VISUALIZATION TOOLS FOR ELECTRIC VEHICLE CHARGING TIME AND RANGE ANALYSIS USING TABLEAU

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1. INTRODUCTION

1.1 Overview

A vehicle that can be powered by an electric motor that draws electricity from a battery and is capable of being charged from an external source and have an electric motor instead of an internal combustion engine. 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. The new EV's are combined Electrical storage and propulsion systems with electronic sensors, controls, and actuators, integrated closely with software, secure data transfer to form a comprehensive transportation solution.

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The power of a vehicle's electric motor, as in other machines, is measured in kilowatts (kW). Electric motors can deliver their maximum torque over a wide RPM range. This means that the performance of a vehicle with a **100 kW** electric motor exceeds that of a vehicle with a **100 kW** internal combustion engine, which can only deliver its maximum torque within a limited range of engine speed.

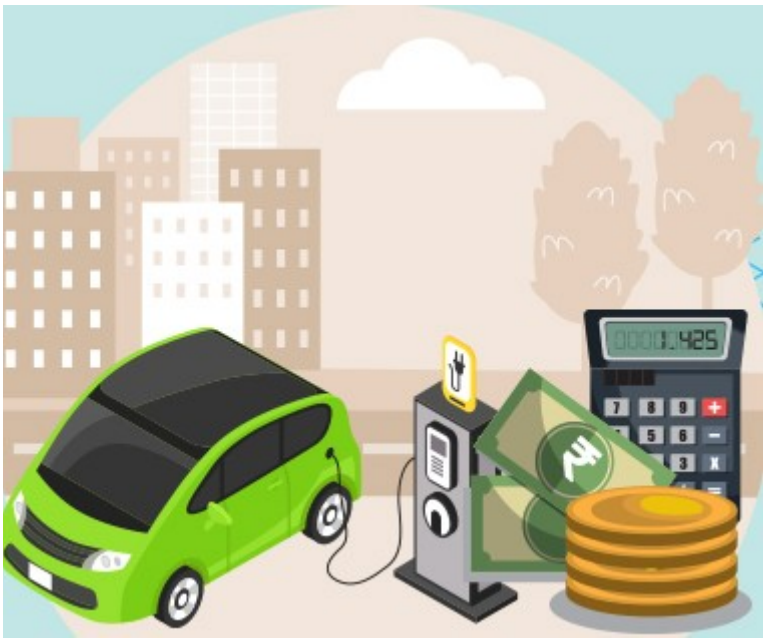
- The auto industry's successful **federal court** challenge to California's **zero-emissions** mandate.
- A federal regulation requiring GM to produce and maintain spare parts for the few thousand EV1s .
- The success of the oil and auto industries' media campaign to reduce public acceptance of EVs.

1.2 Purpose

Transport is a fundamental requirement of modern life, but the traditional combustion engine is quickly becoming outdated. Petrol or diesel vehicles are highly polluting and are being quickly replaced by fully electric vehicles. Fully electric vehicles (EV) have zero tailpipe emissions and are much better for the environment.

Lower running costs

The running cost of an electric vehicle is much lower than an equivalent petrol or diesel vehicle. Electric vehicles use electricity to charge their batteries instead of using fossil fuels like petrol or diesel. Electric vehicles are more efficient, and that combined with the electricity cost means that charging an electric vehicle is cheaper than filling petrol or diesel for your travel requirements. Using renewable energy sources can make the use of electric vehicles more eco-friendly. The electricity cost can be reduced further if charging is done with the help of renewable energy sources installed at home, such as solar panels.



No noise pollution

Electric vehicles have the silent functioning capability as there is no engine under the hood. No engine means no noise. The electric motor functions so silently that you need to peek into your instrument panel to check if it is ON. Electric vehicles are so silent that manufacturers have to add false sounds in order to make them safe for pedestrians.

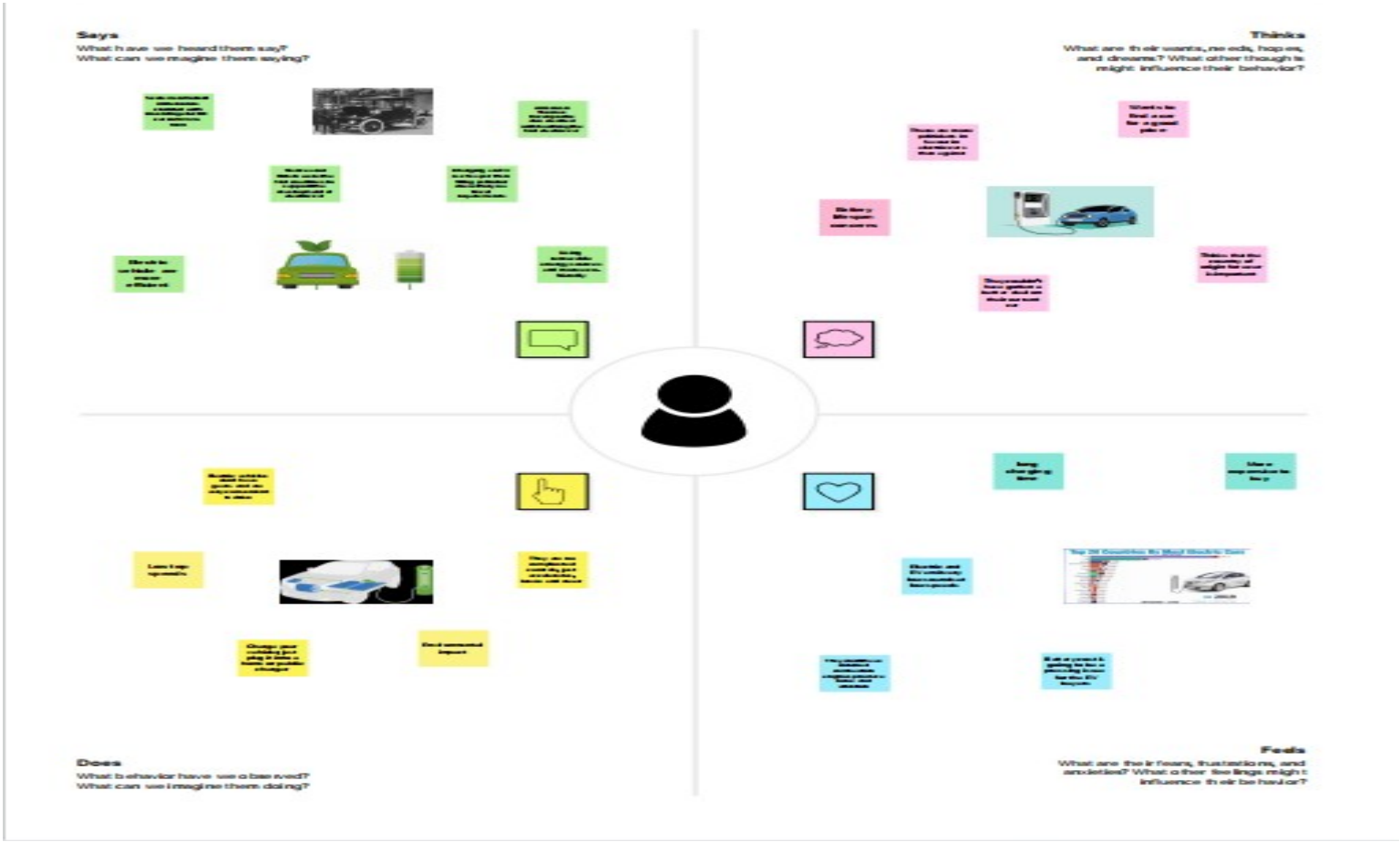
Fuel Economy

Electric vehicles can reduce fuel costs dramatically because of the high efficiency of electric-drive components. Because all-electric vehicles and PHEVs rely in whole or part on electric power, their fuel economy is measured differently than that of conventional vehicles. **Miles per gallon of gasoline equivalent (MPGe)** and kilowatt-hours (kWh) per 100 miles are common metrics. Depending on how they are driven, today's light-duty all-electric vehicles (or PHEVs in electric mode) can exceed 130 MPGe and can drive 100 miles consuming only 25–40 kWh.

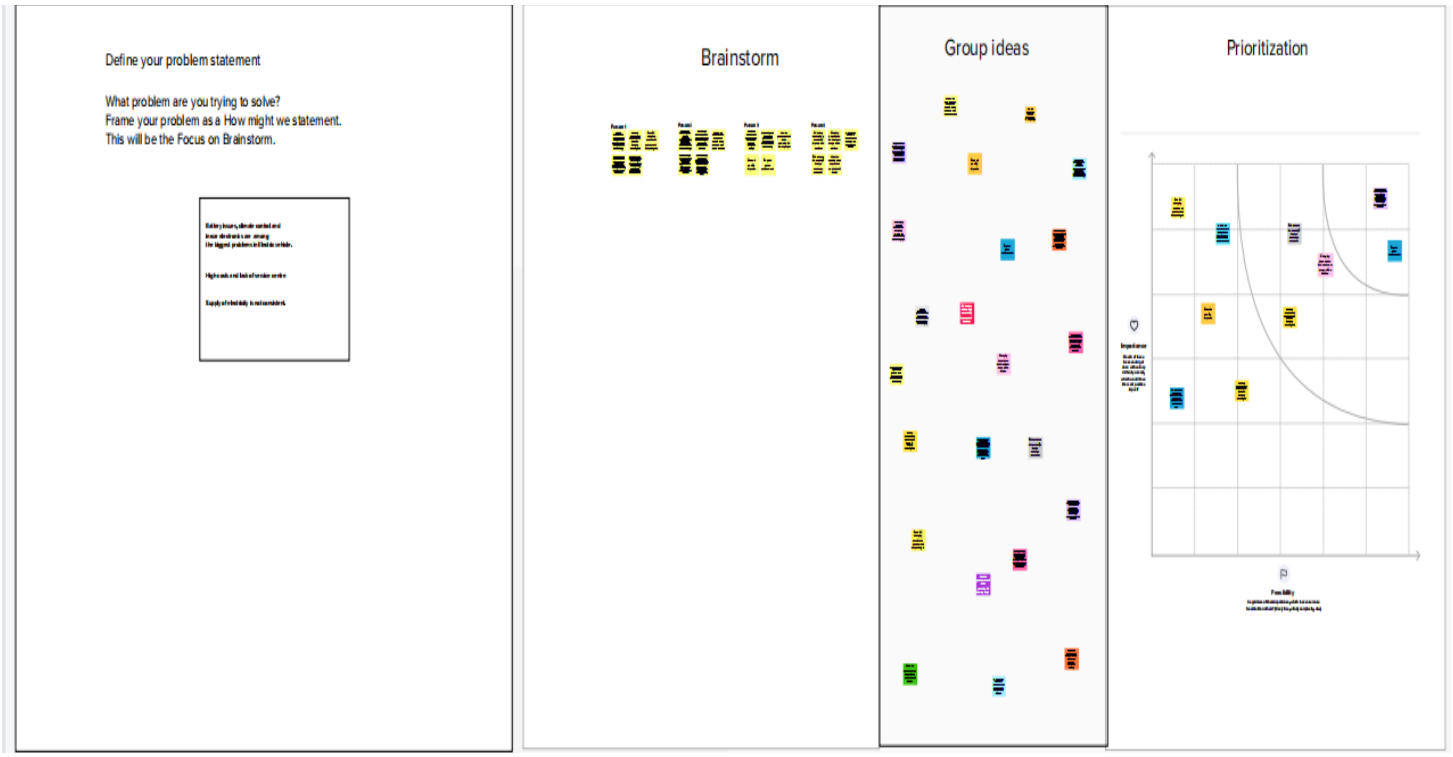
All-electric vehicles and PHEVs have the benefit of flexible charging because the electric grid is near most locations where people park. To safely deliver energy from the electric grid to a vehicle’s battery, a charging station, sometimes referred to as electric vehicle supply equipment (EVSE), is needed. Drivers can charge overnight at a r**esidence** as well as at ,**multi-family housing** the **workplace**, or a **public charging** station when available. PHEVs have added flexibility because they can also refuel with gasoline or diesel (or possibly other fuels in the future) when necessary.

2. PROBLEM DEFINITION & DESIGN THINKING

2.1 Empathy Map



2.2 Ideation & Brainstorming mapping

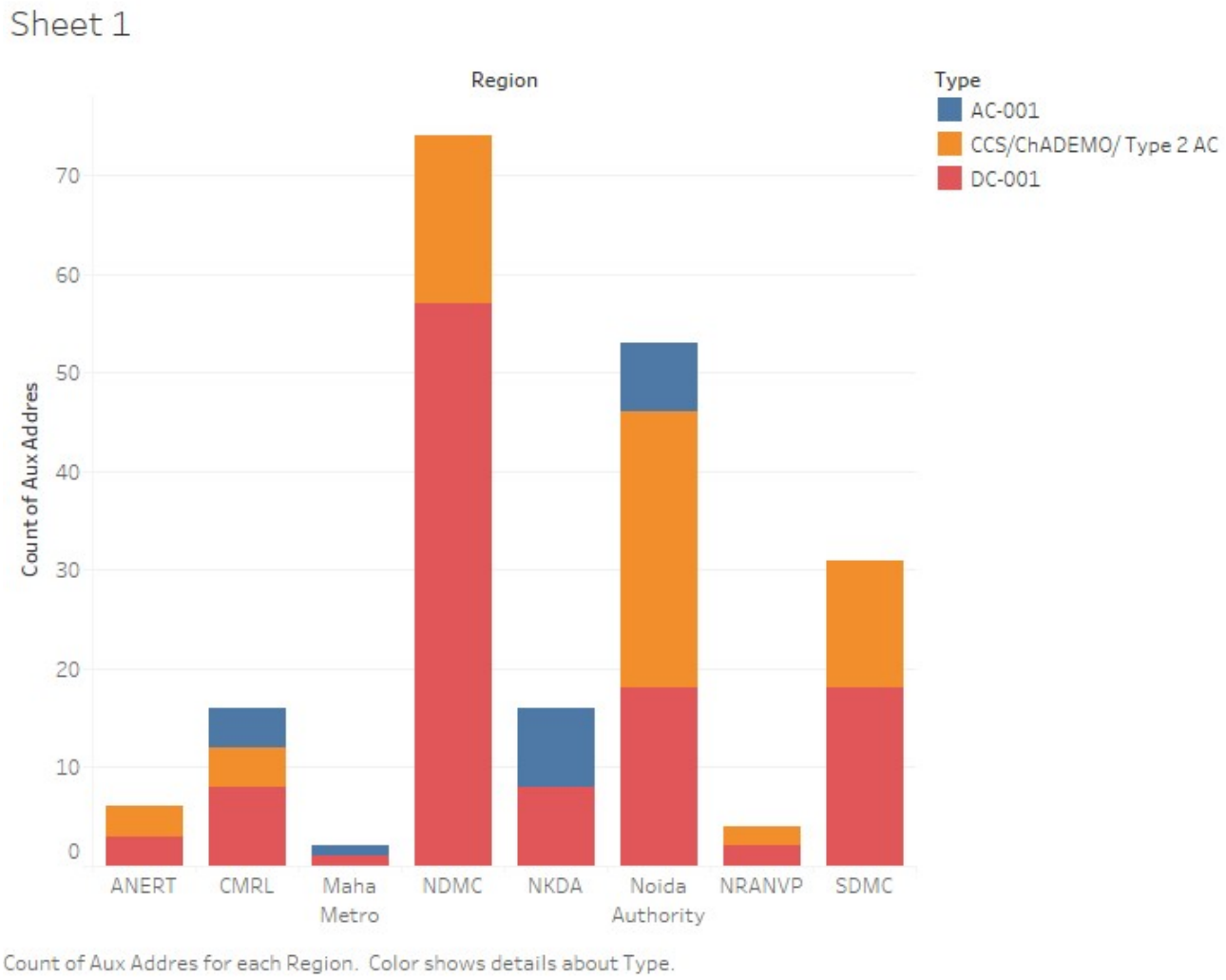


3. RESULT

3.1 Visualization

1. Charging stations by region & types.
2. Charging stations in India.
3. Different EV cars in India.
4. Top speeds for different brands.
5. Price of electric cars by different.
6. Top 10 most efficient brands.
7. Brand according to body style.
8. Different brands & No of models.
9. Brand filtered by power train types.
10. Different brands of electric cars globally.
11. Different electric car brands in India.

1. Charging stations by region & types.

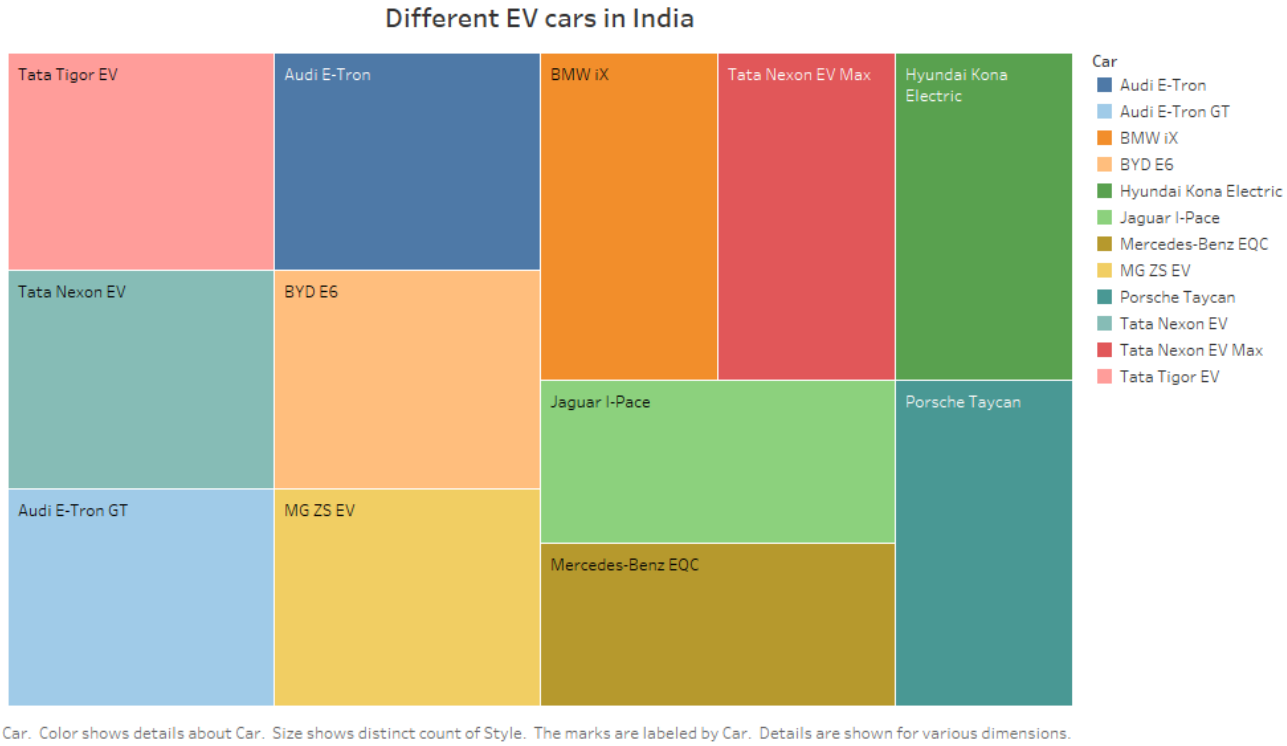


2. Charging stations by region & types.

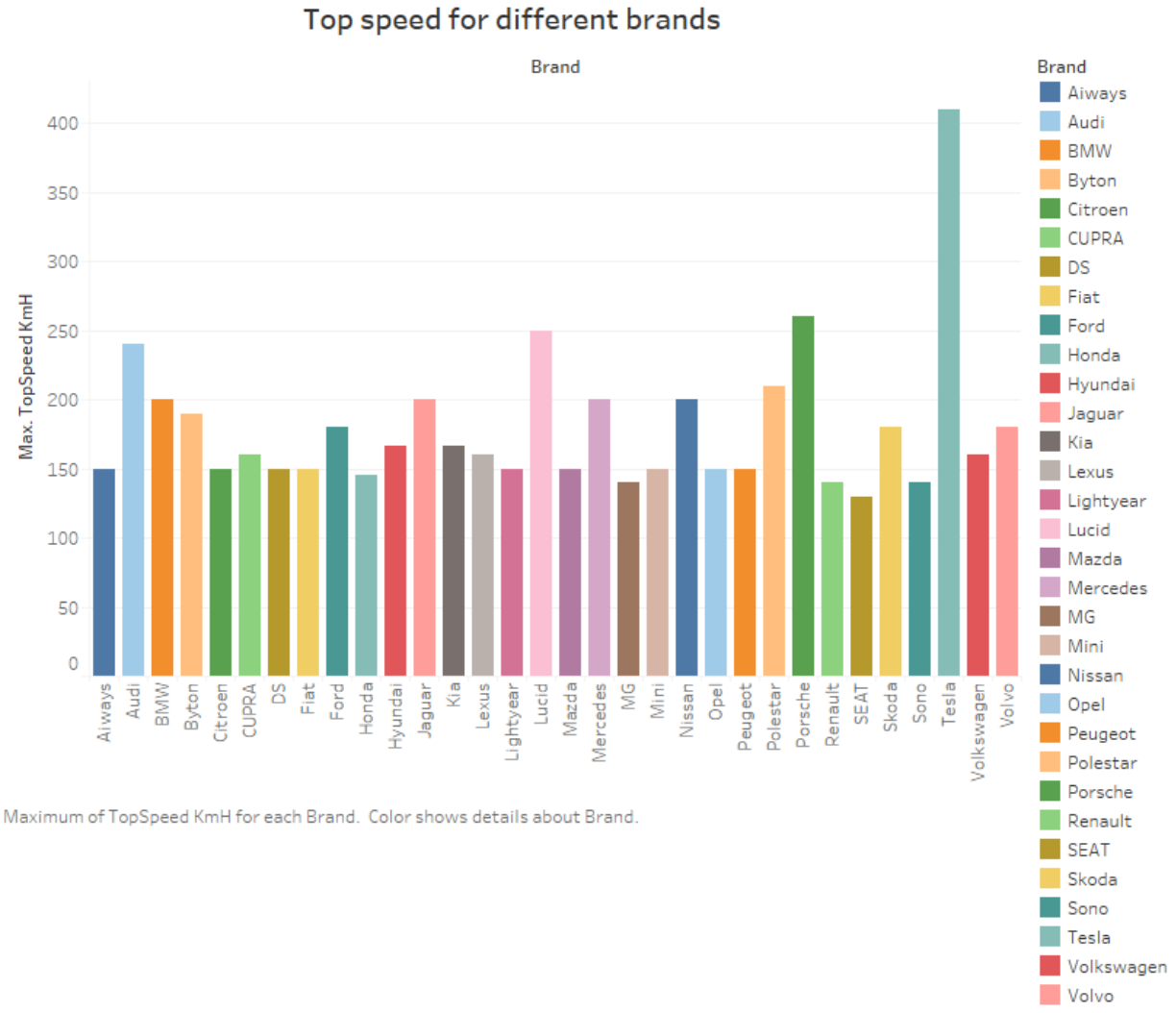
charging station in india

Map based on Longitude and Latitude. Color shows details about Region. Details are shown for Address and Power.

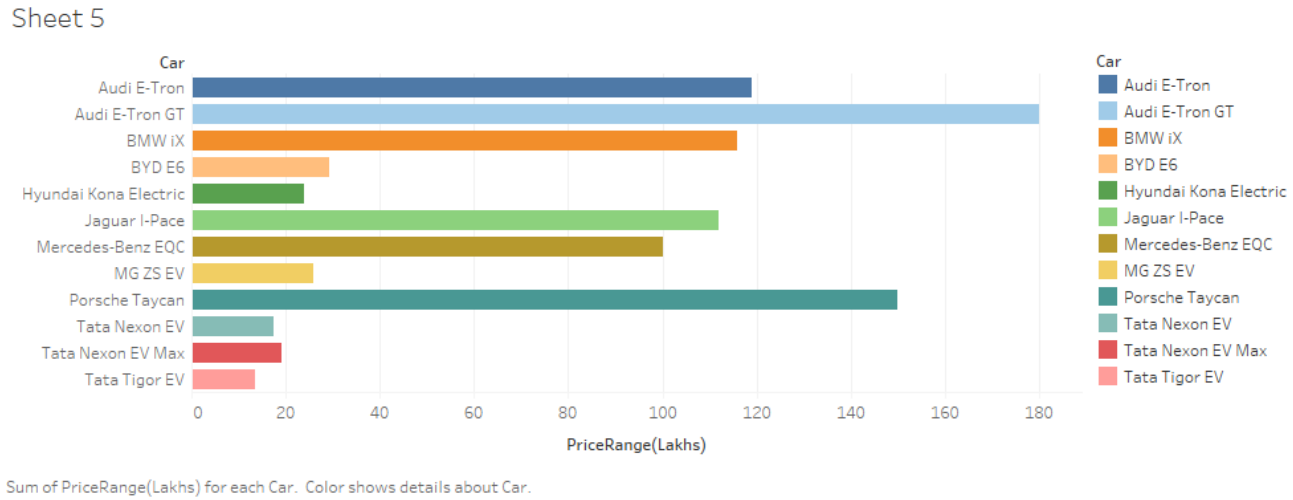
3. Different EV cars in India.



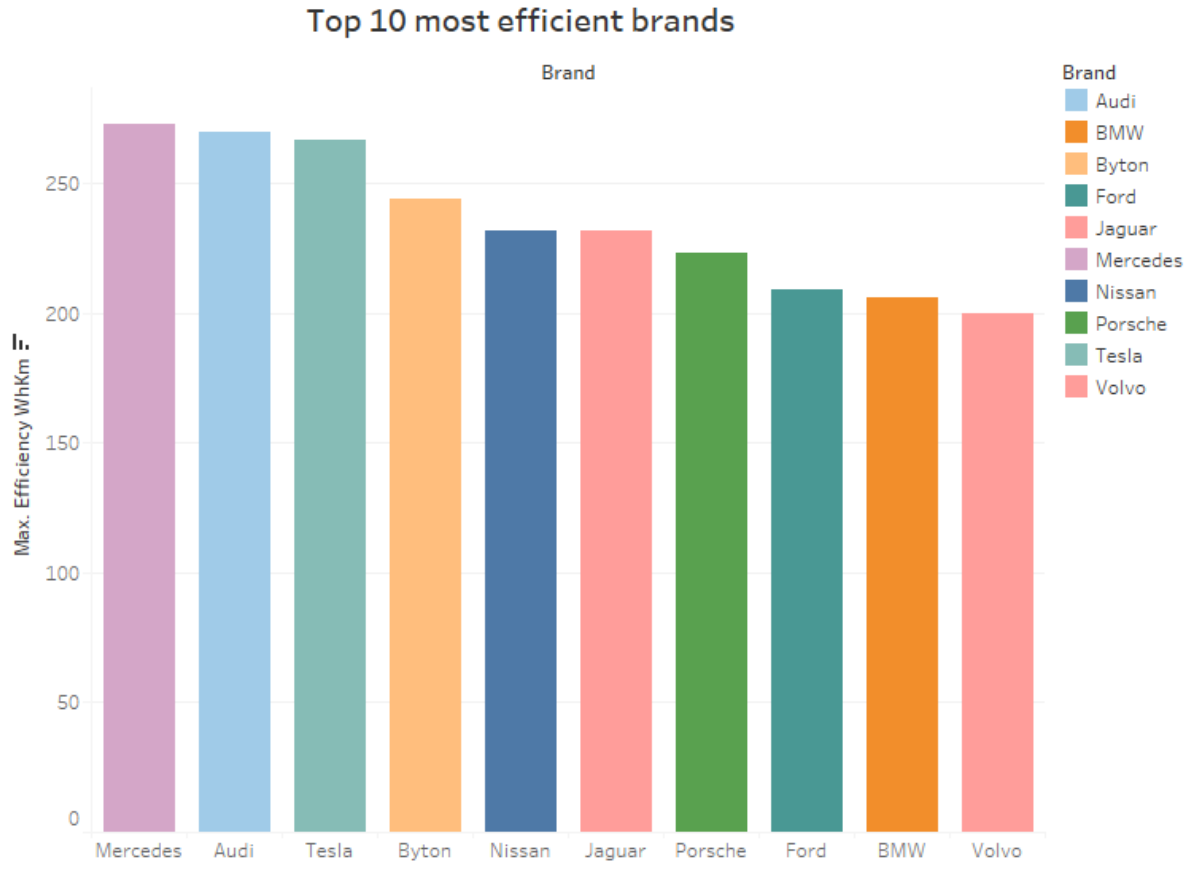
4. Top speeds for different brands.



5. Price of electric cars by different.

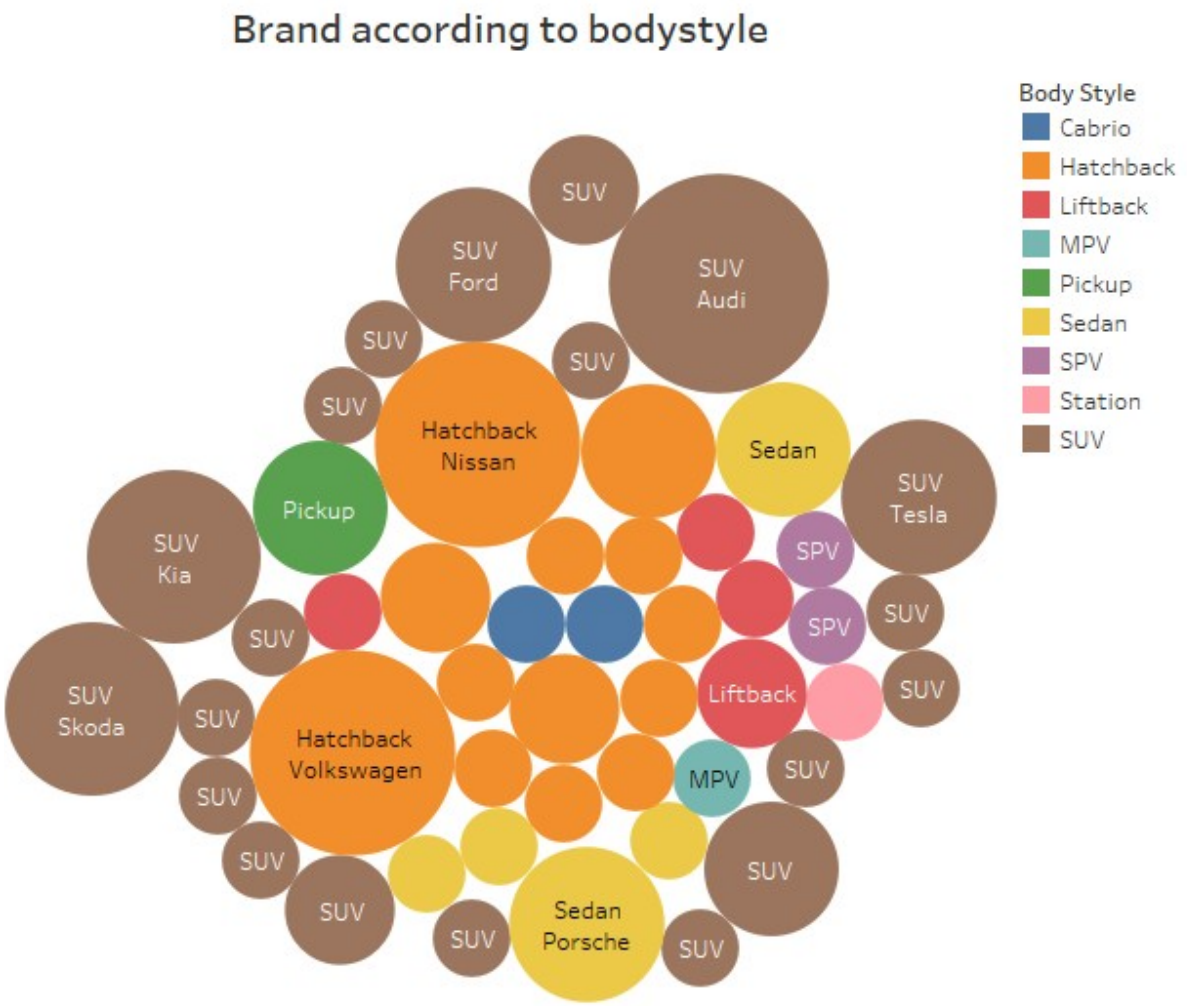


6. Top 10 most efficient brands.



Maximum of Efficiency WhKm for each Brand. Color shows details about Brand. The view is filtered on Brand, which has multiple members selected.

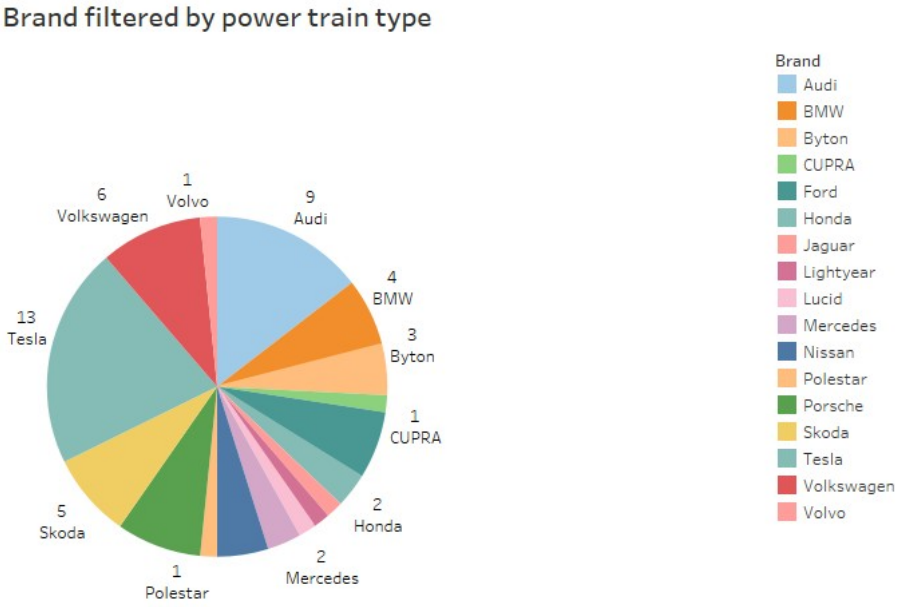
7. Brand according to body style.



Body Style and Brand. Color shows details about Body Style. Size shows bodystyle_count. The marks are labeled by Body Style and Brand.

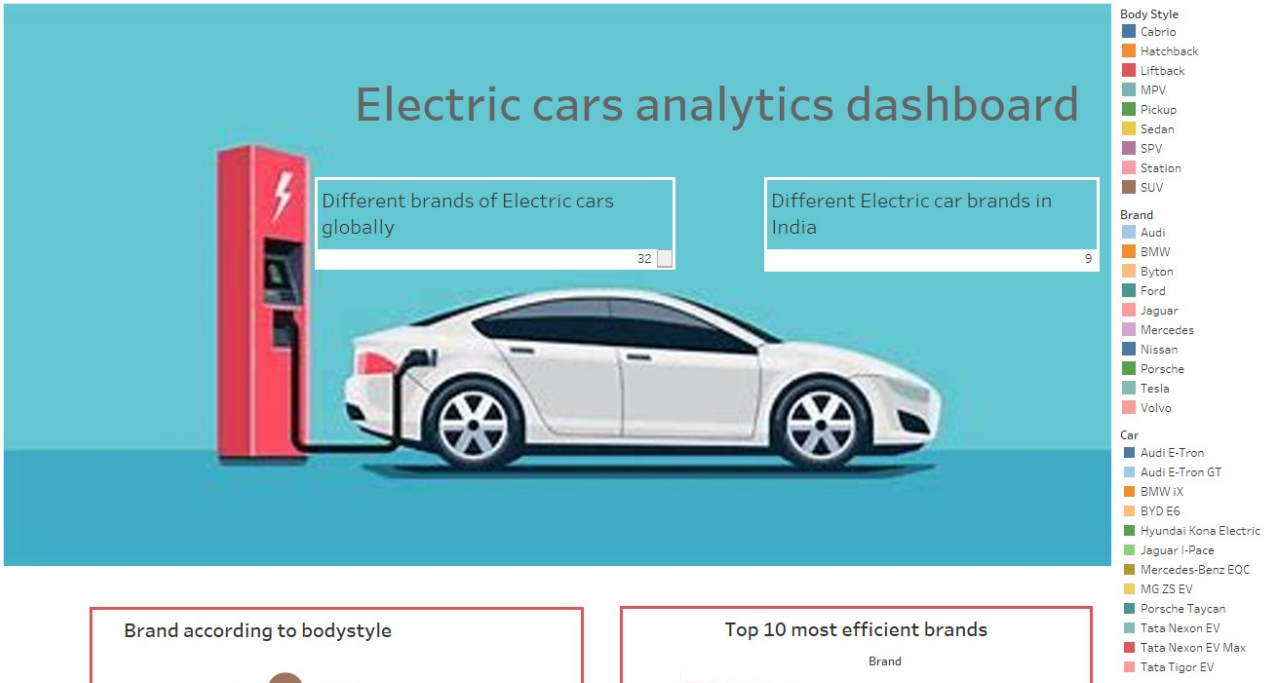
8. Different brands & No of models.

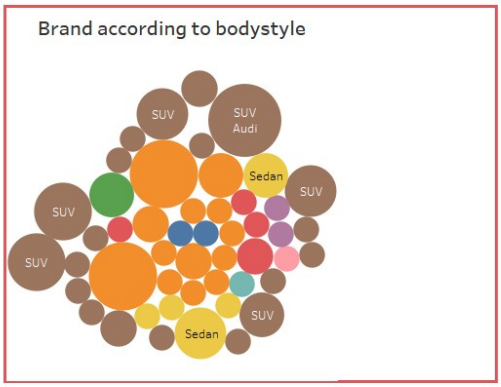
9. Brand filtered by power train types.

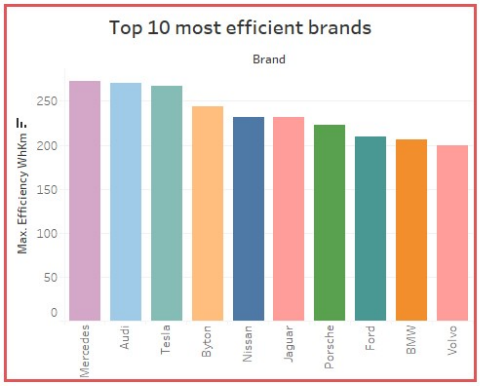


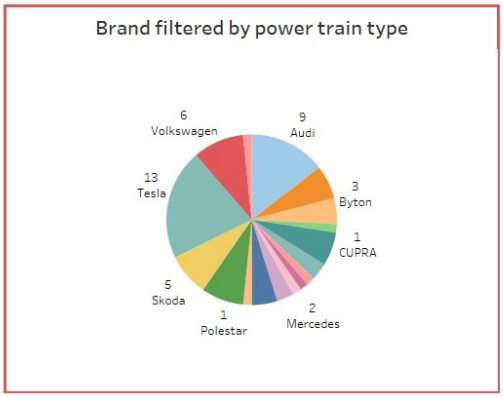
Count_powertrain and Brand. Color shows details about Brand. The marks are labeled by count_powertrain and Brand. The data is filtered on Power Train, which excludes FWD and Null.

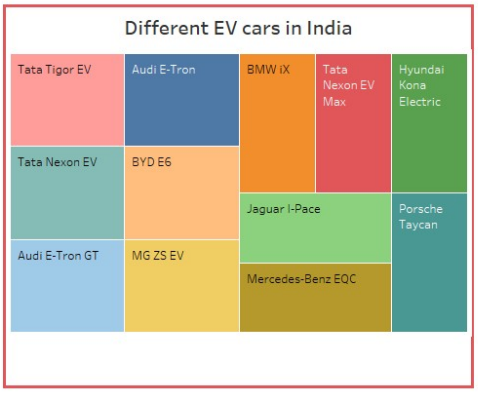
3.2 Dashboard

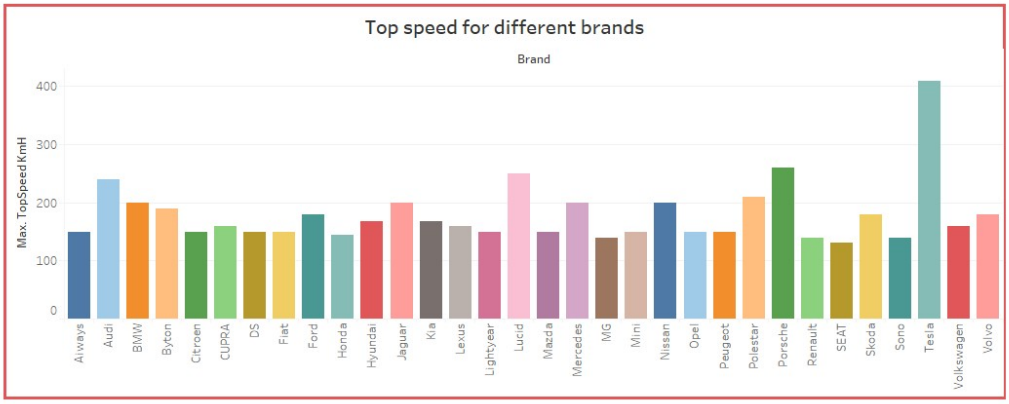




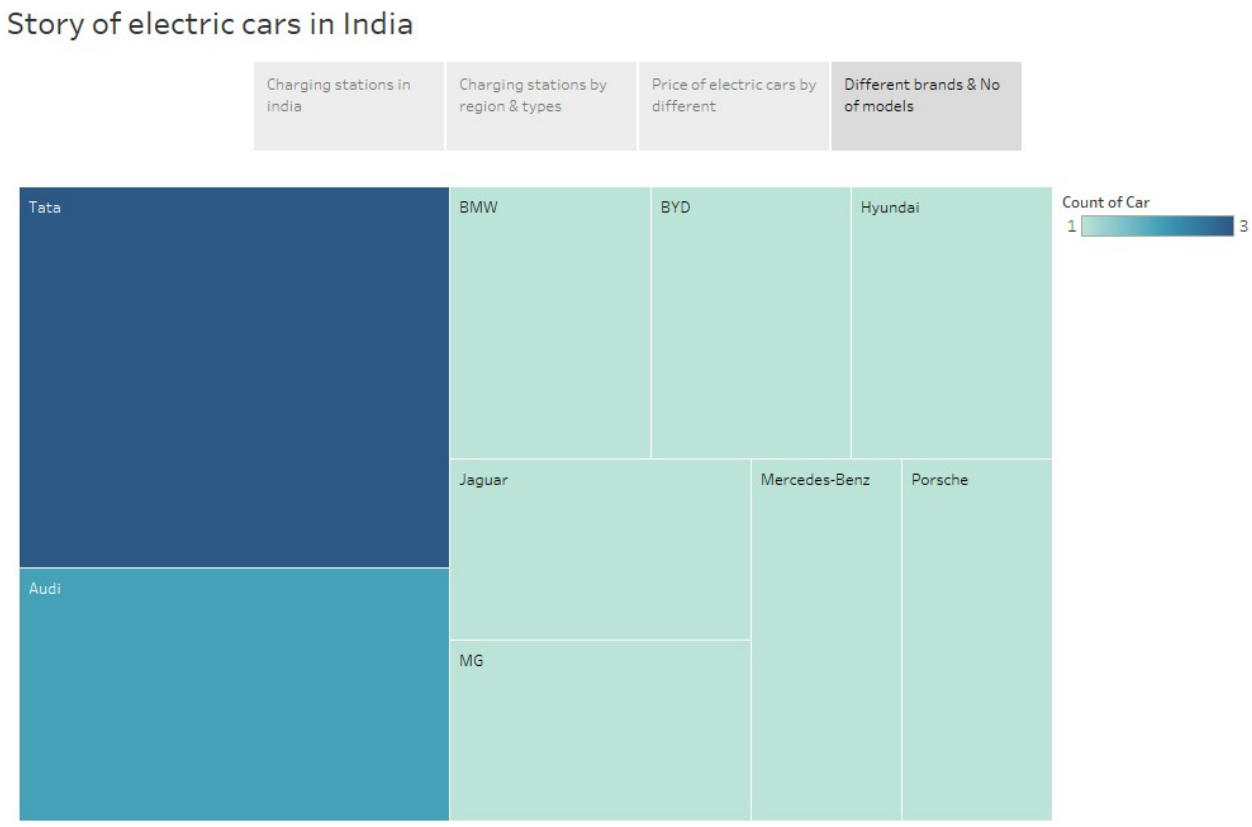








3.3 Story


Story of electric cars in India
Charging stations in india
Charging stations by region & types
Price of electric cars by different
Different brands & No of models
Tata
BMW
BYD
Hyundai
Jaguar
Mercedes-Benz
Porsche
Audi
MG
Count of Car
1
3

4. ADVANTAGES & DISADVANTAGES

4.1 Advantages

- Since you are not paying for petrol or diesel to keep your EV running, you save a lot of money on fuel. The cost to charge an electric vehicle compared to the price of petrol or diesel is substantially low. You can reduce the electricity cost further by utilising renewable energy sources such as solar.
- Petrol or diesel-powered vehicles require regular maintenance since they have multiple moving parts. That's not the case with electric vehicles since they have comparatively lesser moving parts. This means that your electric car is likely to have lower maintenance costs in the long run.
- With India embracing the inclusion of Es, the government offers several policies and incentives to encourage the usage of such vehicles. For instance, the registration fees and road tax on purchasing Es are lesser than ICE vehicles.
- In the past, Es were seen as impractical. However, that has changed over the years, with manufacturers offering well-designed and good-looking Es. Even the performance of Es has changed for the better. Electric Vehicles are lighter in weight, and their acceleration is impeccable compared to fuel-powered vehicles.
- Es emit zero tailpipe emissions, helping reduce the carbon footprint. You can further reduce your carbon footprint by utilising renewable energy to charge your EV.

4.2 Disadvantages

- One of the biggest disadvantages of Es versus Ices is the time it takes to get a full charge. In the case of combustion cars, it is a purely mechanical process: pouring a liquid into a tank. In the case of electric cars, it is not so simple.
- As for the latter, you could opt for a Battery Electric Vehicle (BEV) or a Plug-In Hybrid Electric Vehicle (PHEW), but as far as charging time is concerned, there is no doubt: a PHEW is better, which in some cases is fully charged in 10 percent of the time it takes to charge a BEV.
- Another classic problem that electric car developers faced in the past and still face today is that of range. While much progress has been made, a range comparable to that of conventional cars has not yet been achieved.
- Although electric vehicles do not utilize gasoline, the batteries that power them are quite powerful. Aside from that, if the battery is not changed within a defined time interval, it might cause the vehicle to be damaged.
- Electric vehicles require many hours to charge, unlike engine-powered vehicles, which can recharge quickly. The charging of these auto mobiles is quite sluggish.
- If there is any other choice than recharging the electric vehicles at a charging station, it is to charge them with the electrical power supply connected to their houses. If you do this, your electricity bill may surprise you considerably. To recharge these vehicles, a high-voltage electric current is required.
- You may already be aware that many nations only have relevance because of the fuel they provide. Fuel sales power the economies of numerous nations, including Iran, Oman, and Saudi Arabia. If the number of diesel fuel cars suddenly declines, these nations may face a financial crisis. As a result, the popularity of fuellers electric cars may prove to be a problem for fuel-producing countries.

5. APPLICATIONS

An Electric vehicle (EV) is a vehicle that runs on electric energy, powered by a motor. Since they do not emit exhaust gas, they are rapidly gaining popularity in recent years as eco-friendly vehicles. It is equipped with a high capacity lithium-ion battery pack and a high-power motor for driving.

■ The output from the lithium-ion battery is DC current, but the drive motor of electric vehicles is an AC motor. Therefore, an inverter that converts the DC current into three-phase AC must also be installed.

■ A harness is also essential to ensure the safe and reliable transmission of high-voltage electricity. Electric vehicles use the back EMF from the motor to save energy. Therefore, in the development of motors and inverters for electric vehicles, it is also necessary to conduct tests using regenerative DC power supplies.

■ The most common battery voltage installed in electric vehicles is around 300 V to 400 V. Motor, and battery capacities are expected to become high voltage and high power in the future in order to improve driving range.

Electric vehicles use electricity to charge their batteries instead of using fossil fuels like petrol or diesel. Electric vehicles are more efficient, and that combined with the electricity cost means that charging an electric vehicle is cheaper than filling petrol or diesel for your travel requirements.

6. CONCLUSION

The project **"Visualization Tool for Electric Vehicle and Charging Time and Range Analysis"** which can be accomplished by **"Data Analytics by Tableau"** has various milestones.

Milestone 1 was completed by creating **Empathy Mapping, Brainstorming and Idea prioritization** by using **Mural** which is a system that takes offers workspace to collaborate and contribute innovative ideas as a teamwork and uploaded in **GitHub** which is an internet hosting service for software development and version control using Git. **Repositories** can be created and uploaded files into it.

Milestone 2 was completed by collecting the **dataset,** storing the **database** in **MY SQL Workbench** and connecting database with **Tableau.**

Milestone 3 was completed by preparing the data for visualization involves cleaning the data to remove irrelevant or missing data, transforming the data into a format that can be easily visualized, exploring the data to identify patterns and trends, filtering the data to focus on specific subsets of data, preparing the data for visualization software, and ensuring the data is accurate and complete. This process helps to make the data easily understandable and ready for creating visualization to gain insights into our Analysis.

Milestone 4 is **Data Visualization** which is the process of creating graphical representation of data to help people understand and explore information. This involves **Number of unique**

visualizations are **Top speed for different brands, Brand filtered by power train type, Different EV cars in India, Brand according to body style, Top 10 most efficient brands, Charging stations in India, Charging station by region & types, Price of electric cars by different, Different brands & number of models.**

Milestone 5 is response and design **Dashboard**.

Milestone 6 was completed by creating **No of Scenes of Story.** A data story is a way of presenting data and analysis in a narrative format, with the goal of making the information more engaging and easier to understand. A data story typically includes a clear introduction that sets the stage and explains the context for the data, a body that presents the data and analysis in a logical and systematic way, and a conclusion that summarize the key findings and highlights their implications. Data stories can be told using a variety of mediums, such as reports, presentations, interactive visualizations, and videos. The number of scenes in a storyboard for a data **Visualization of Electric Vehicle Charging Time and Range Analysis** of the conveyed in storyboard. A storyboard is a visual representation of the data analysis process, and its breaks down the analysis into a series of steps or scenes.

Milestone 7 is to accomplish **performance testing** which includes amount of data rendered to database, utilization of data filters, Number of calculation fields and Number of Visualization or Graphs.

Milestone 8 was completed by doing **Web Integration.** The first step is to **publish dashboard, story and reports to Tableau public.** The next step is **Embed Dashboard and story with UI with flask.**

Milestone 9 was completed by recording explanation **Video for project** end to end solution and making **Project Documentation-**step by step project development procedure. This project concludes that large data of population over the world the easily by Data Analysis with Tableau.

7. FUTURE SCOPE

- The Economic Survey 2023 predicts that India's domestic electric vehicle market will see a 49 percent compound annual growth rate (CAGR) between 2022 and 2030, with 10 million annual sales by 2030. Additionally, the electric vehicle industry is projected to create around 50 million direct and indirect jobs by 2030.

- Most Indian buyers believe that an electric vehicle will be ready by 2023, but the majority also believe that it would no longer be available until 2025. Consumers in India are looking for a lower price for EVs than those in other countries, with the global average tipping price for EVs being $36,000.

- Lately, every major auto manufacturer appears to have a strategy aimed at an all-electric future. Many automakers are investing billions of dollars in research & development and manufacturing to electrify their global lineups to go EV-only by the middle of the next decade.

- Automotive doyens like Tata, Mahindra, Hyundai, Toyota, and many others are now able to provide EVs at pocket-friendly prices. For example, a Tata Nexon SUV starts at the price of Rs. 14.99 lakhs, which is more affordable than various other SUVs like the Hyundai Creta, Vitara Brezza, and a few others. While these may carry similar price tags, their running and maintenance costs are higher than the Nexon EV. What’s more, the Nexon EV comes with a factory-fitted 30.2 kWh battery pack that offers an ARAI-certified driving range of 312 kilometres per charge.

8. APPENDIX

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            <li class="nav-item"><a class="nav-link" href="#<Dashboard>">Dashboard</a></li>
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<h2 class="text-white-50 mx-auto mt-2 mb-5">Visualization Tool for Electric Vehicles Charging Time and Range Ananlysis.</h2>
<a class="btn btn-primary" href="#about">Get Started</a>
</div>
</div>
</div>
</header>
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<div class="container px-4 px-lg-5">
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Advances in all these areas have contributed to the overall rise of EV's, but the common thread through all these element is data Analysis
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relative'><noscript><a href='#'><img alt='Story of electric cars in India '
src='https:&#47;&#47;public.tableau.com&#47;static&#47;images&#47;Vi&#47;Visualisation
ofelectricvehiclestory&#47;StoryofelectriccarsinIndia&#47;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='Visualisationofelectricvehiclestory&#47;StoryofelectriccarsinIndia'
/><param name='tabs' value='no' /><param name='toolbar' value='yes' /><param
name='static_image'
value='https:&#47;&#47;public.tableau.com&#47;static&#47;images&#47;Vi&#47;Visualisati
onofelectricvehiclestory&#47;StoryofelectriccarsinIndia&#47;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-US' /></object></div> <script type='text/javascript'> var divElement =
document.getElementById('viz1681188743727'); var vizElement =
divElement.getElementsByTagName('object')[0];
vizElement.style.width='1016px';vizElement.style.height='991px'; var scriptElement =
document.createElement('script'); scriptElement.src =
'https://public.tableau.com/javascripts/api/viz_v1.js';
vizElement.parentNode.insertBefore(scriptElement, vizElement); </script>
<!-- Contact-->
<!-- Footer-->
<footer class="footer bg-black small text-center text-white-50"><div class="container
px-4 px-lg-5">THANK YOU</div></footer>
<!-- Bootstrap core JS-->
<script
src="https://cdn.jsdelivr.net/npm/bootstrap@5.2.3/dist/js/bootstrap.bundle.min.js"></
script>
<!-- Core theme JS-->
<script src="js/scripts.js"></script>
<!-- * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *--
>
<!-- * * SB Forms JS * *-->
<!-- * * Activate your form at https://startbootstrap.com/solution/contact-forms * *--
>
<!-- * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *--
```

```
>
<script src="https://cdn.startbootstrap.com/sb-forms-latest.js"></script>
</body>
</html>
```