Data Analytics for the EV Market and Performance Analysis

Created by

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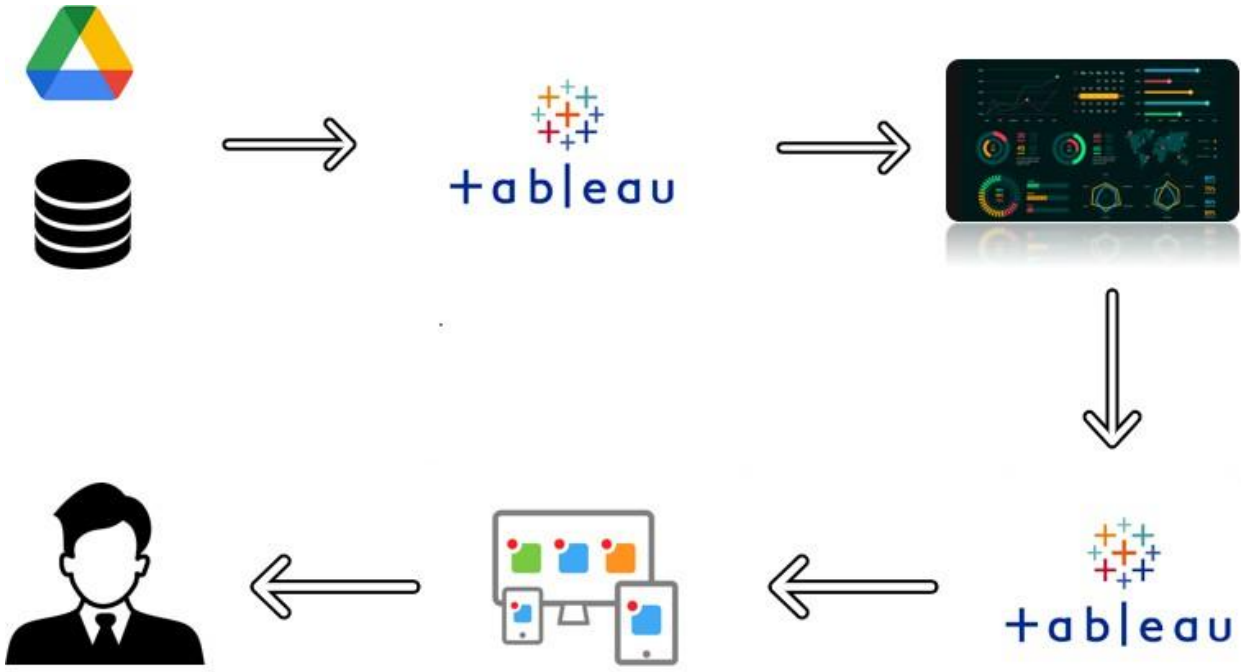
VISUALIZATION TOOL FOR ELECTRIC VEHICLE CHARGE AND RANGE ANALYSIS

INTRODUCTION

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. Today the transport sector stands for roughly 60% of the global consumption (IEA, 2010), and is attributable for roughly 20-25% of all CO2 emissions (EEA, 2011; IEA, 2009). A wide adaption of electric vehicles (EVs) could significantly lower the CO2 emissions (Reiner et al., 2010). A market that is therefore of great interest is the electric vehicle charging station (EVCS) market, it is growing at a rapid pace and there are as of today many different actors that are struggling to capture market segments (Pike Research 2011a), and gain customer loyalty. The current competitive situation for this market is not well defined within the company and therefore it is important to perform a competitor analysis to define the competitive situation (Porter, 2008)

TECHINICAL ARCHITECTURE:



2 OVERVIEW OF THE PROJECT

This report presents the findings from a competitor analysis involving competitor identification, understanding the competitors' target customers, how they do business, and an assessment of competitors' marketing material. This analysis of the competitive situation in the EVCS market is done in order to enhance the knowledge of possible competitors and their offers to the rapidly growing EVCS market. A brief market analysis is also performed to assess the potential of the EVCS market along with related market drivers and restraints, this to show the opportunities that the market present.

3 PURPOSE

The main purpose of this project is to conduct a competitor analysis within the area of electric vehicle charging stations (EVCS) to increase the existing knowledge of possible competitors and their offers to the market. Prior to performing the competitor analysis a basic market analysis will be performed to assess the EVCS market. The research questions have been developed in cooperation with a company that has an interest in the EVCS market, and these questions are thus based on this company's interests concerning the EVCS market and its competitors.

4 PROJECT OBJECTION

The main objectives of this project are as follows:

i. To analyze electric vehicle pricing and performance characteristics
ii. To study brand-wise distribution of electric vehicles
iii. To analyze charging station availability by region and charger type
iv. To develop interactive dashboards and stories using Tableau
v. To support informed decision-making through visual analytics

5 PROJECT FLOW

The project follows a systematic and structured workflow beginning with data collection and ending with dashboard deployment. Initially, datasets related to electric vehicles and charging infrastructure were collected from multiple sources.

The collected datasets were examined to understand their structure, attributes, and data quality. After cleaning and preprocessing, the datasets were imported into Tableau Desktop for analysis. Visualizations were created based on defined business questions, followed by dashboard and story development.

6 DATASET DECRIPTION

Four different datasets were used in this project to ensure comprehensive analysis of the EV ecosystem.

The EV India dataset provides information about electric vehicles available in India, including pricing, vehicle type, transmission, and capacity. This dataset helps analyze the Indian EV market.

The Electric Vehicle Charging Station dataset contains information about charging stations, such as region, charger type, power capacity, and service availability. This dataset helps assess infrastructure readiness.

The Electric Car Data Clean dataset includes global EV performance metrics such as acceleration, top speed, range, and efficiency. The Cheapest Electric Cars dataset focuses on affordability and pricing trends.

7 DATA UNDERSTANDING AND PREPARATION

Understanding the data is a critical step in any analytics project. Each dataset was explored to identify data types, missing values, inconsistencies, and duplicates.

Data preprocessing included removing null values, standardizing units such as price and speed, and ensuring consistency across datasets. Clean data ensured reliable and accurate analysis.

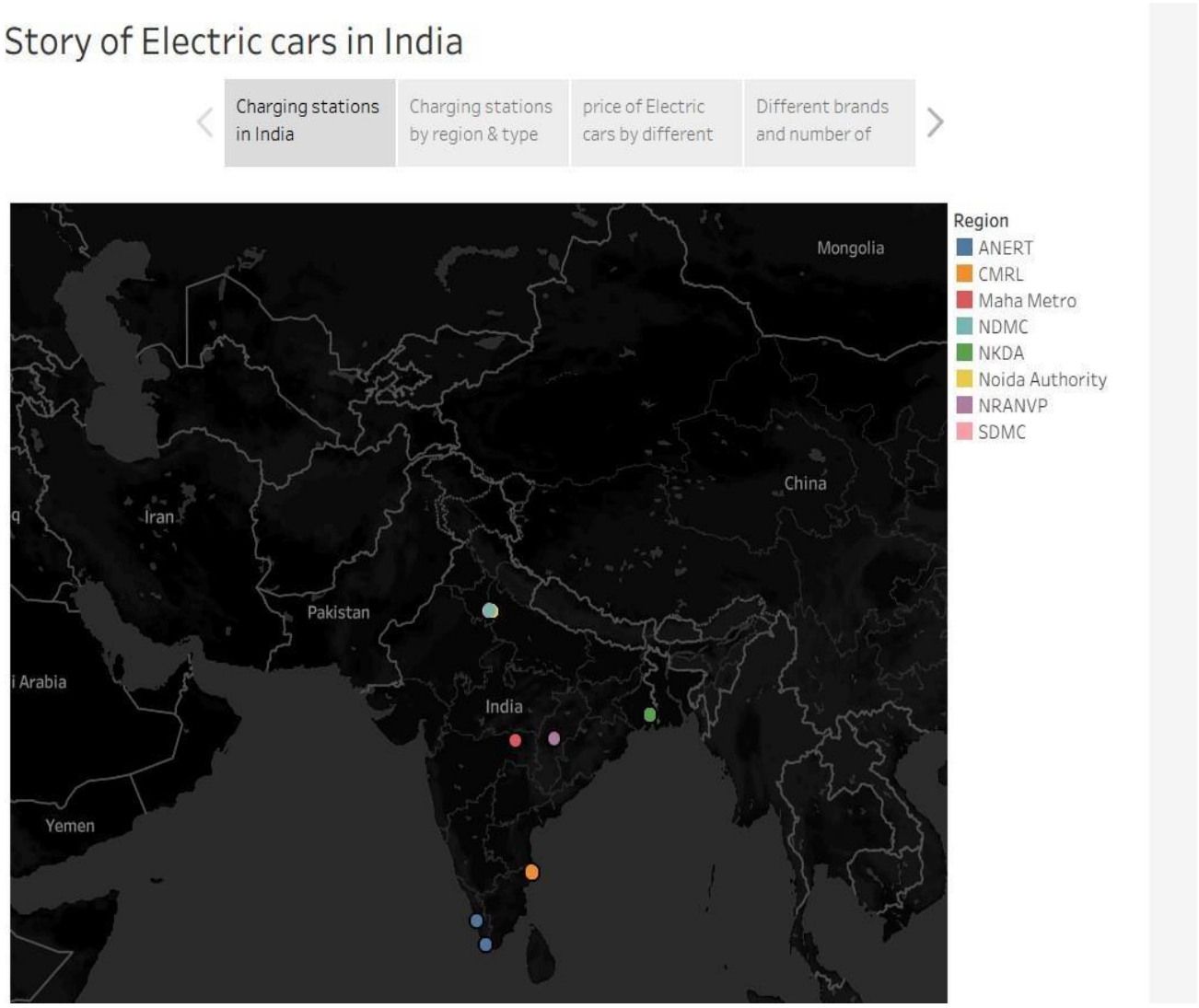
8 TOOLS AND TECHNOLOGIES USED

The project utilized a combination of analytical, visualization, and development tools. Tableau Desktop was used to create visualizations and dashboards, while Tableau Public was used for publishing.

CSV files served as the primary data storage format. HTML, CSS, and Bootstrap were used to integrate the dashboards into a web application. Microsoft Word was used for documentation

9 Data Visualization and Analysis

EV Charging Stations Map of India



EV Charging Stations Map of India

In this chart we plot the Charging Stations of India on the map. We also show that address, power & in which region the charging stations belongs to . It is clear that in North Delhi there are many Charging Stations

Data Visualization and Analysis

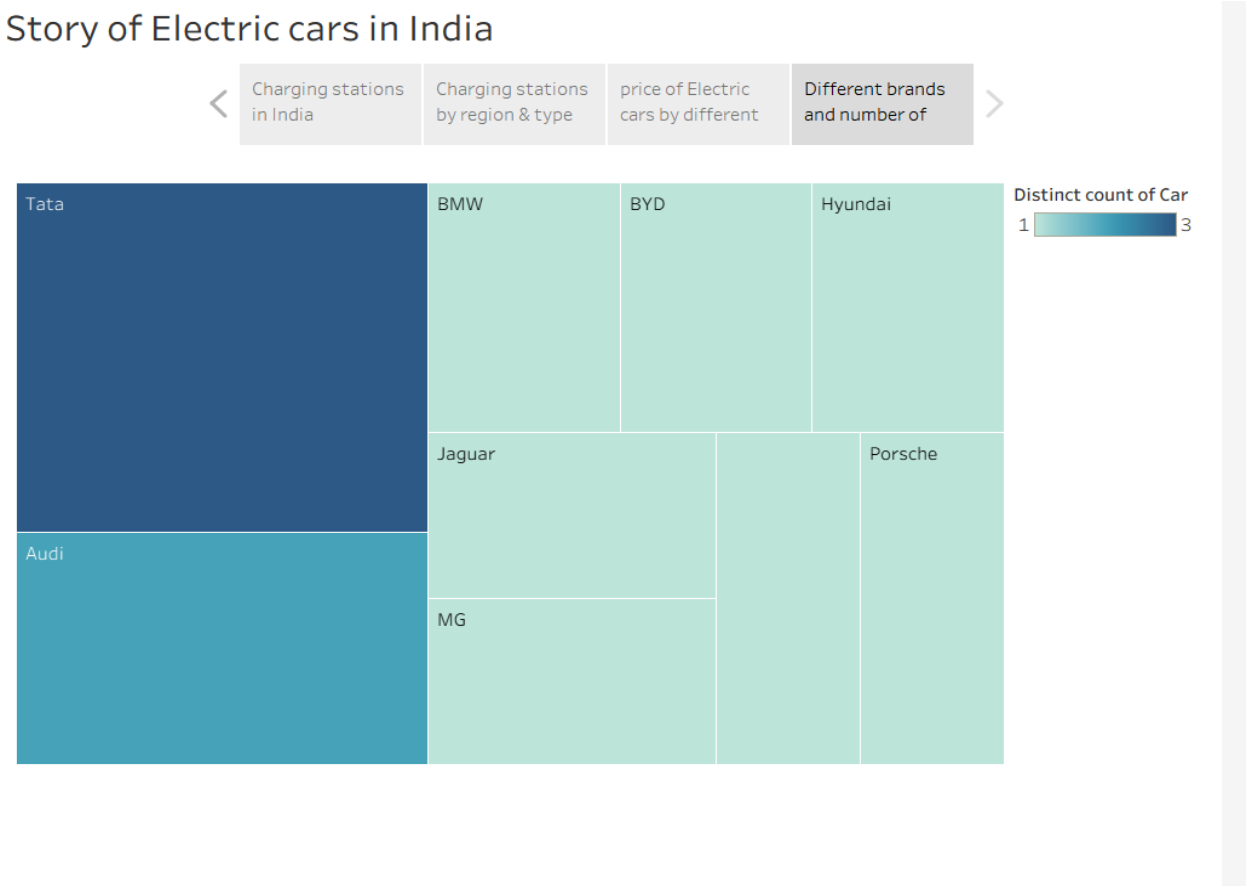


Figure 1: Different Brands and Number of Electric Cars in India

Business Insight: Tata Motors has the highest number of electric vehicle models in India, demonstrating its strong focus on affordable and mass-market EVs.

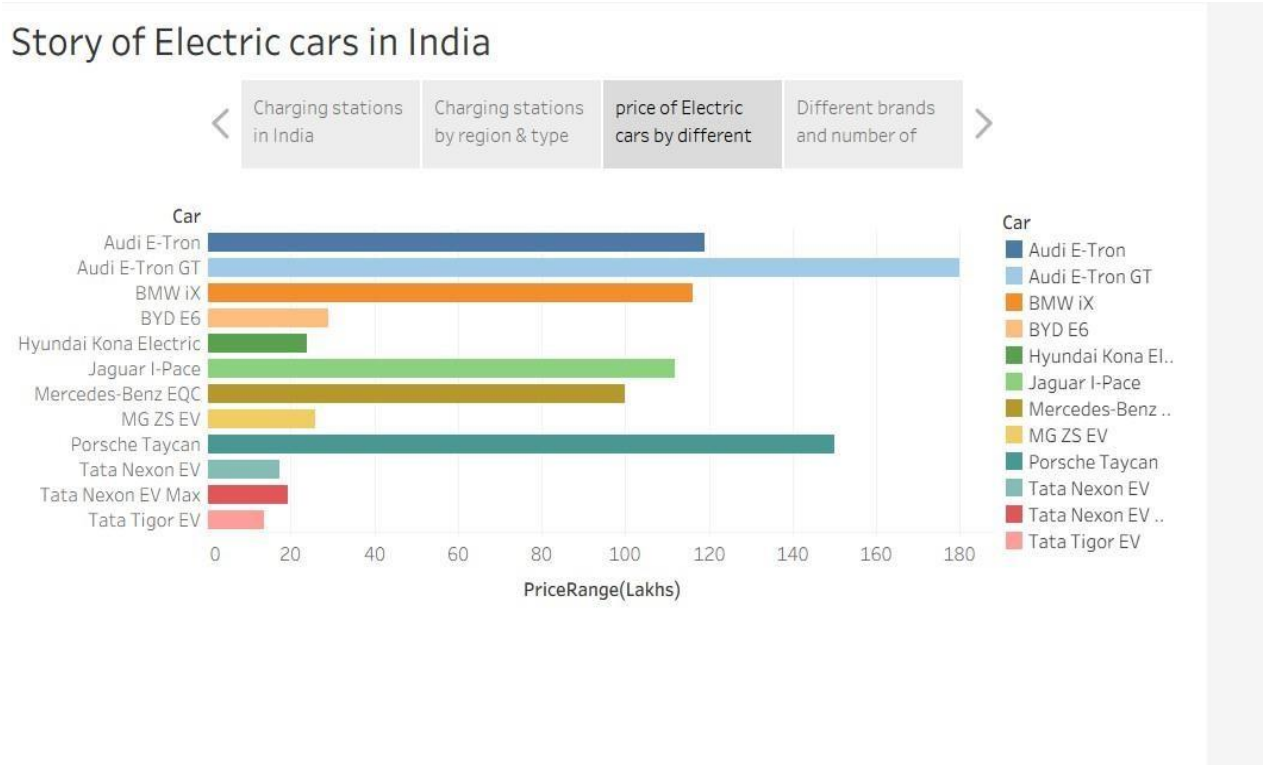
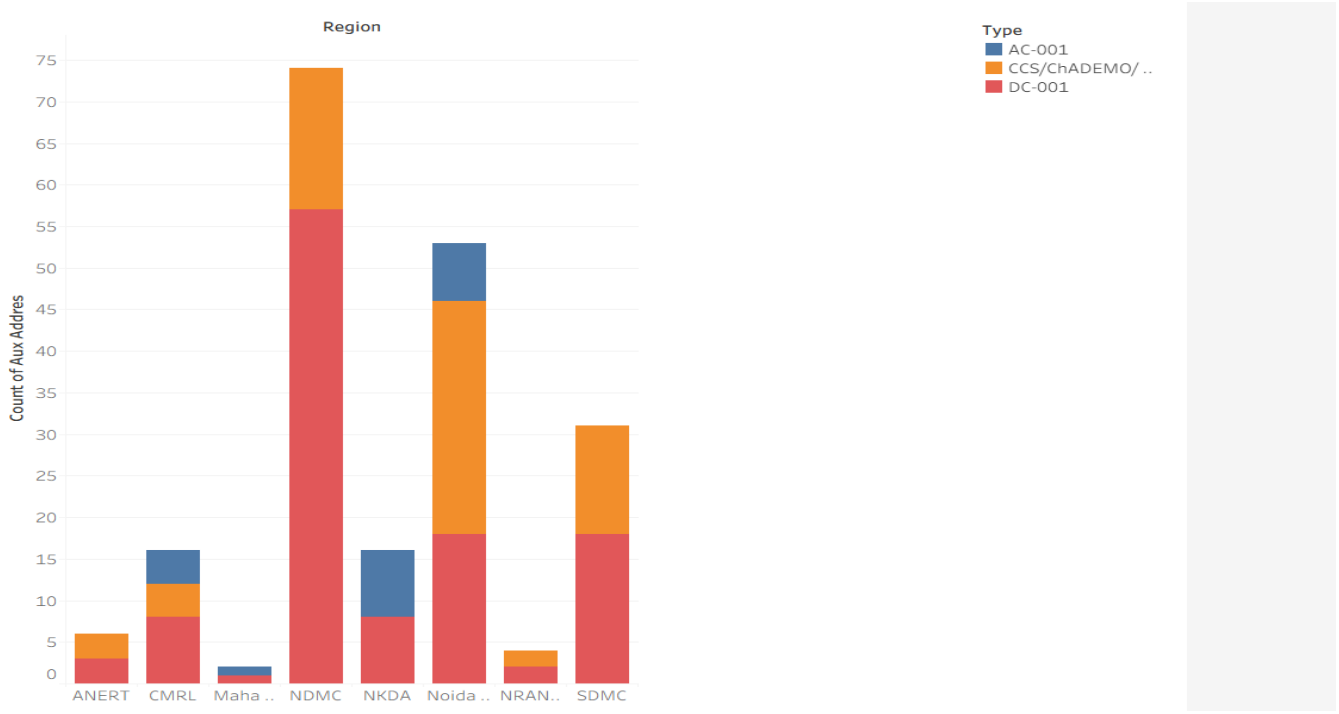
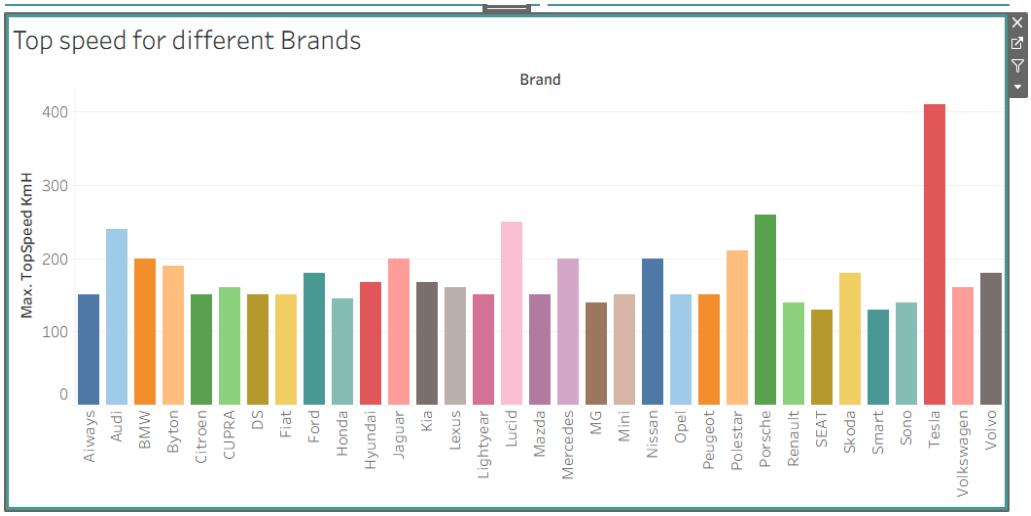


Figure 2: Price of Electric Cars by Different Brands

Business Insight: Premium brands such as Audi, BMW, and Porsche target the luxury EV segment, while Indian brands focus on budget-friendly options.

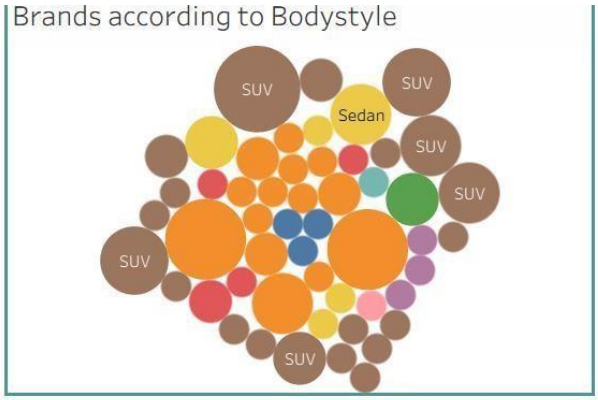


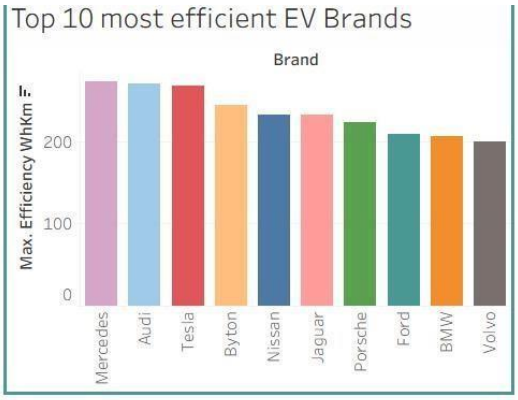
Top Speed for Different Brands



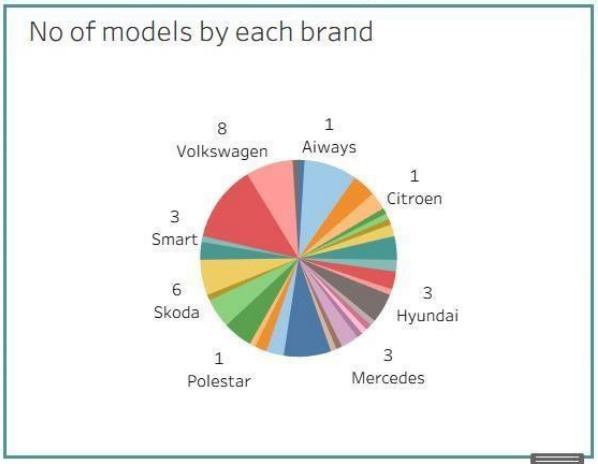
DASHBOARD

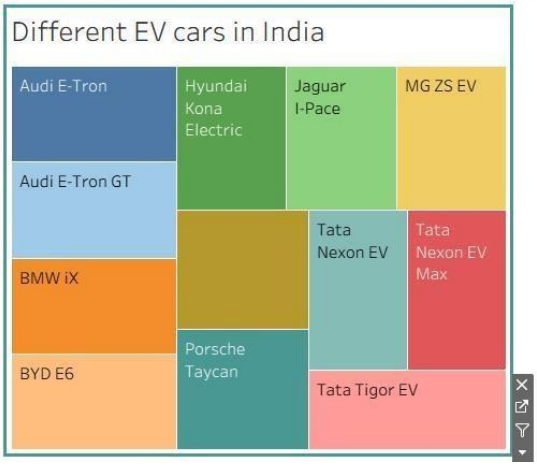

Electric Cars Analytic Dashboard
Different brands of EV Cars globally
33
Different brands of EV Cars in India
9
85%
Body Style
Cabrio
Hatchback
Liftback
MPV
Pickup
Sedan
SPV
Station
SUV
Brand
Audi
BMW
Byton
Ford
Jaguar
Mercedes
Nissan
Porsche
Tesla
Volvo
Car
Audi E-Tron
Audi E-Tron GT
BMW iX


Brands according to Bodystyle
SUV
SUV
Sedan
SUV
SUV
SUV
SUV


Top 10 most efficient EV Brands
Brand
Max. Efficiency WhKm
200
100
0
Mercedes
Audi
Tesla
Byton
Nissan
Jaguar
Porsche
Ford
BMW
Volvo

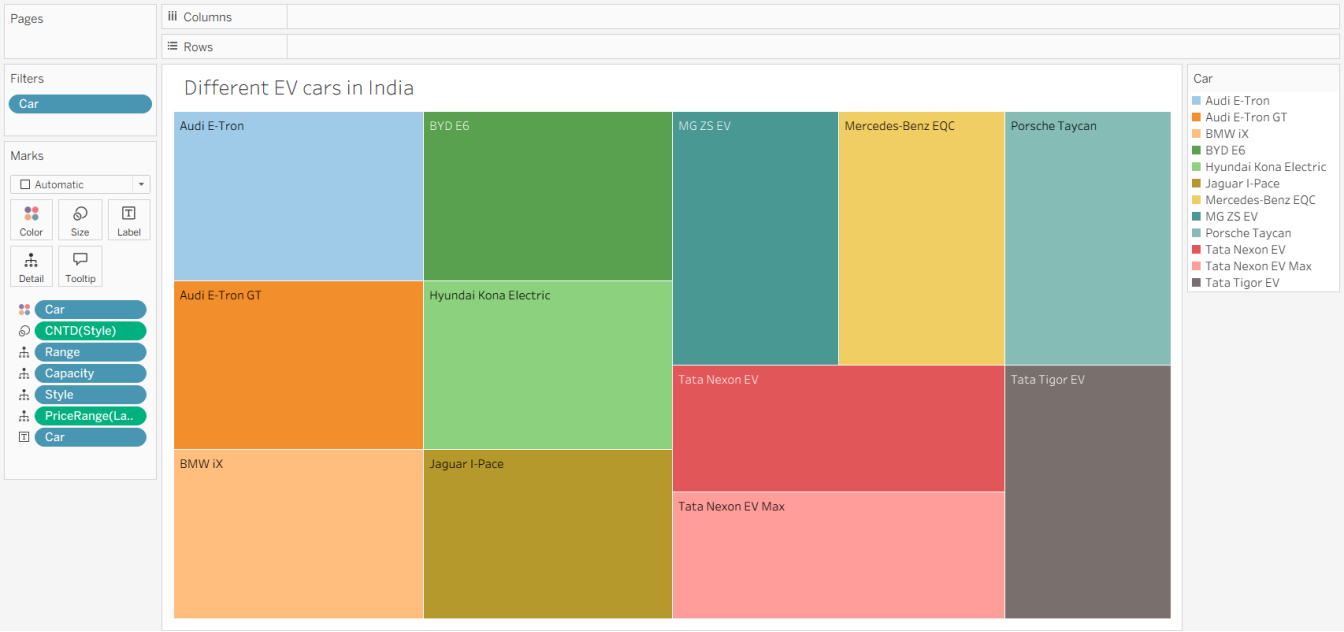

Hyundai Kona El..
Jaguar I-Pace
Mercedes-Benz ..
MG ZS EV
Porsche Taycan
Tata Nexon EV
Tata Nexon EV ..
Tata Tigor EV


No of models by each brand
8
Volkswagen
1
Aiways
1
Citroen
3
Smart
6
Skoda
3
Hyundai
1
Polestar
3
Mercedes


Different EV cars in India
Audi E-Tron
Hyundai Kona Electric
Jaguar I-Pace
MG ZS EV
Audi E-Tron GT
Tata Nexon EV
Tata Nexon EV Max
BMW iX
Porsche Taycan
BYD E6
Tata Tigor EV

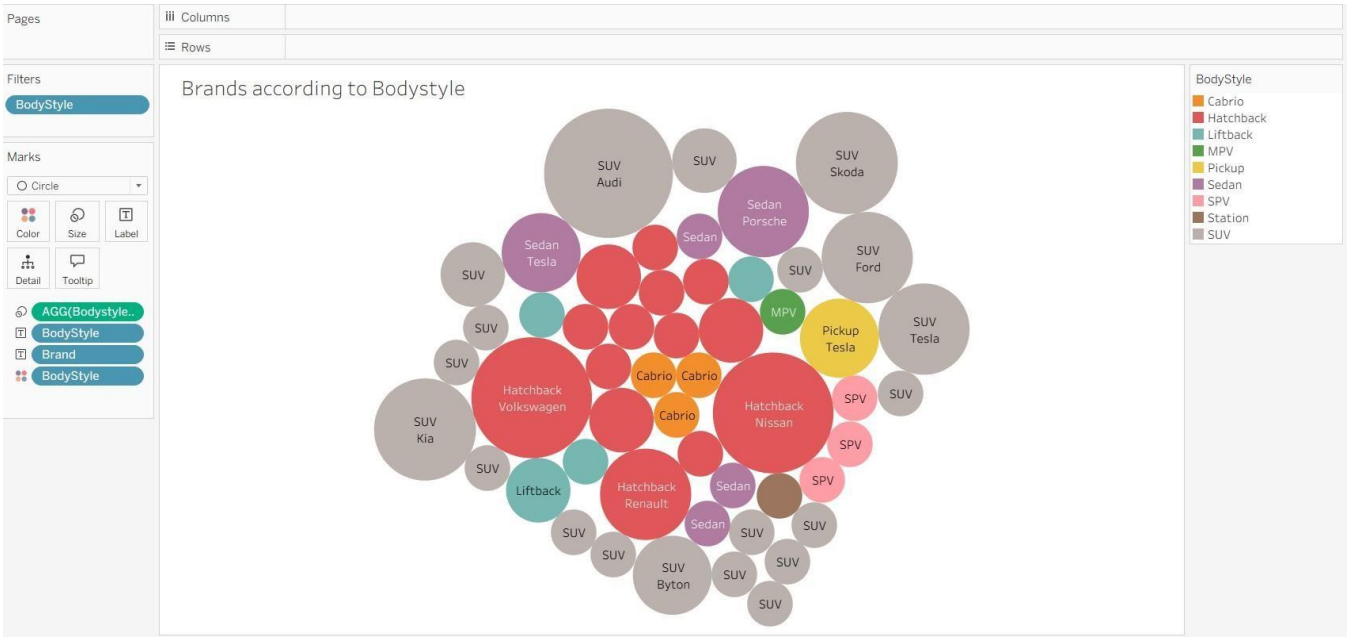
PRICE FOR DIFFERENT CARS IN INDIA

DIFFERENT EV CARS IN INDIA



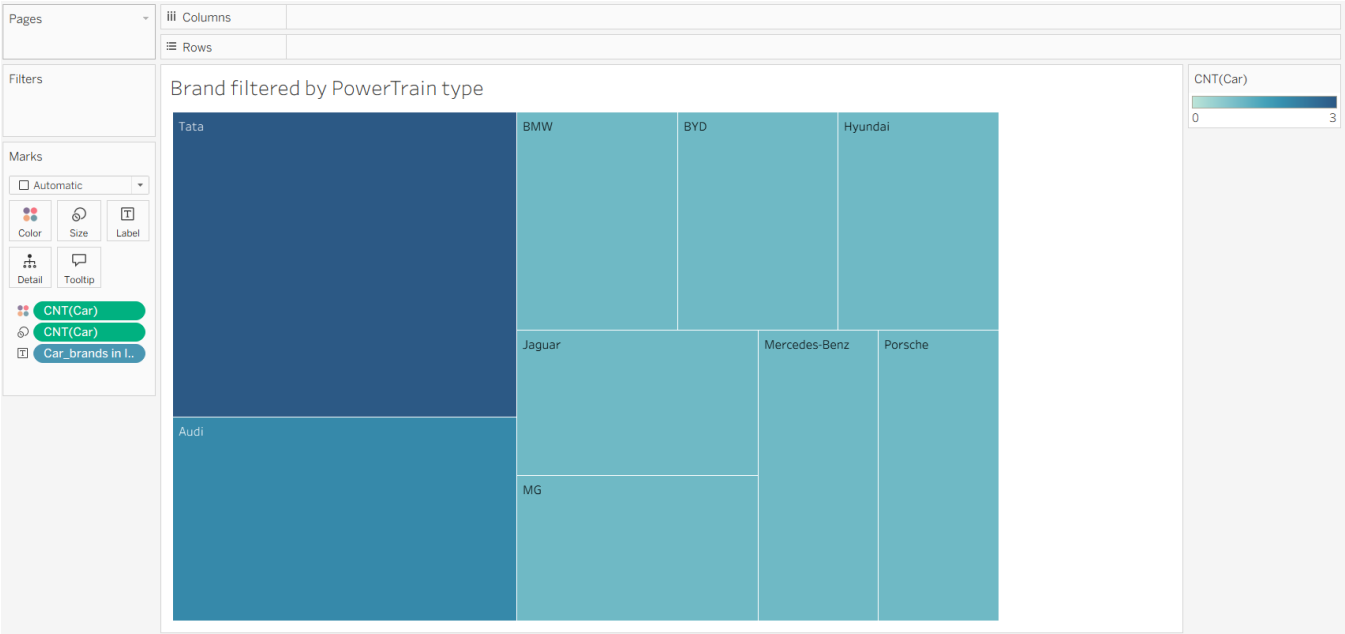
BRANDS ACCORDING TO BODYSTYLE

In this chart we count the body style for different brand, for that we create the calculation field to count bodystyle then we create a bubble chart , the size of the bubbles is according to the bodystyle



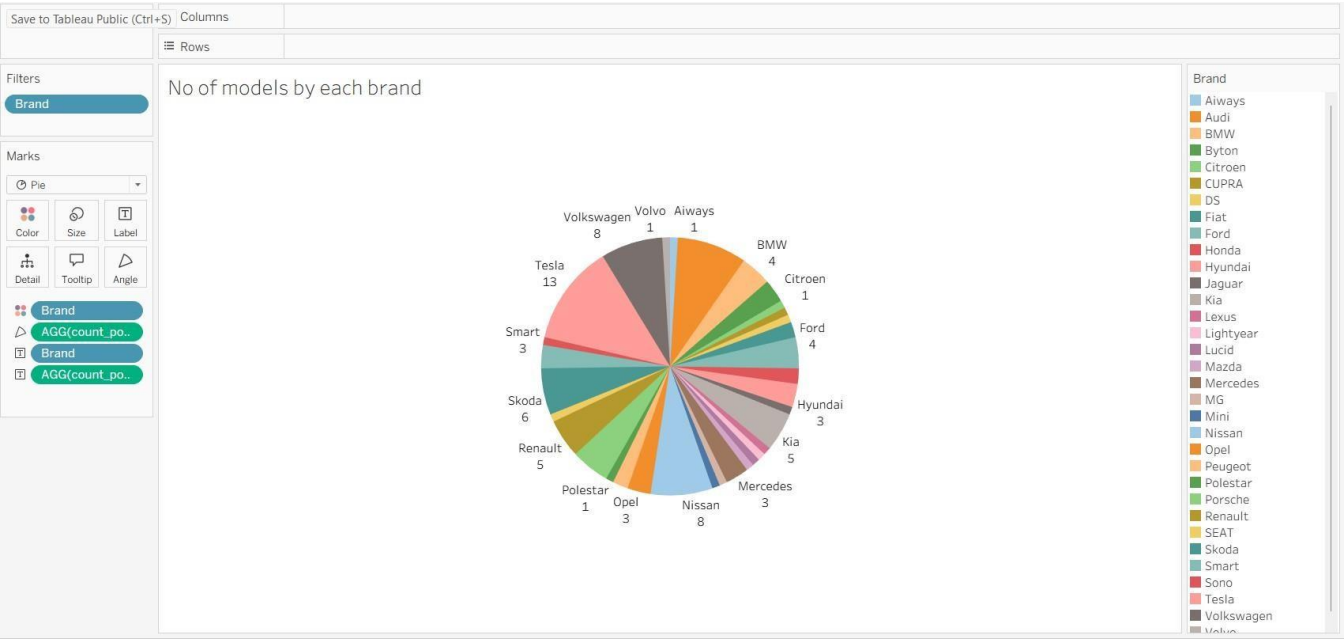
TOP 10 MOST EFFICENT EV BRANDS

BRAND FILTERED BT POWERTRAIN TYPE

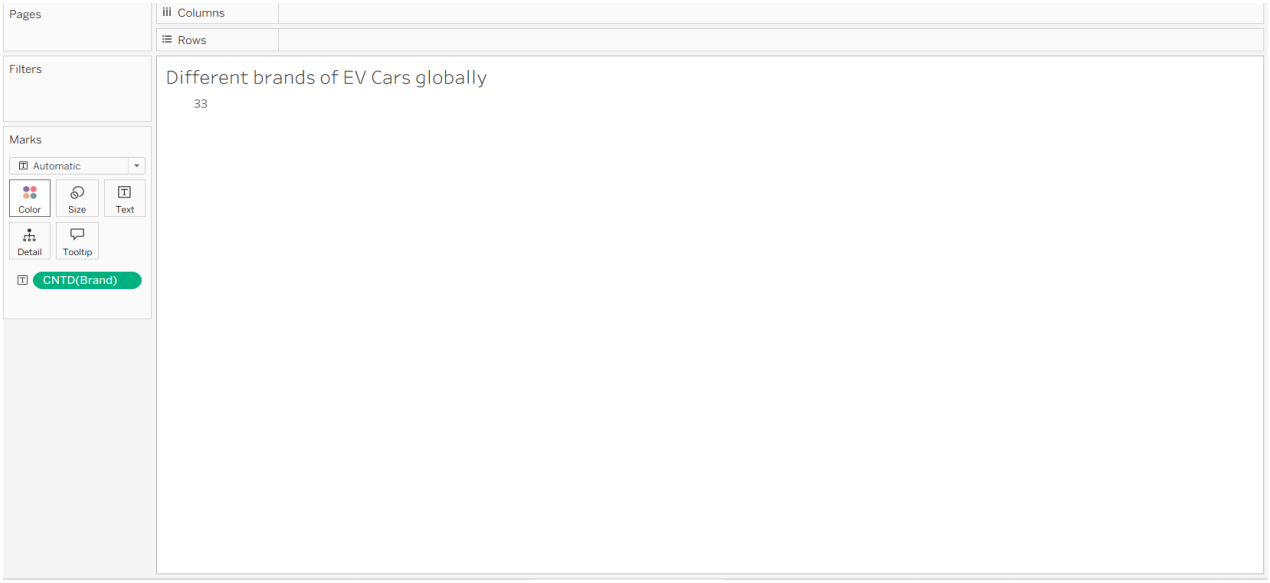


No of Models by each brand

In this chart, we create the calculation field to have a count of power train and filter the brand according to Power train type and we create the Pie Chart. The below Pie Chart shows the No of models by each brand

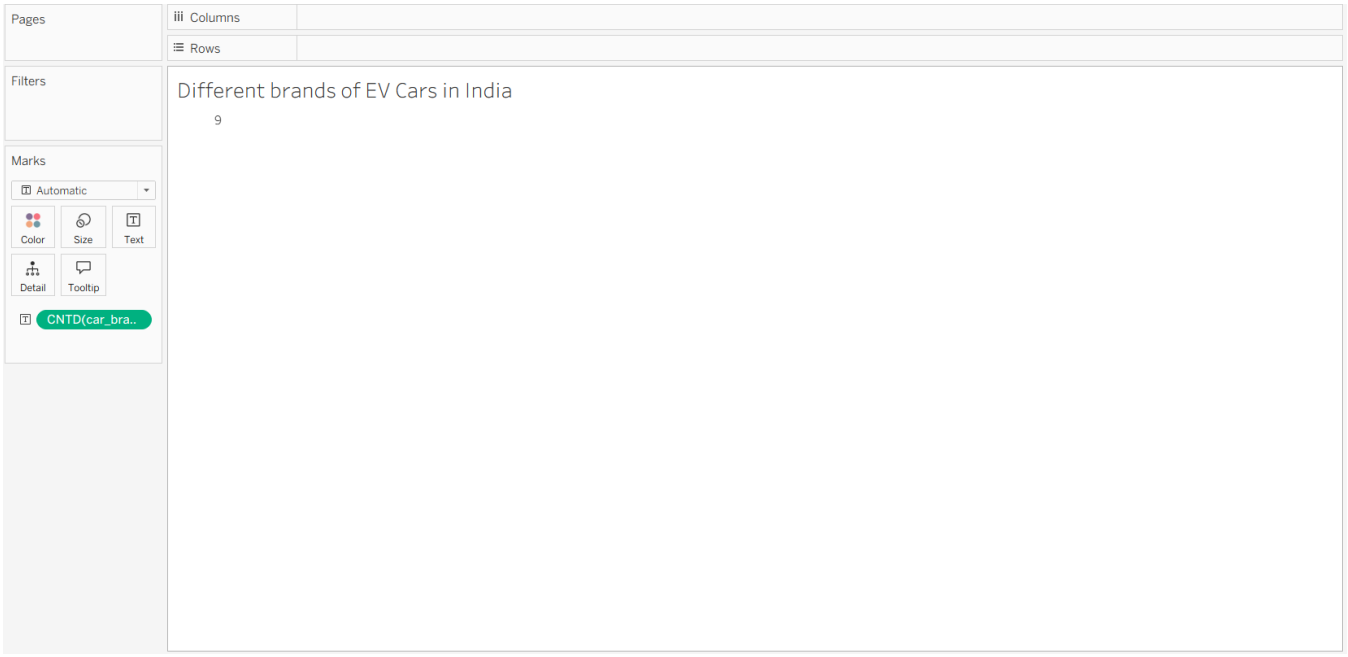


SUMMARY CARD FOR DIFFERENT BRANDS OF EV CARS GLOBALLY



The above visualization chart shows that, there are 33 different brands of Electric Cars are in Globally

Summary card for different brands of EV Cars in India

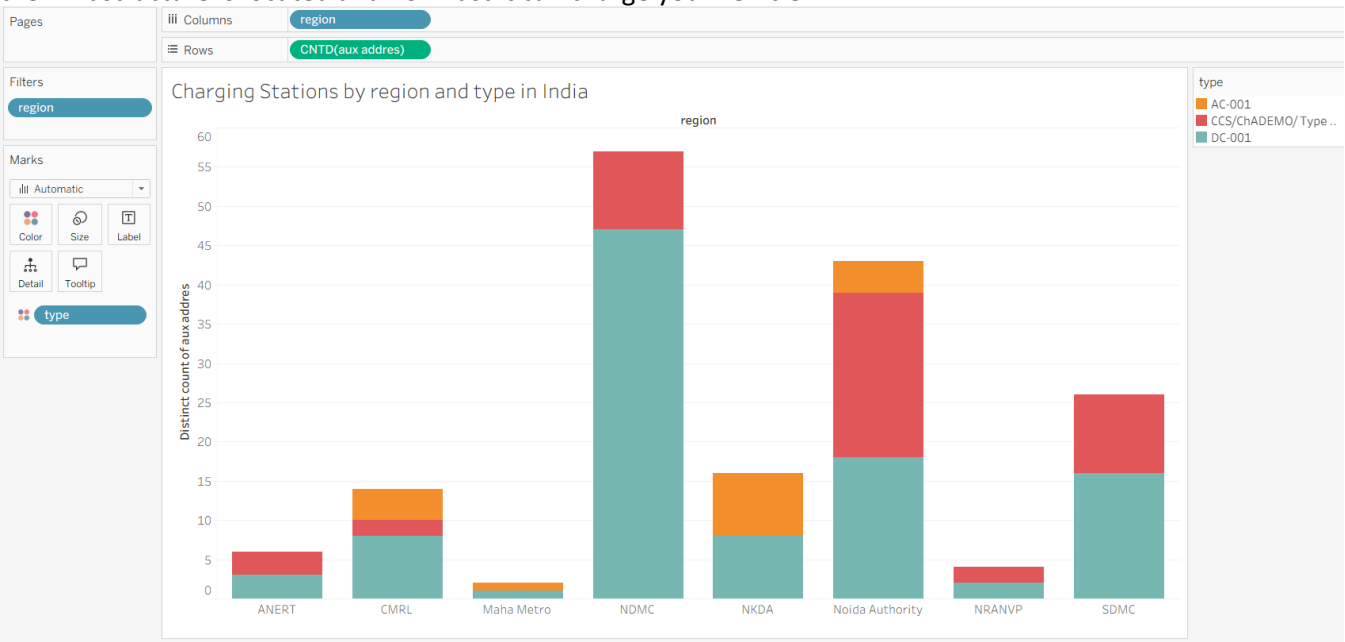


APPLICATIONS

- Consumer Electronics
- Public Transportation
- Aviation
- Renewable Energy Storage
- Military
- Spaceflight
- Wearable Technology

CHARGING STATIONS BT REGION AND TYPE IN INDIA

Charging Stations by Region and Type represents the "Backbone" of the EV ecosystem in India. It shows where the infrastructure is located and how fast it can charge your vehicle.



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ADVANTAGES AND DISADVANTAGES ADVANTAGES

- Eco-friendly : Because electric vehicles do not utilize fuel for combustion, there are no emissions or gas exhaust.
- Renewable Energy Source: Electric Vehicles run on renewable power
- Less noise & smoother motion: Driving an electric car is significantly smoother
- Cost Effective
- Low maintenance
- Government Support

DISADVANTAGES

- High Initial Cost: Electric Vehicles continue to be quite expensive
- Charging station limitations
- Recharging takes time
- Limited Option: there are not many electric car models to pick from in terms of appearance,
- Lack of standardization across EV models and brands
- Limited availability of real-world EV data
- Lack of real-time charging and usage data
- Battery performance degradation over time
- Variation between actual range and estimated range
- Dependence on assumptions in analysis
- Uneven distribution of charging infrastructure
- Inconsistent data from multiple sources

ADVANTAGES AND DISADVANTAGES CONCLUSION:

Although electric vehicle manufacturers must solve the hurdles that are currently preventing People from purchasing, the future is clear EVs will outlast gas-powered automobiles in the long run.

Both GM and Nissan declared in January 2021 that they will go all-electric by the 2030s. Other Automakers will undoutdly follow suit

FUTURE SCOPE:

The future Scope of Electric Vehicle is therefore enormous. We have already seen that Technology for these vehicles is here and becoming for more advanced. We now know that such vehicles Can provide us with great flexibility and we will soon see that potential. It will also be interesting to see the impact of regulations which will come into force from the EU and US. These regulations are seen to reduce their use petrol engine vehicles use. As electric vehicles grow in popularity, so will the need to reduce their use. It is clear that there will be a need to develop new zero emission technologies. India is the world's third-largest EV market. This competitive market which grew by 23% in 2022, is set to transform the Indian automative sector in 2023. During the union budget for the fiscal year 2023-2024, the FinanceMinister allocated Rs 35,000 crore to achieve net-zero carbon emission by 2070.

Templates:

Ideation Phase
Define the Problem Statements

Date	31 January 2026
Team ID	LTVIP2026TMIDS90945
Project Name	Visualizations tools of ev charge and range Analysis
Maximum Marks	2 Marks

Customer Problem Statement Template:

Create a problem statement to understand your customer's point of view. The Customer Problem Statement template helps you focus on what matters to create experiences people will love.

A well-articulated customer problem statement allows you and your team to find the ideal solution for the challenges your customers face. Throughout the process, you'll also be able to empathize with your customers, which helps you better understand how they perceive your product or service.

I am	Describe customer with 3-4 key characteristics - *who are they?*	Describe the customer and their attributes here
I'm trying to	*List their outcome or "job" the care about - what are they trying to achieve?*	List the thing they are trying to achieve here
but	Describe what problems or barriers stand in the way – *what bothers them most?*	Describe the problems or barriers that get in the way here
because	Enter the "root cause" of why the problem or barrier exists – *what needs to be solved?*	Describe the reason the problems or barriers exist
which makes me feel	Describe the emotions from the customer's point of view – *how does it impact them emotionally?*	Describe the emotions the result from experiencing the problems or barriers

Example:

Example:

Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	EV Buyer	Choose the best EV model	I cannot compare easily	The data is scattered across many sources	Confused and unsure
PS-2	EV Manufacturer	Analyze EV market performance	I dont get clear insights	The dataset is large and unorganized	Frustrated and stressed

Empathize & Discover:

Date	**31 January 2026**
Team ID	**LTVIP2026TMIDS90945**
Project Name	**Visualizations tools of ev charge and range analysis**
Maximum Marks	**4 Marks**

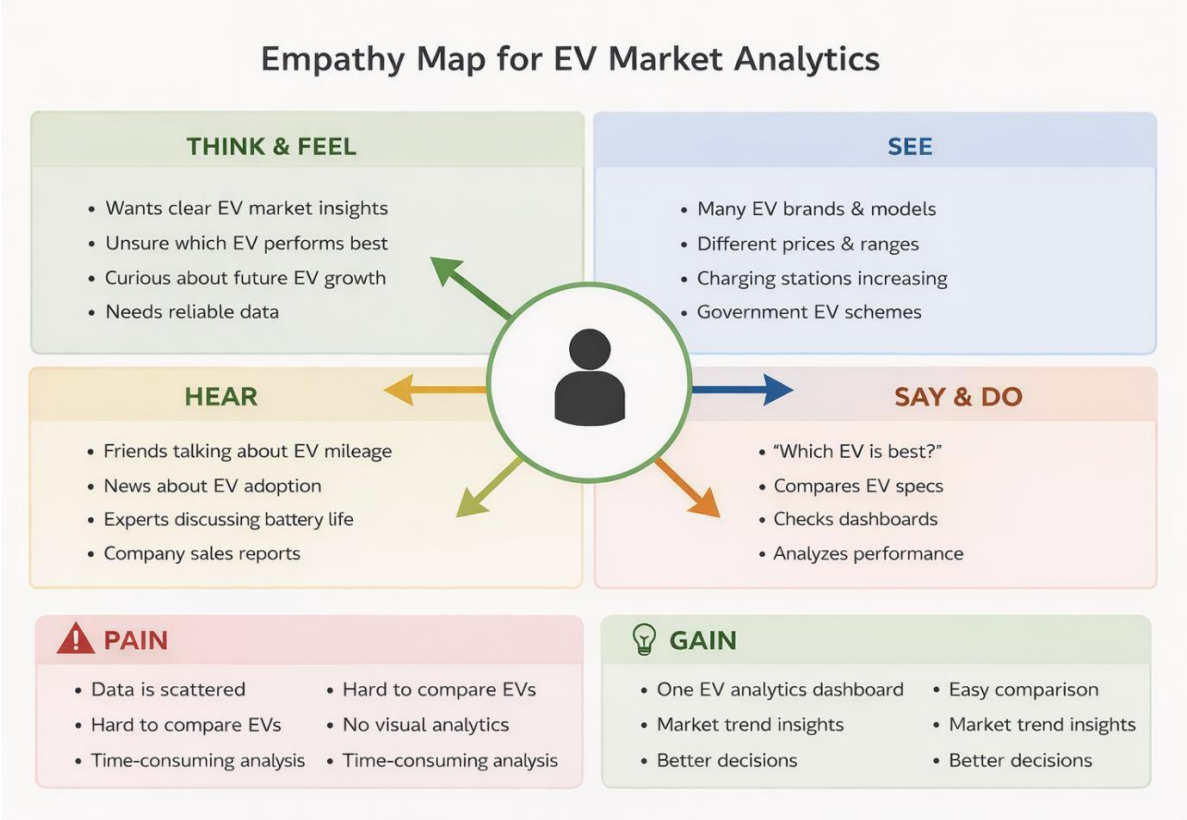
Empathy Map Canvas:

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviours and attitudes.

It is a useful tool to helps teams better understand their users.

Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.

Example:



Brainstorm & Idea Prioritization Template

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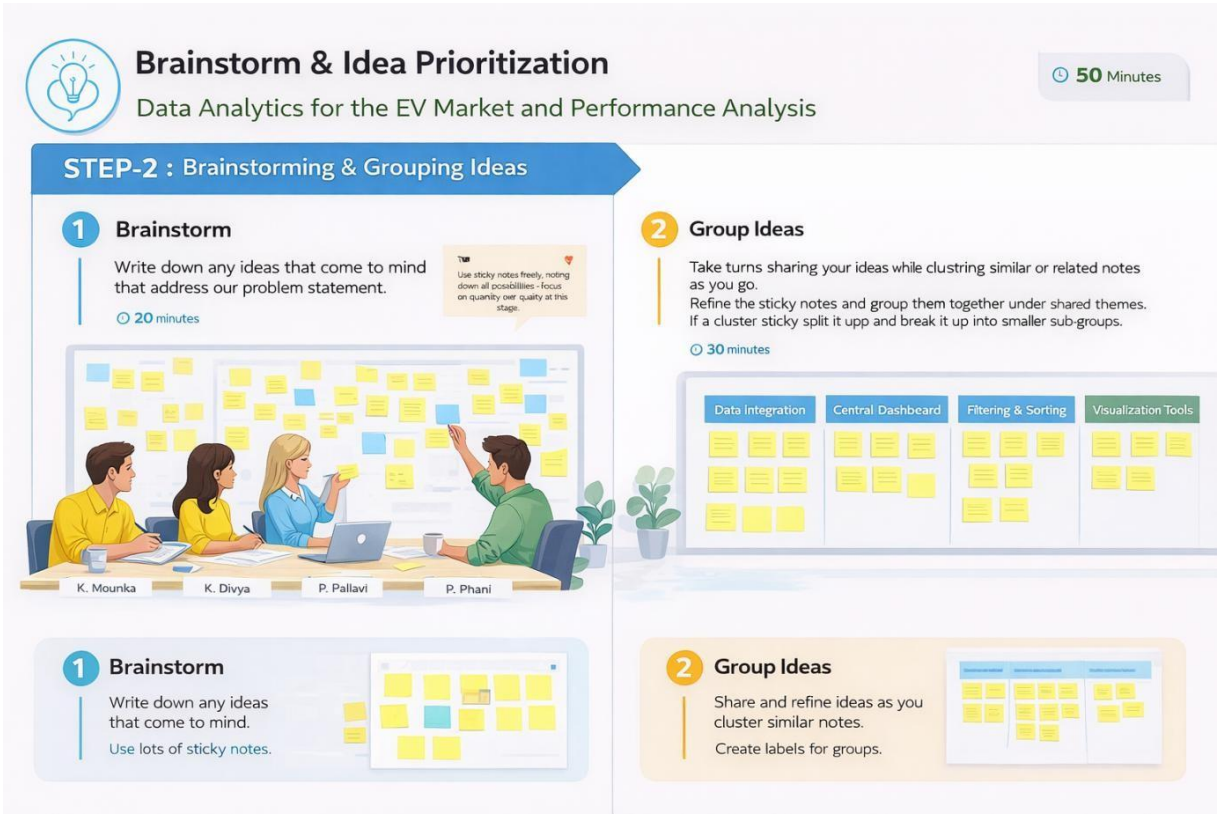
Maximum Marks	4 Marks

Brainstorm & Idea Prioritization Template: Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich amount of creative solutions.

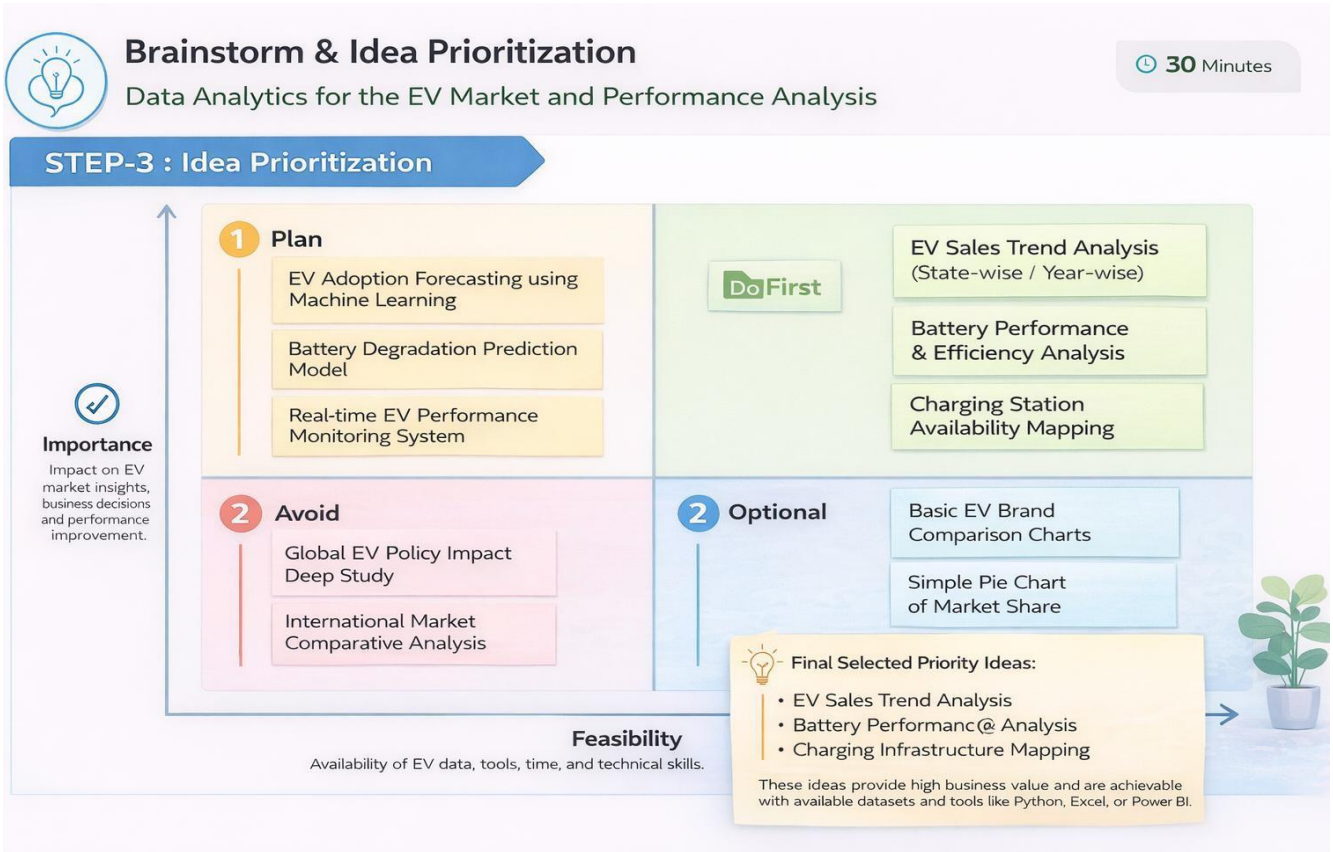
Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

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

Step-2: Brainstorm, Idea Listing and Grouping



Step-3: Idea Prioritization



Project Design Phase-II

Solution Requirements (Functional & Non-functional)

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Maximum Marks	4 Marks

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 through Gmail Registration through LinkedIN
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	User Login	Login using email and password Secure session management
FR-4	EV Data Management	Upload EV sales datasets Upload battery performance data Upload charging infrastructure data
FR-5	Data Analysis	EV sales trend analysis Battery performance analysis Charging station availability analysis
FR-6	Dashboard & Reports	Interactive dashboards Downloadable analytics reports (PDF/CSV)
FR-7	User Management	View and manage user roles Activate or deactivate users

Non-functional Requirements:

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

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	The system should be easy to use with a simple and intuitive user interface for analysts.
NFR-2	**Security**	User data and EV datasets must be protected using authentication and authorization mechanisms.
NFR-3	**Reliability**	The system should consistently produce accurate analytics results without data loss.
NFR-4	**Performance**	The system should process large EV datasets efficiently and generate dashboards quickly.
NFR-5	**Availability**	The system should be available to users with minimal downtime.
NFR-6	**Scalability**	The system should handle increasing EV data volume and number of users without performance degradation.

Data Flow Diagram & User Stories

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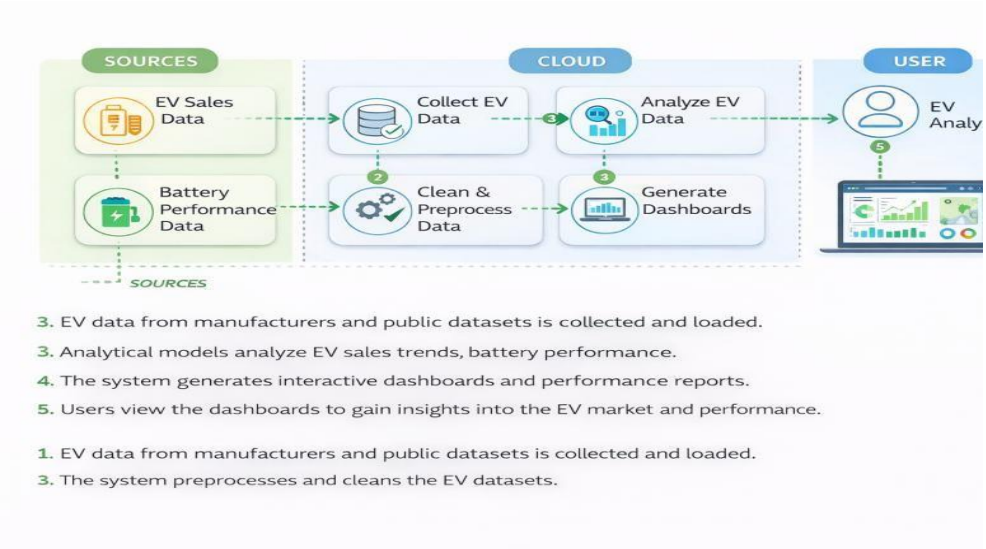
Maximum Marks	4 Marks

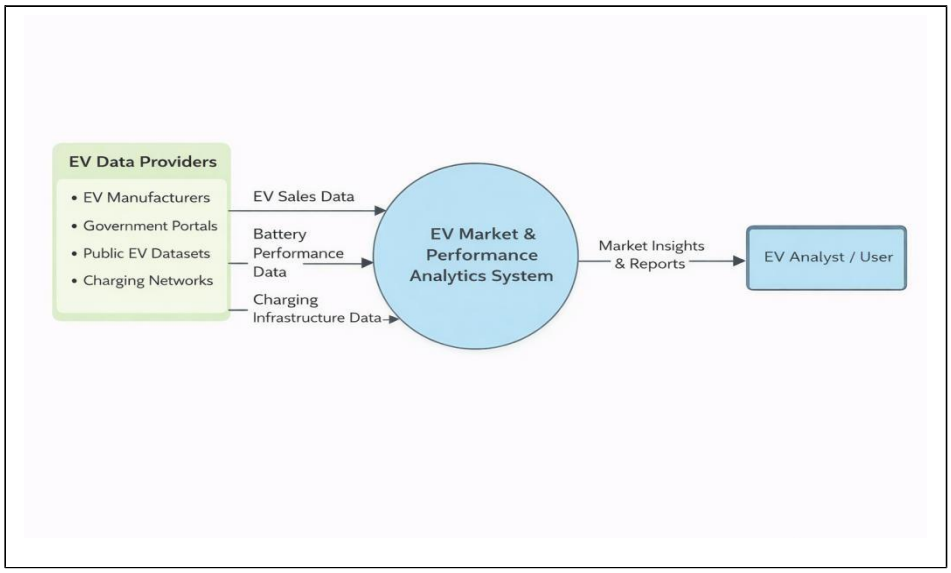
Data Flow Diagrams:

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

EXANPLE: (Simplified)



DFD Level-0 (Context Diagram) – EV Market & Performance Analytics System



User Stories

Use the below template to list all the user stories for the product.

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
EV Analyst	Registration	USN-1	As an EV analyst, I want to register using email and password so that I can access the analytics system.	User can successfully register and access dashboard	High	Sprint-1
EV Analyst	Login	USN-2	As an EV analyst, I want to log in using valid credentials to view EV analytics.	User logs in and dashboard loads	High	Sprint-1
EV Analyst	Dashboard	USN-3	As an EV analyst, I want to view EV market trends on a dashboard.	Dashboard shows charts and KPIs	High	Sprint-1
EV Analyst	Sales Analysis	USN-4	As an EV analyst, I want to analyze EV sales by year and region.	Sales data is filtered correctly	Medium	Sprint-2
EV Analyst	Battery Analysis	USN-5	As an EV analyst, I want to view battery performance reports.	Battery efficiency metrics are displayed	High	Sprint-2
EV Analyst	Charging Analysis	USN-6	As an EV analyst, I want to analyze charging station availability.	Charging locations are visualized	Medium	Sprint-2
EV Analyst	Reports	USN-7	As an EV analyst, I want to download analytics reports	Reports are generated and downloadable	Medium	Sprint-3
Admin	Data Upload	USN-8	As an admin, I want to upload EV datasets into the system.	Data is uploaded successfully	High	Sprint-1
Admin	Data Validation	USN-9	As an admin, I want to validate EV datasets.	Clean data is available for analysis	High	Sprint-1
Admin	User Management	USN-10	As an admin, I want to manage user access.	Users are added/removed correctly	Medium	Sprint-2

Technology Stack (Architecture & Stack)

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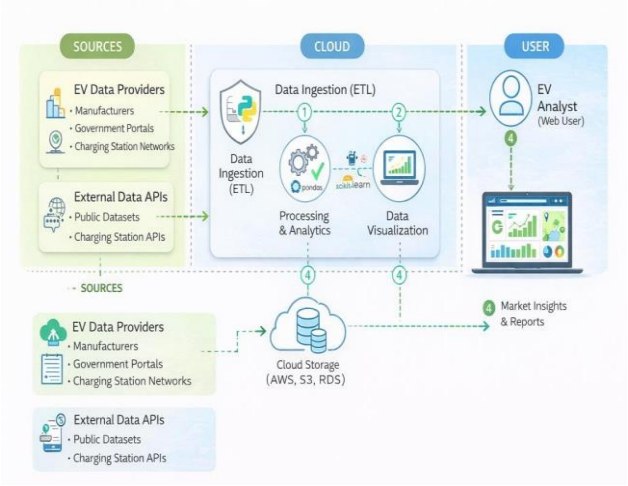
Project Name	Visualizations tools of ev charge and range analysis
Maximum Marks	4 Marks

Technical Architecture:

The Deliverable shall include the architectural diagram as below and the information as per the table1 & table 2

EXAMPLE : EV Market & Performance Analytics System



Guidelines:

Include all the processes (As an application logic / Technology Block) Provide infrastructural demarcation (Local / Cloud) Indicate external interfaces (third party API's etc.) Indicate Data Storage components / services Indicate interface to machine learning models (if applicable)

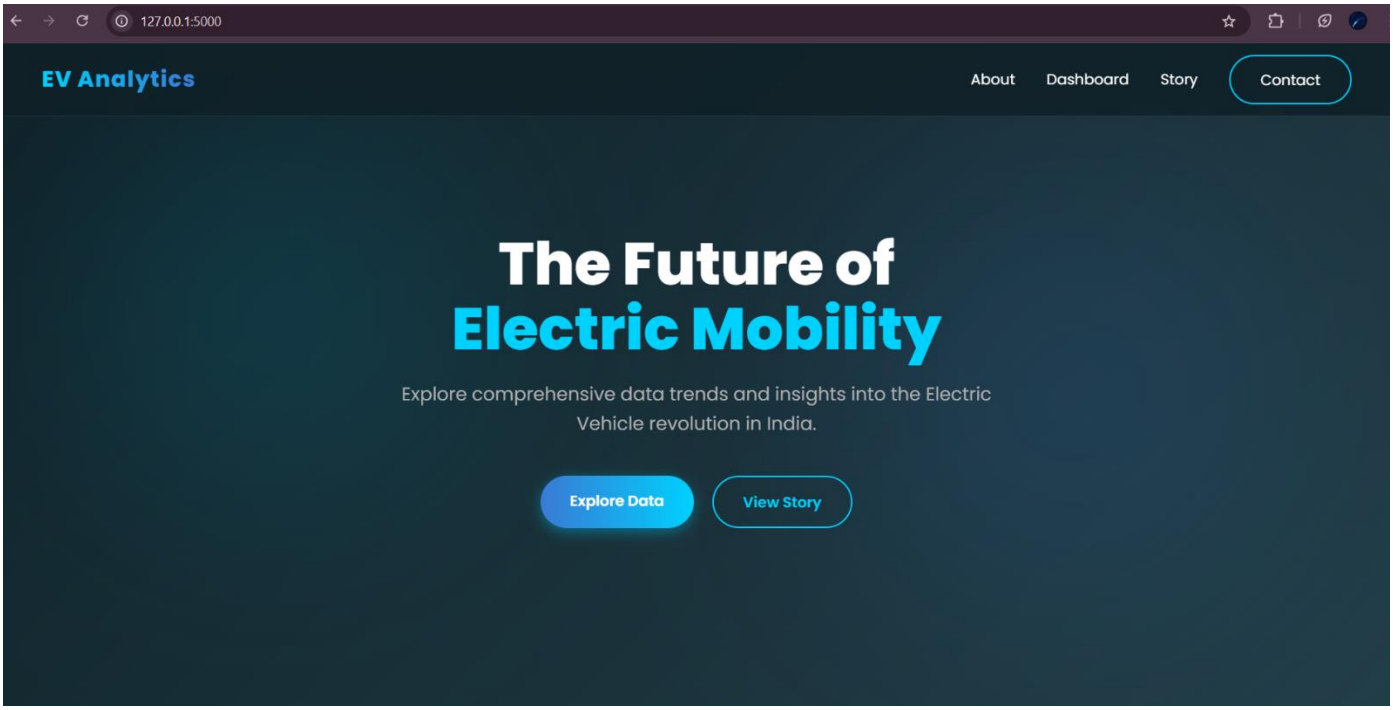
S.No	Component	Descripti		Technolo
1.	User Interface	Interface for EV analysts to interact with		HTML, CSS, JavaScript, Power BI / Tableau

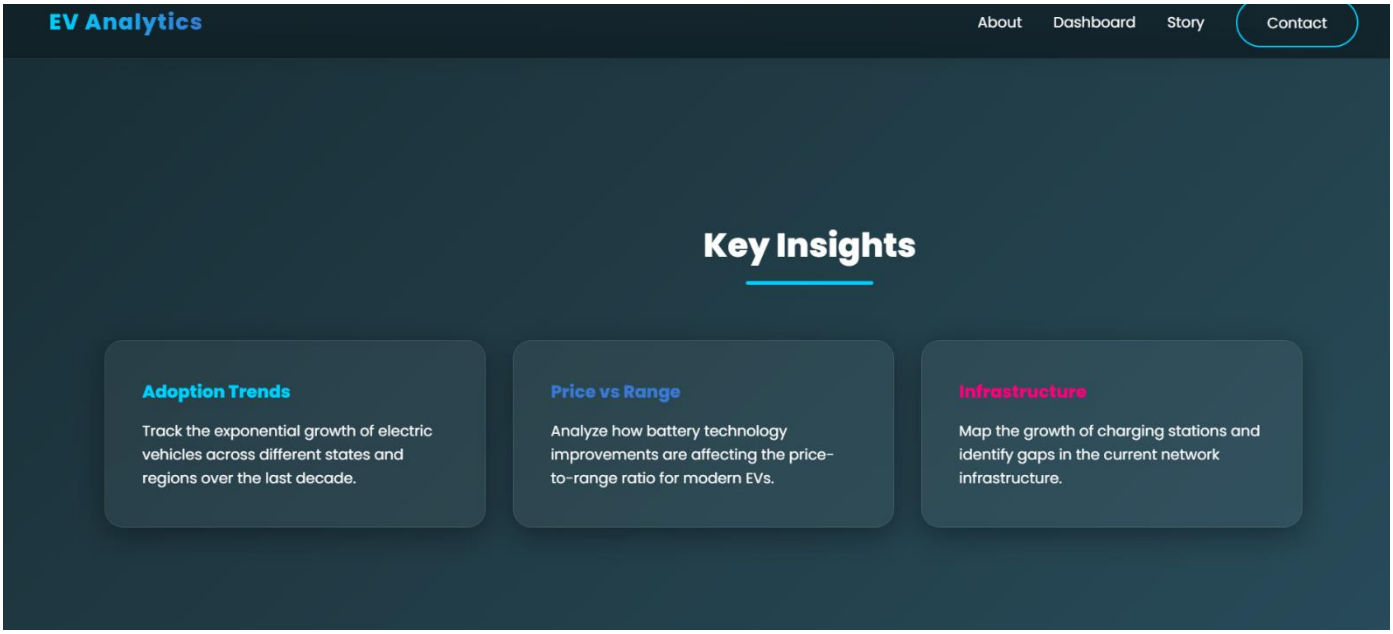
2.	Application Logic-1	Data ingestion and preprocessing logic	Python
3.	Application Logic-2	EV sales and battery performance analytics	Python (Pandas, NumPy)
4.	Application Logic-3	data visualization and reporting logic	Power BI / Matplotlib
5.	Database	Stores structured EV sales and performance	MySQL
6.	Cloud Database	Cloud-based storage for large EV datasets	AWS RDS / Google BigQuery
7.	File Storage	Storage for raw datasets and reports	AWS S3 / Local File System
8.	External API-1	Fetch public EV datasets and statistics	Government EV Data APIs.
9.	External API-2	Charging station location data	OpenChargeMap API
10.	Machine Learning Model	Forecasting EV adoption and performance trends	Python (Scikit-learn)
11.	Infrastructure (Server / Cloud)	loyment environment	Local System / AWS Cloud

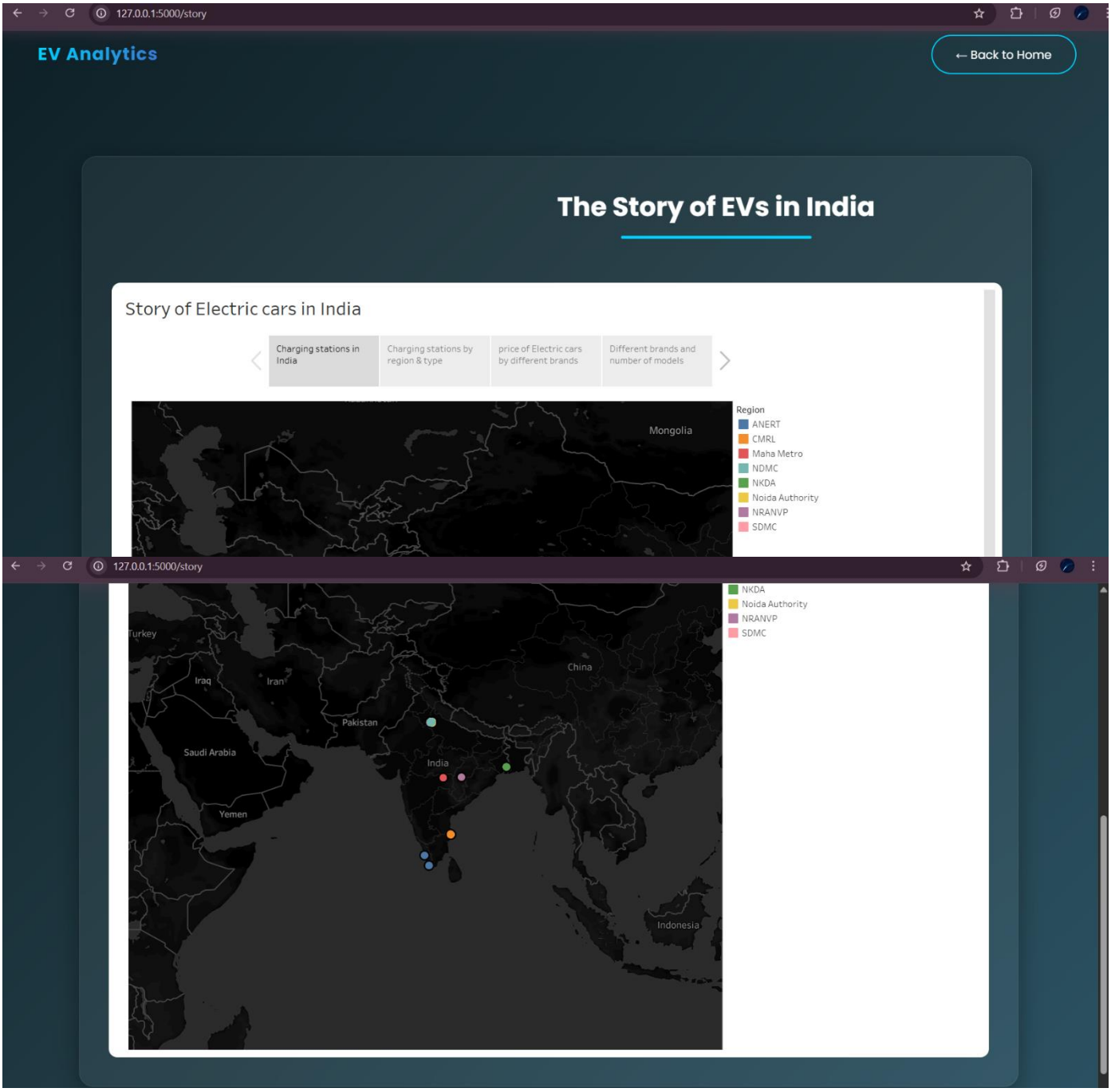
Table-2: Application Characteristics

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	Frameworks used for data analysis and visualization	Pandas, NumPy, Matplotlib
2.	Security Implementations	Secure access and data protection	User Authentication, Role-Based Access
3.	Scalable Architecture	System supports growing EV datasets	Cloud-based 3-Tier Architecture
4.	Availability	High availability for users	Cloud Hosting with Backup Storage
5.	Performance	Efficient handling of large datasets	Optimized SQL Queries, Data Caching

Web Integration:



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The Story of EVs in India
Story of Electric cars in India
Charging stations in India
Charging stations by region & type
price of Electric cars by different brands
Different brands and number of models
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Region
ANERT
CMRL
Maha Metro
NDMC
NKDA
Noida Authority
NRANVP
SDMC
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EV Analytics

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Interactive Dashboard