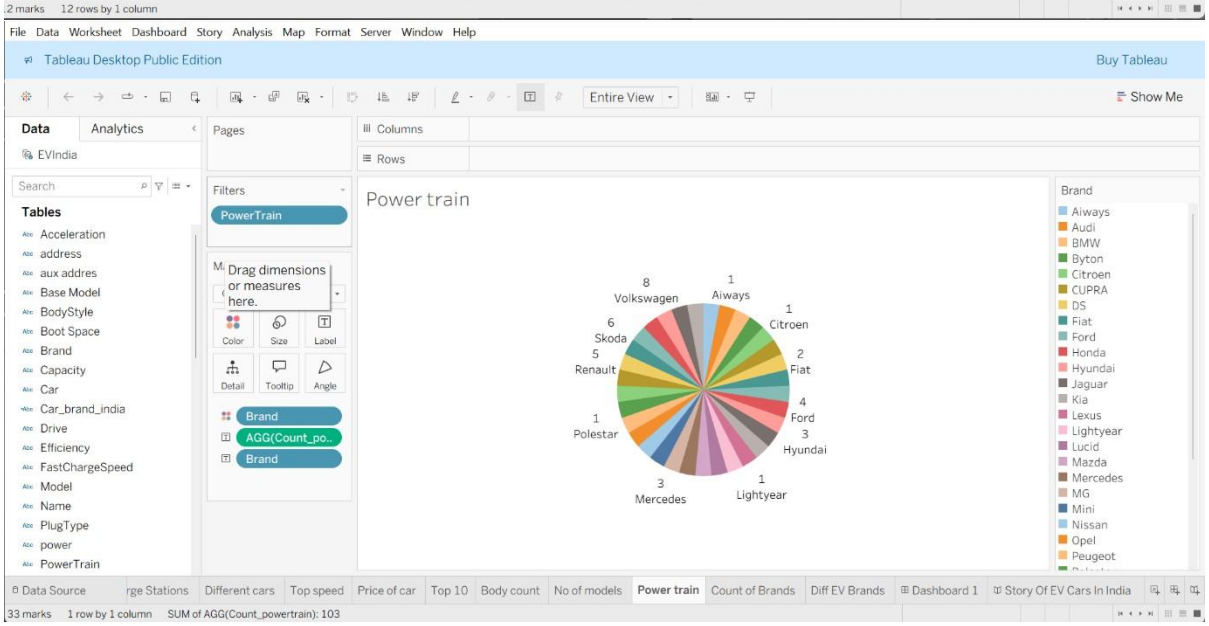
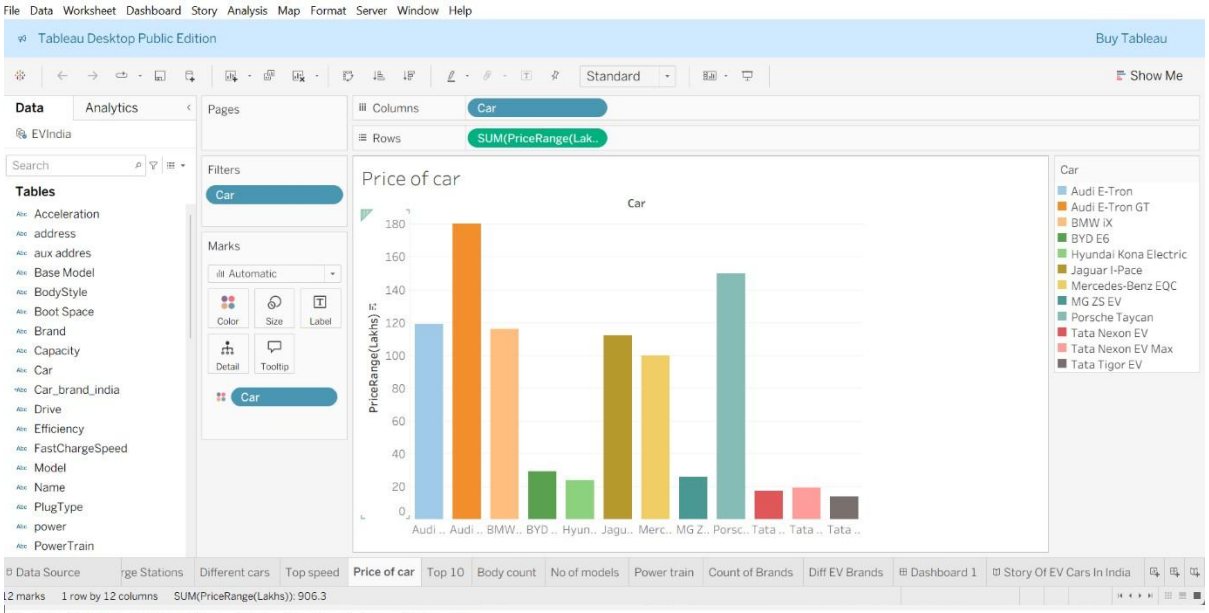


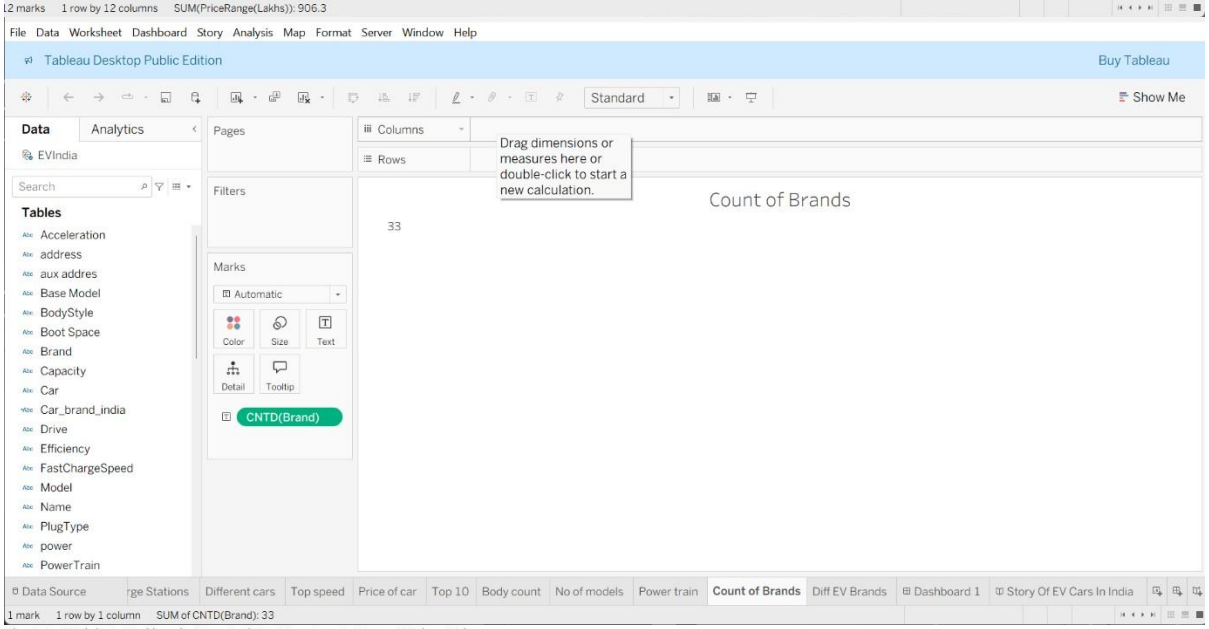
Tableau Public - Book1
File Data Worksheet Dashboard Story Analysis Map Format Server Window Help
Tableau Desktop Public Edition
Buy Tableau
Show Me
Data
Analytics
EVIndia
Search
Tables
aux addres
Base Model
BodyStyle
Boot Space
Brand
Capacity
Car
Drive
Efficiency
FastChargeSpeed
Model
Name
PlugType
power
PowerTrain
PriceinGermany
PriceinUK
Range
Pages
Columns
Rows
Filters
Marks
Automatic
Color
Size
Label
Detail
Tooltip
CNTD(Style)
Car
Capacity
Range
Style
Car
Different cars
5 Seater
400 Km/Full Charge
Compact SUV
Audi E-Tron
5 Seater
415 Km/Full Charge
Subcompact MPV
BYD E6
5 Seater
419 Km/Full Charge
Compact SUV
MG ZS EV
5 Seater
471 Km/Full Charge
Compact SUV
Mercedes-Benz EQC
4 Seater
na
Premium
Sports Sedan
Porsche Taycan
5 Seater
388 Km/Full Charge
Premium Coupe
Audi E-Tron GT
5 Seater
452 Km/Full Charge
Compact SUV
Hyundai Kona Electric
5 Seater
312 Km/Full Charge
Compact SUV
Tata Nexon EV
5 Seater
306 Km/Full Charge
Subcomp
Sedan
Tata Tig
5 Seater
425 Km/Full Charge
Premium Fullsize SUV
BMW iX
5 Seater
470 Km/Full Charge
Premium Midsize Sedan
Jaguar I-Pace
5 Seater
437 Km/Full Charge
Compact SUV
Tata Nexon EV Max
Capacity: 5 Seater
Car: Tata Tigor EV
Range: 306 Km/Full Charge
Style: Subcompact Sedan
Distinct count of Style: 1
Car
Null
Audi E-Tron
Audi E-Tron GT
BMW iX
BYD E6
Hyundai Kona Electric
Jaguar I-Pace
Mercedes-Benz EQC
MG ZS EV
Porsche Taycan
Tata Nexon EV
Tata Nexon EV Max
Tata Tigor EV
Data Source
charge stations
ev charge
Different cars
81 marks
1 row by 1 column
SUM of CNTD(Style): 12
upendra s
File Data Worksheet Dashboard Story Analysis Map Format Server Window Help
Tableau Desktop Public Edition
Buy Tableau
Show Me
Data
Analytics
EVIndia
Search
Tables
Acceleration
address
aux addres
Base Model
BodyStyle
Boot Space
Brand
Capacity
Car
Car_brand_india
Drive
Efficiency
FastChargeSpeed
Model
Name
PlugType
power
PowerTrain
Pages
Columns
Rows
Filters
BodyStyle
Marks
Circle
Color
Size
Label
Detail
Tooltip
AGG(Body_cou..
BodyStyle
BodyStyle
Brand
BodyStyle
Body count
SUV
Audi
SUV
SUV
Sedan
Sedan
SUV
SUV
Pickup
SUV
Hatchback
Hatchback
Nissan
SUV
SUV
BodyStyle
Cabrio
Hatchback
Liftback
MPV
Pickup
Sedan
SPV
Station
SUV
Data Source
rge Stations
Different cars
Top speed
Price of car
Top 10
Body count
No of models
Power train
Count of Brands
Diff EV Brands
Dashboard 1
Story Of EV Cars In India
52 marks
1 row by 1 column
SUM of AGG(Body_count): 103

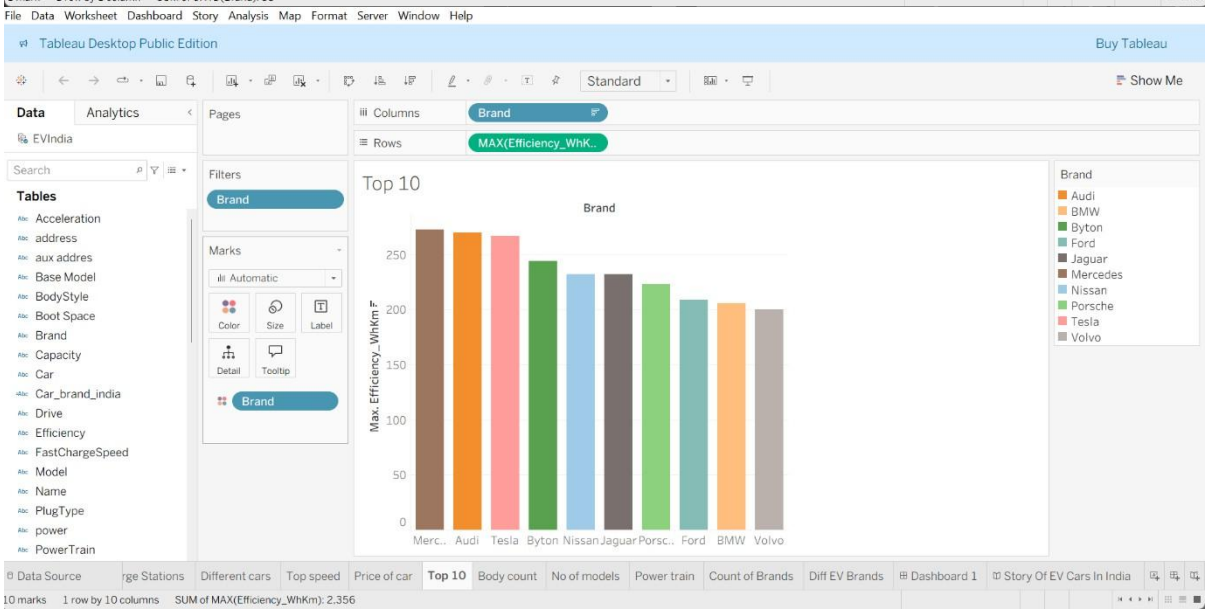

File Data Worksheet Dashboard Story Analysis Map Format Server Window Help
Tableau Desktop Public Edition
Buy Tableau
Standard
Show Me
Data
Analytics
EVIndia
Search
Tables
Acceleration
address
aux addres
Base Model
BodyStyle
Boot Space
Brand
Capacity
Car
Car_brand_india
Drive
Efficiency
FastChargeSpeed
Model
Name
PlugType
power
PowerTrain
Pages
Filters
Marks
Automatic
Color
Size
Text
Detail
Tooltip
CNTD(Car_bra..
Columns
Rows
Diff EV Brands
9
Data Source
rge Stations
Different cars
Top speed
Price of car
Top 10
Body count
No of models
Power train
Count of Brands
Diff EV Brands
Dashboard 1
Story Of EV Cars In India
1 mark
1 row by 1 column
SUM of CNTD(Car_brand_india): 9

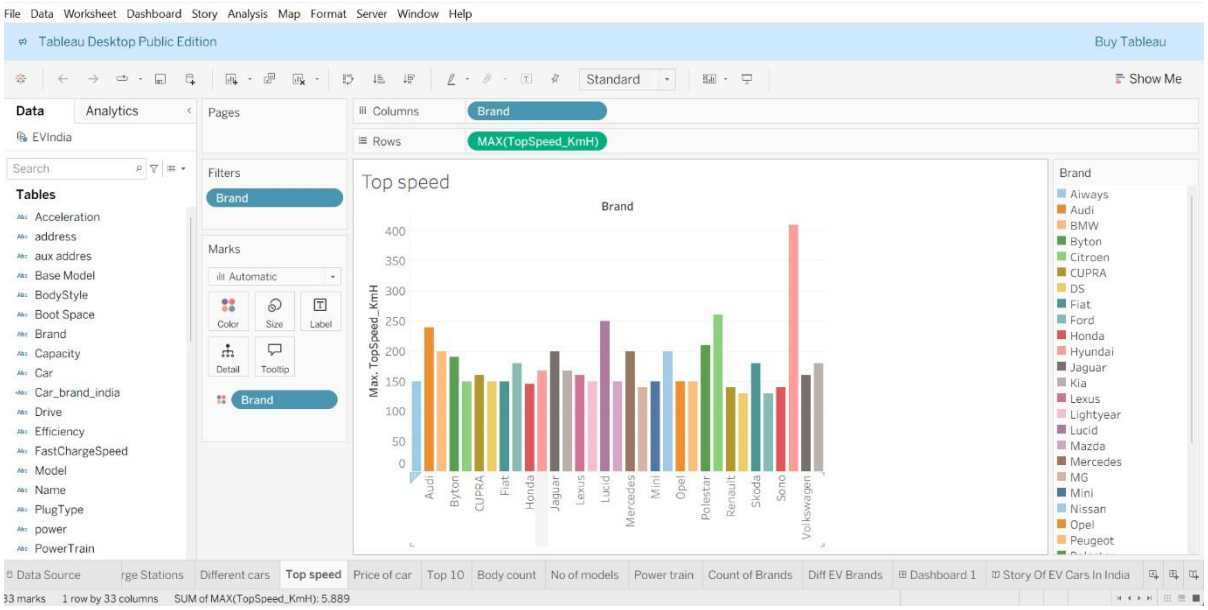

File Data Worksheet Dashboard Story Analysis Map Format Server Window Help
Tableau Desktop Public Edition
Buy Tableau
Standard
Show Me
Data
Analytics
EVIndia
Search
Tables
Acceleration
address
aux addres
Base Model
BodyStyle
Boot Space
Brand
Capacity
Car
Car_brand_india
Drive
Efficiency
FastChargeSpeed
Model
Name
PlugType
power
PowerTrain
Pages
Filters
Car
Marks
Automatic
Color
Size
Text
Detail
Tooltip
Car_brand_india
Columns
Model
Rows
Car_brand_india
Car
No of models
Car_brand_in..
Car
Model
Null
Audi
Audi E-Tron
Audi
Audi E-Tron GT
Audi
BMW
BMW iX
BMW
BYD
BYD E6
BYD
Hyundai
Hyundai Kona El..
Hyundai
Jaguar
Jaguar I-Pace
Jaguar
Mercedes-Benz
Mercedes-Benz ..
Mercedes-Benz
MG
MG ZS EV
MG
Porsche
Porsche Taycan
Porsche
Tata
Tata Nexon EV
Tata
Tata Nexon EV M..
Tata
Tata Tigor EV
Tata
Data Source
rge Stations
Different cars
Top speed
Price of car
Top 10
Body count
No of models
Power train
Count of Brands
Diff EV Brands
Dashboard 1
Story Of EV Cars In India
2 marks
12 rows by 1 column


File Data Worksheet Dashboard Story Analysis Map Format Server Window Help
Tableau Desktop Public Edition
Buy Tableau
Entire View
Show Me
Data
Analytics
EVIndia
Search
Tables
Acceleration
address
aux addres
Base Model
BodyStyle
Boot Space
Brand
Capacity
Car
Car_brand_india
Drive
Efficiency
FastChargeSpeed
Model
Name
PlugType
power
PowerTrain
Pages
Filters
PowerTrain
Drag dimensions or measures here.
Color
Size
Label
Detail
Tooltip
Angle
Brand
AGG(Count_po..
Brand
Columns
Rows
Power train
8
Volkswagen
1
Aiways
1
Citroen
6
Skoda
5
Renault
2
Fiat
4
Ford
1
Polestar
3
Hyundai
3
Mercedes
1
Lightyear
Brand
Aiways
Audi
BMW
Byton
Citroen
CUPRA
DS
Fiat
Ford
Honda
Hyundai
Jaguar
Kia
Lexus
Lightyear
Lucid
Mazda
Mercedes
MG
Mini
Nissan
Opel
Peugeot
Data Source
rge Stations
Different cars
Top speed
Price of car
Top 10
Body count
No of models
Power train
Count of Brands
Diff EV Brands
Dashboard 1
Story Of EV Cars In India
33 marks
1 row by 1 column
SUM of AGG(Count_powertrain): 103


File Data Worksheet Dashboard Story Analysis Map Format Server Window Help
Tableau Desktop Public Edition
Buy Tableau
Standard
Show Me
Data
Analytics
EVIndia
Search
Tables
Acceleration
address
aux addres
Base Model
BodyStyle
Boot Space
Brand
Capacity
Car
Car_brand_india
Drive
Efficiency
FastChargeSpeed
Model
Name
PlugType
power
PowerTrain
Pages
Filters
Car
Marks
Automatic
Color
Size
Label
Detail
Tooltip
Columns
Car
Rows
SUM(PriceRange(Lak..
Price of car
Car
PriceRange(Lakhs): S
180
160
140
120
100
80
60
40
20
0
Audi .. Audi .. BMW.. BYD .. Hyun.. Jagu.. Merc.. MG Z.. Porsc.. Tata .. Tata .. Tata ..
Car
Audi E-Tron
Audi E-Tron GT
BMW iX
BYD E6
Hyundai Kona Electric
Jaguar I-Pace
Mercedes-Benz EQC
MG ZS EV
Porsche Taycan
Tata Nexon EV
Tata Nexon EV Max
Tata Tigor EV
Data Source
rge Stations
Different cars
Top speed
Price of car
Top 10
Body count
No of models
Power train
Count of Brands
Diff EV Brands
Dashboard 1
Story Of EV Cars In India
12 marks
1 row by 12 columns
SUM(PriceRange(Lakhs)): 906.3


File Data Worksheet Dashboard Story Analysis Map Format Server Window Help
Tableau Desktop Public Edition
Buy Tableau
Standard
Show Me
Data
Analytics
EVIndia
Search
Tables
Acceleration
address
aux addres
Base Model
BodyStyle
Boot Space
Brand
Capacity
Car
Car_brand_india
Drive
Efficiency
FastChargeSpeed
Model
Name
PlugType
power
PowerTrain
Pages
Filters
Marks
Automatic
Color
Size
Text
Detail
Tooltip
CNTD(Brand)
Columns
Rows
Drag dimensions or measures here or double-click to start a new calculation.
Count of Brands
33
Data Source
rge Stations
Different cars
Top speed
Price of car
Top 10
Body count
No of models
Power train
Count of Brands
Diff EV Brands
Dashboard 1
Story Of EV Cars In India
1 mark
1 row by 1 column
SUM of CNTD(Brand): 33


File Data Worksheet Dashboard Story Analysis Map Format Server Window Help
Tableau Desktop Public Edition
Buy Tableau
Standard
Show Me
Data
Analytics
EVIndia
Search
Tables
Acceleration
address
aux addres
Base Model
BodyStyle
Boot Space
Brand
Capacity
Car
Car_brand_india
Drive
Efficiency
FastChargeSpeed
Model
Name
PlugType
power
PowerTrain
Pages
Filters
Brand
Marks
Automatic
Color
Size
Label
Detail
Tooltip
Brand
Columns
Brand
Rows
MAX(Efficiency_WhK..
Top 10
Brand
Max. Efficiency_WhKm
250
200
150
100
50
0
Merc.. Audi Tesla Byton Nissan Jaguar Porsc.. Ford BMW Volvo
Brand
Audi
BMW
Byton
Ford
Jaguar
Mercedes
Nissan
Porsche
Tesla
Volvo
Data Source
rge Stations
Different cars
Top speed
Price of car
Top 10
Body count
No of models
Power train
Count of Brands
Diff EV Brands
Dashboard 1
Story Of EV Cars In India
10 marks
1 row by 10 columns
SUM of MAX(Efficiency_WhKm): 2.356



8. ADVANTAGES & DISADVANTAGES

Advantages:

- Improved Decision-Making:
  Users can make informed decisions about charging behavior and travel planning using visual insights.

- User-Friendly Interface**:**
  The dashboards are simple, interactive, and easy to understand, even for non-technical users.

- Time Efficiency:
  Instead of analyzing raw data, users can quickly interpret trends and patterns from the visualizations.

- Customizable Analysis:
  Filters and views allow users to focus on specific vehicles, time periods, or conditions (e.g., temperature).

Disadvantages:

- Static Data Dependency:
  The tool relies on pre-collected datasets and does not support real-time data updates.
- Limited Interactivity Outside Tableau:
  The dashboards are best viewed within Tableau; exporting to other formats may reduce interactivity.
- No Predictive Analytics:
  The current version focuses on historical and descriptive analysis without predictive modeling.
- Requires Tableau Knowledge:
  Users may need basic familiarity with Tableau to navigate or customize the dashboards effectively.

9.CONCLUSION

This project successfully developed a visualization tool to analyze electric vehicle (EV) charge and range data using Tableau. The dashboards provide clear insights into charging behavior, driving range patterns, and usage trends, enabling users to better understand and manage their EV performance. The interactive visualizations help simplify complex data and support data-driven decision-making for EV owners, manufacturers, and analysts. Overall, the project demonstrates the value of data visualization in addressing key challenges in electric mobility

10.FUTURE SCOPE

• Real-Time Data Integration:
Future versions of the tool can integrate real-time EV telemetry data to provide live updates on charge levels and range.

• Predictive Analytics:
Implementing machine learning models can help predict range based on driving habits, terrain, and weather conditions.

• Mobile Accessibility:
Creating a mobile-friendly version or app will allow users to access insights on the go.

• Charging Station Mapping:
Adding location-based data to visualize nearby charging stations and estimated wait times.

• Battery Health Analysis:
Future enhancements can include monitoring long-term battery degradation trends and alerts.

• Multi-Brand Comparison:
Expanding the dataset to include multiple EV brands for broader comparison and benchmarking.

11.APPENDIX

Source Code(if any)

Dataset Link:

https://drive.google.com/drive/

folders/1Rkzdks6Us1Uq2SRB

4nxMAb83jN5bpHll

GitHub & Project Demo Link:
https://github.com/upendrasanagala/Visualization-Tool-for-Electric-Vehicle-Charge-and-RangeAnalysis

Tableau public link:
https://public.tableau.com/views/EVchargestations/Chargestations?:language=en-US&:sid=&:redirect=auth&:display_count=n&:origin=viz_share_link