Data Analytics with Tableau Project Documentation

Project Title : **visualization tool for electric vehicle charge and range analysis**

Team ID : **LTVIP2026TMIDS24131**

Team Members :

Konatham Nandini (Team Leader)

Maddala Yamini (Member 2)

Madda Santhoshini (Member 3)

Kukkala Bhuvana Gayatri (Member 4)

1. INTRODUCTION:

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 has 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.

1.1 Overview:

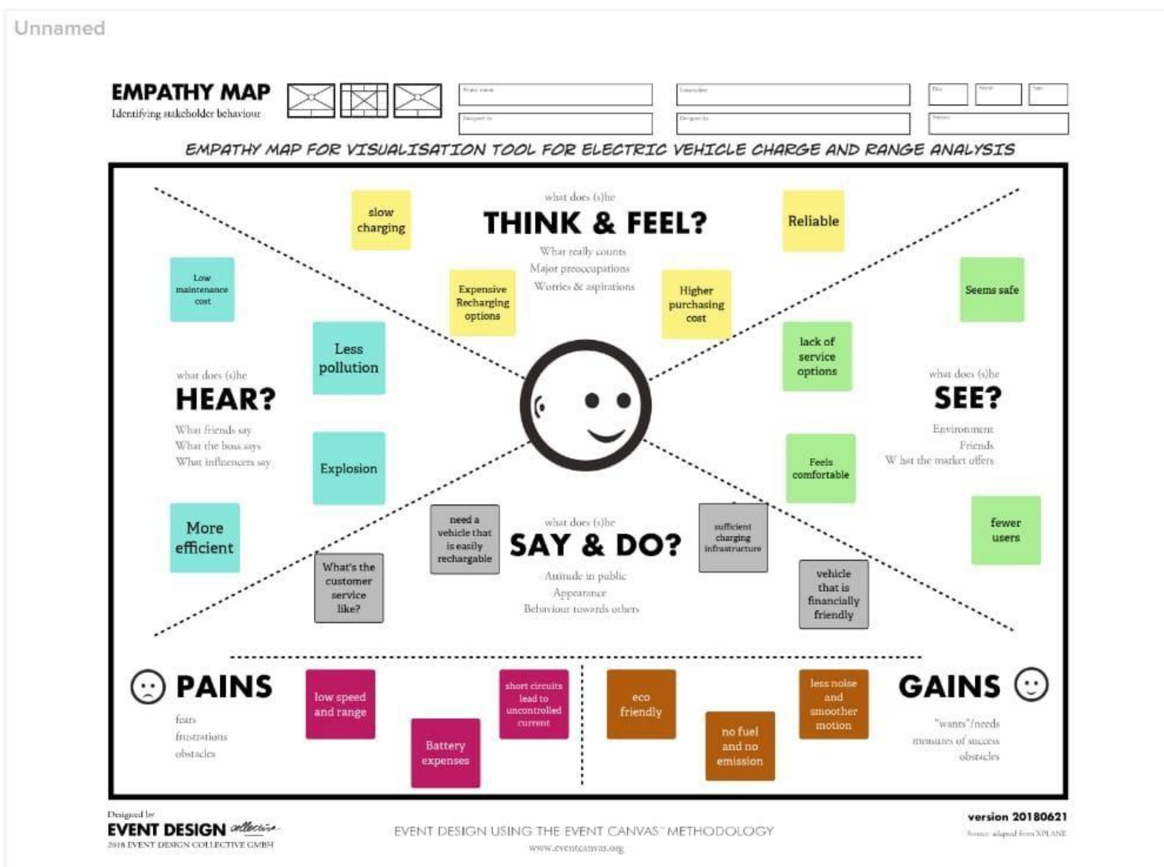
To accomplish this, research in the field has been deducted and the key factors which define and influence the state of infrastructure have been outlined. Existing visualizations related to the Mobility infrastructure as well as similar domains have been analyzed. A total of five visualizations have been designed to represent the current state of electric mobility infrastructure. Those include the distribution of charge points among the world, charging networks within Europe, charging speed, range of EVs (Electric Vehicles) and the relation between purchase price and range of EVs. The results have then been tested and re-evaluated with people representing the two target groups. They have then been implemented and presented on a landing page together with the findings of Gleb Podorozhnyy, whose project focused on the market side. Presented as a story and including background information as well as interesting facts and figures, an extensive overview of the current state of Emobility has been created. Hubject hopes to benefit from the project by attracting new clients as a thought leader of Emobility

1.2 Purpose:

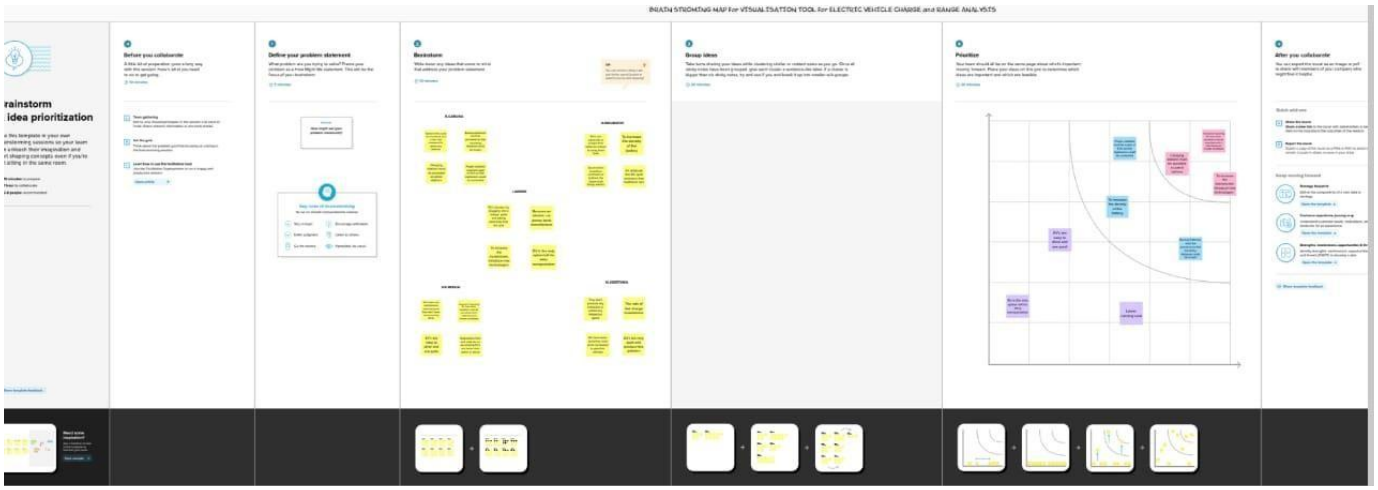
This EV charging system aims to subsidize and nullify the effect of these factors and provide a user-friendly design for charging. requirements. A fast-charging module is connected to the system, which boosts the power level and enhances the speed of charging. According to the theory of ampere-hour integration, SOC is particularly critical because it can accurately reflect the energy state, and its calculation formula is as follows: is the remaining electric quantity and is the initial electric quantity at a certain temperature or the rated charge at a certain temperature.

2. Problem Definition & Design Thinking:

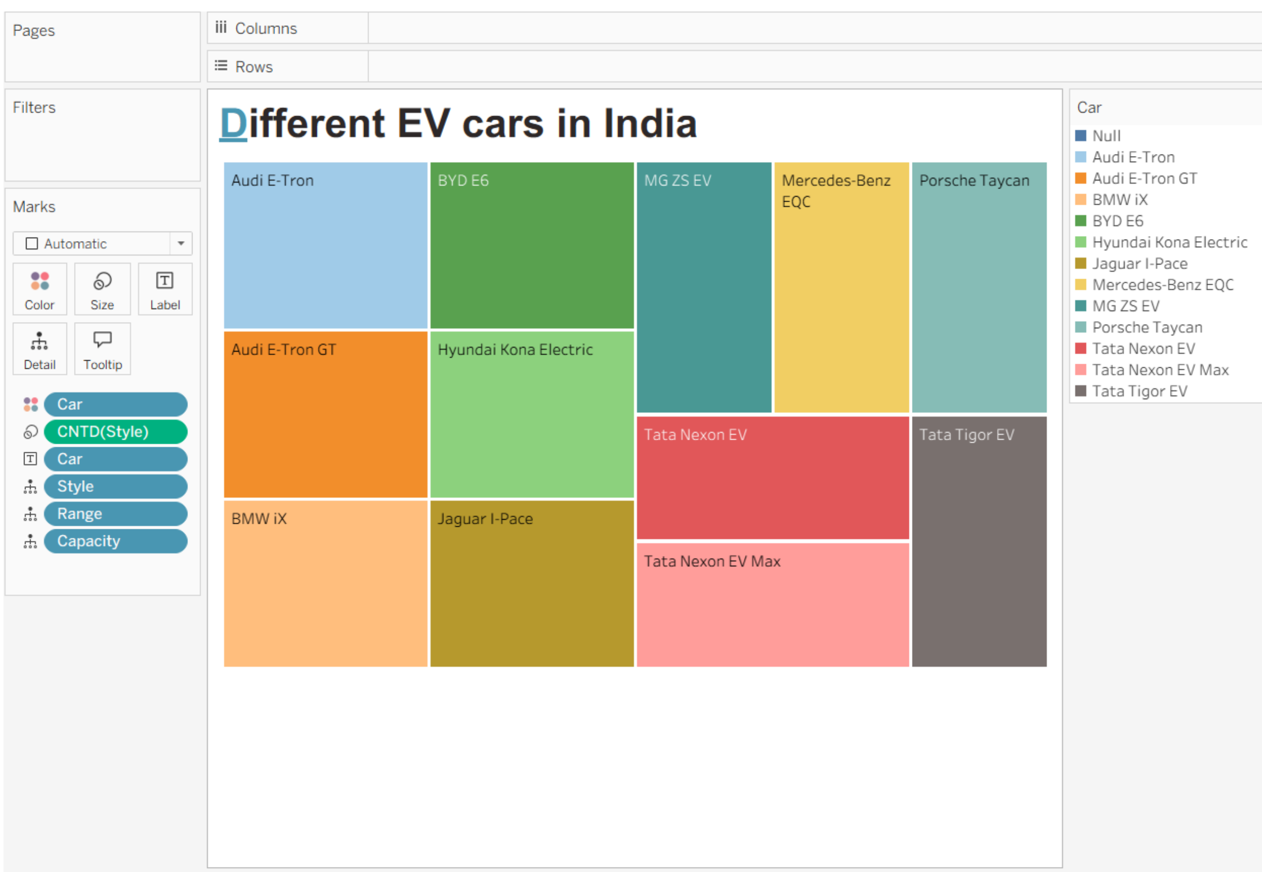
2.1 Empathy Map:

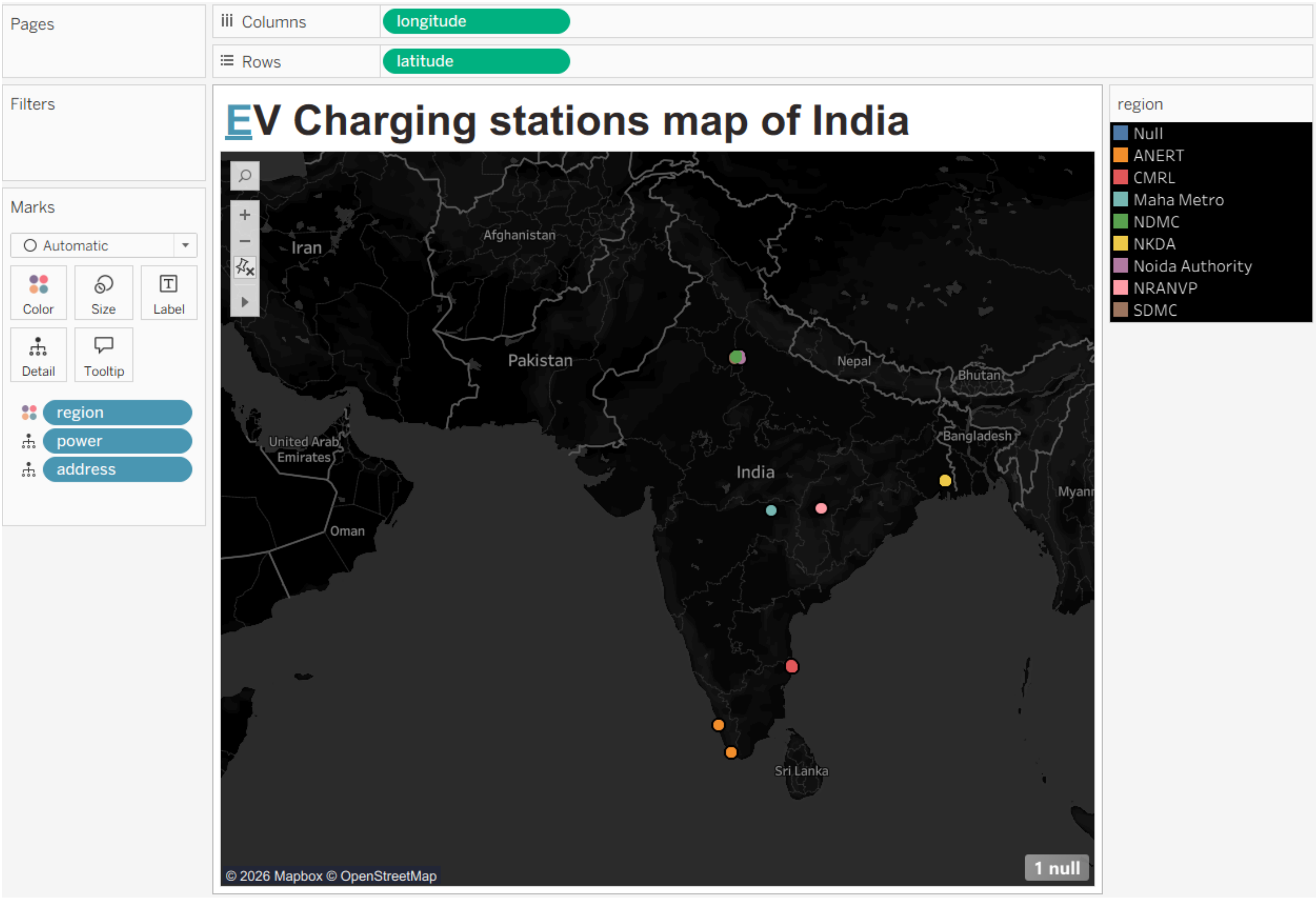


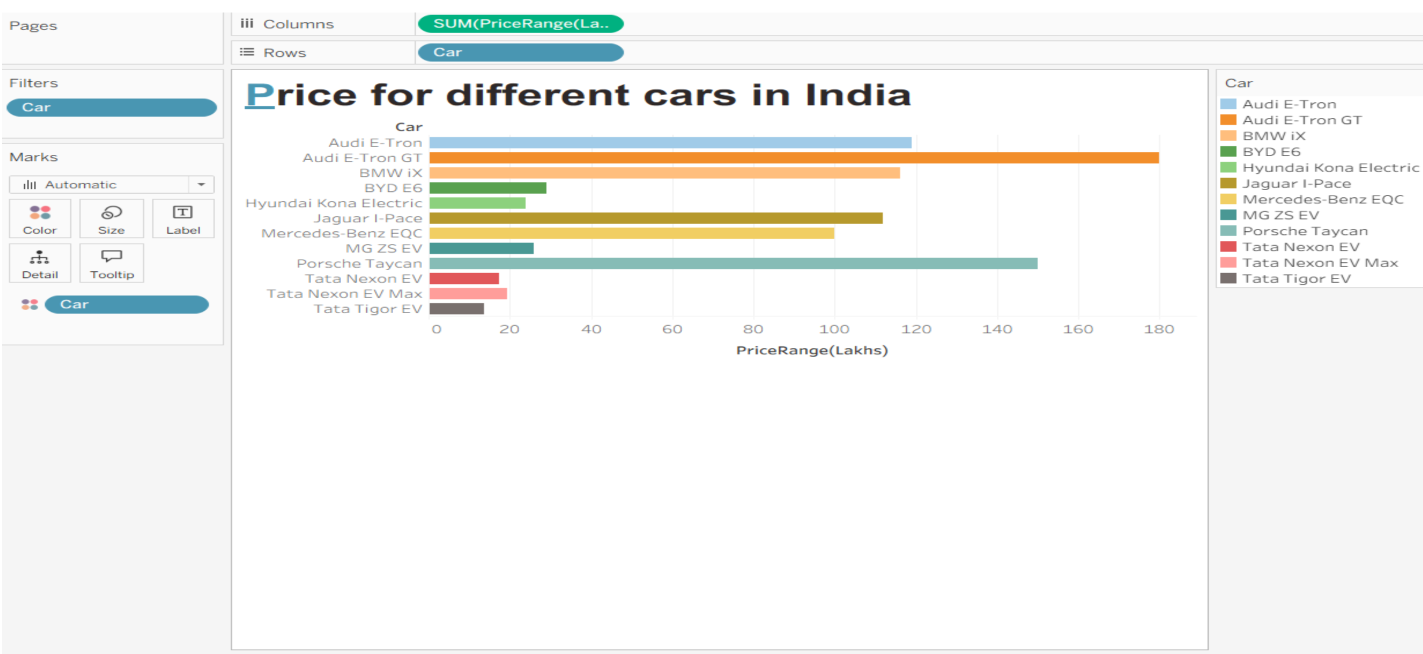
2.2 Ideation & Brainstorming Map:

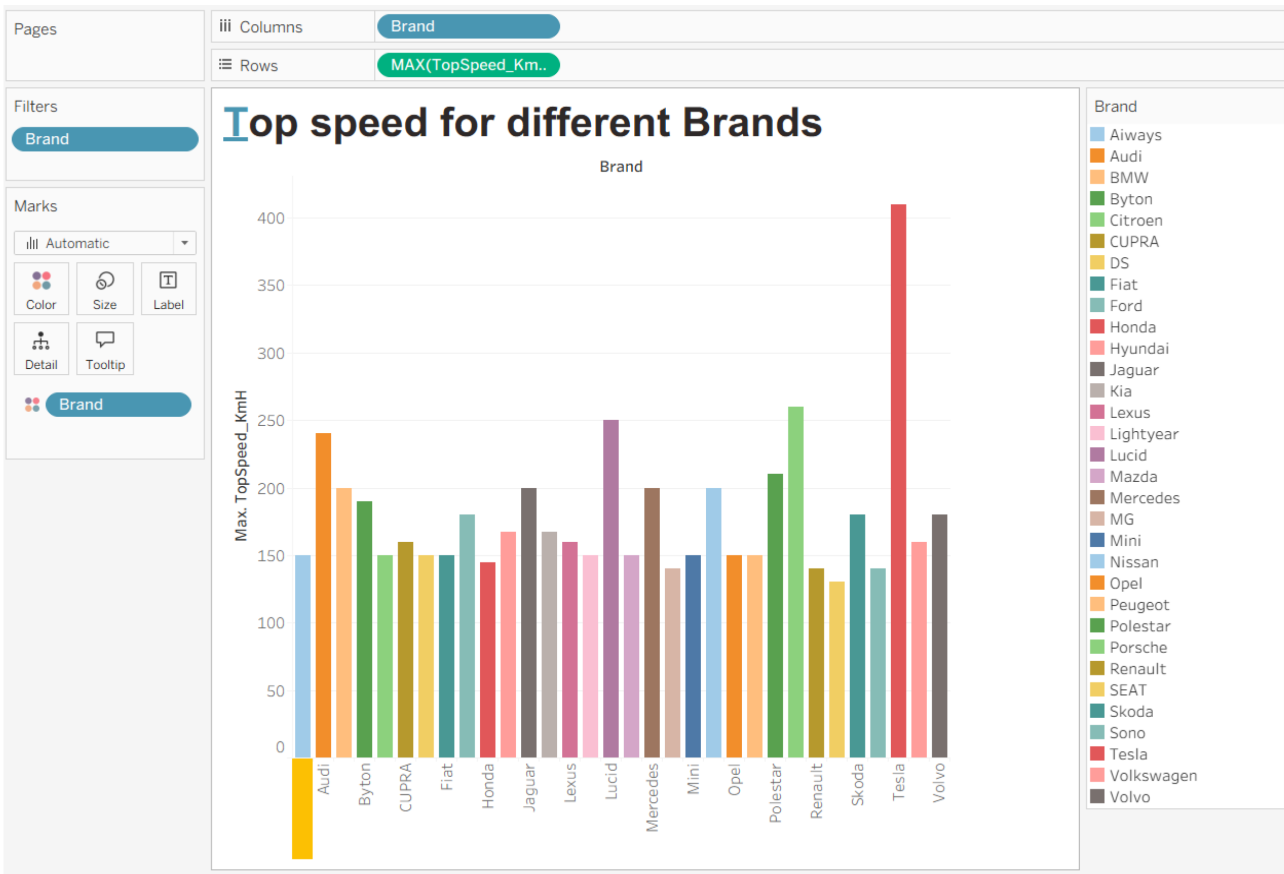

rainstorm
idea prioritization

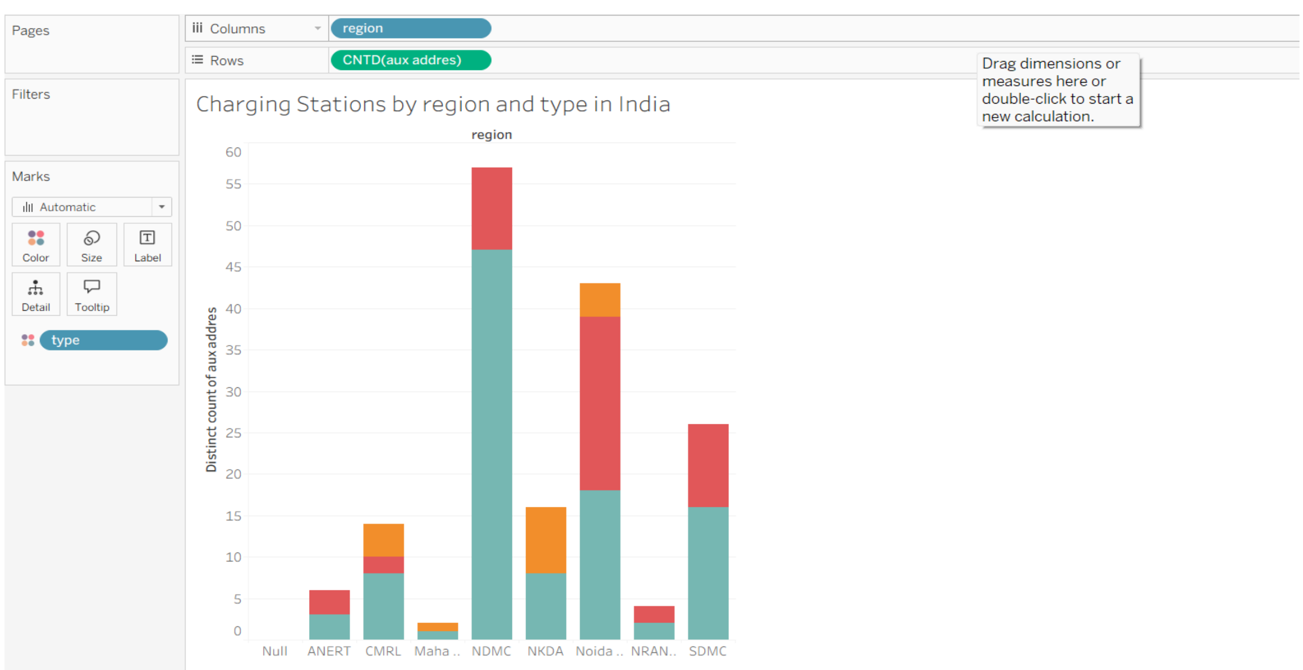
3. Results:

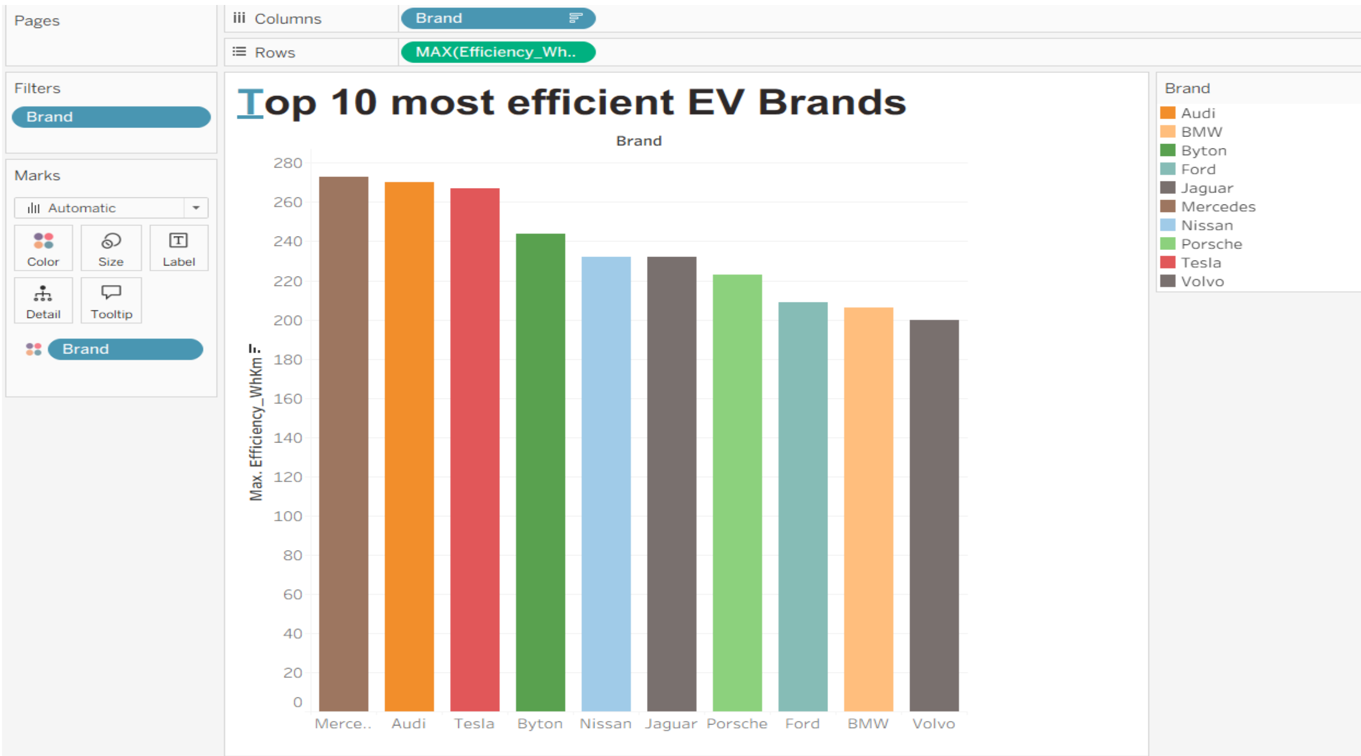

Pages
Columns
Rows
Filters
Marks
Automatic
Color
Size
Label
Detail
Tooltip
Car
CNTD(Style)
Car
Style
Range
Capacity
Different EV cars in India
Audi E-Tron
BYD E6
MG ZS EV
Mercedes-Benz EQC
Porsche Taycan
Audi E-Tron GT
Hyundai Kona Electric
Tata Nexon EV
Tata Tigor EV
Tata Nexon EV Max
BMW iX
Jaguar I-Pace
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

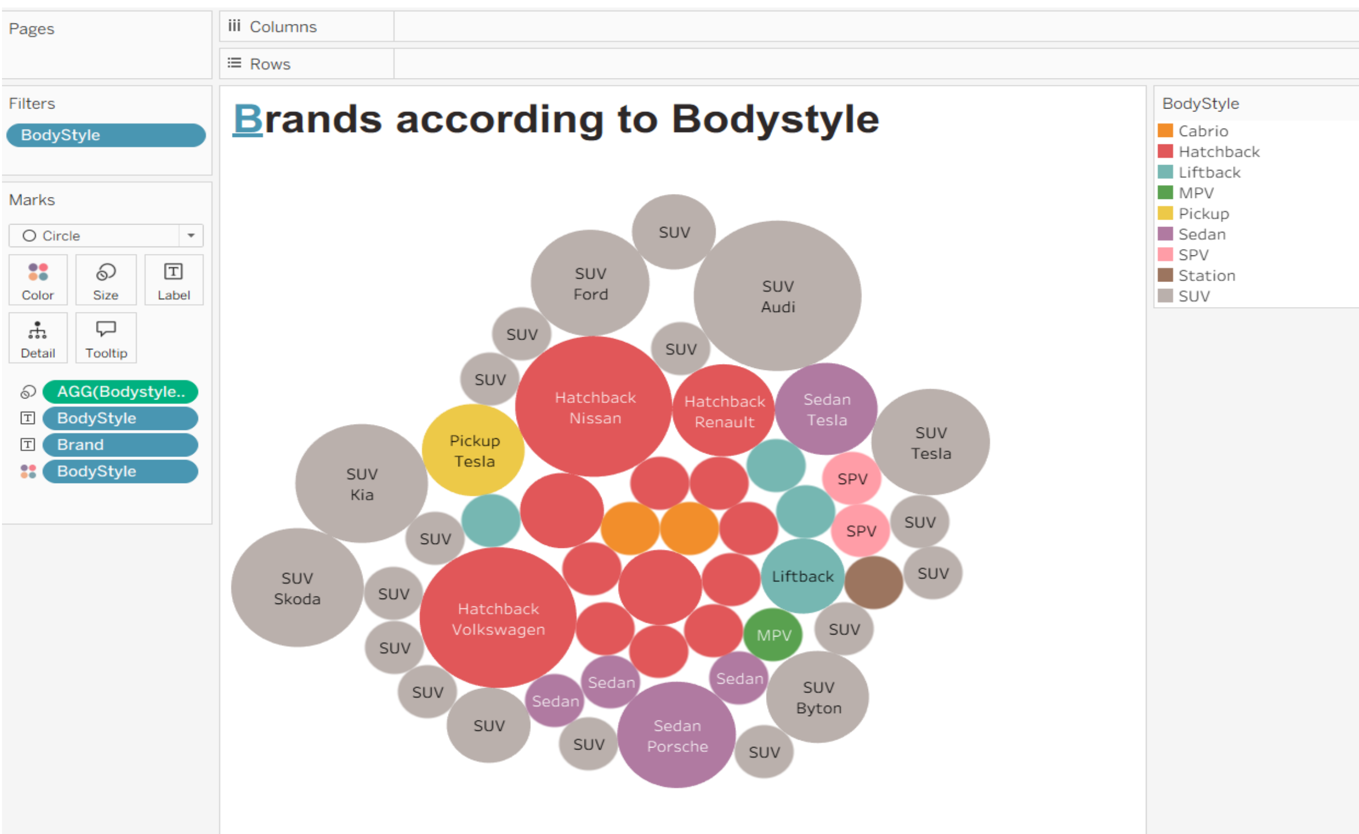

Pages
Columns
longitude
Rows
latitude
Filters
Marks
Automatic
Color
Size
Label
Detail
Tooltip
region
power
address
EV Charging stations map of India
Iran
Afghanistan
Pakistan
Nepal
Bhutan
Bangladesh
United Arab Emirates
India
Oman
Sri Lanka
© 2026 Mapbox © OpenStreetMap
1 null
region
Null
ANERT
CMRL
Maha Metro
NDMC
NKDA
Noida Authority
NRANVP
SDMC

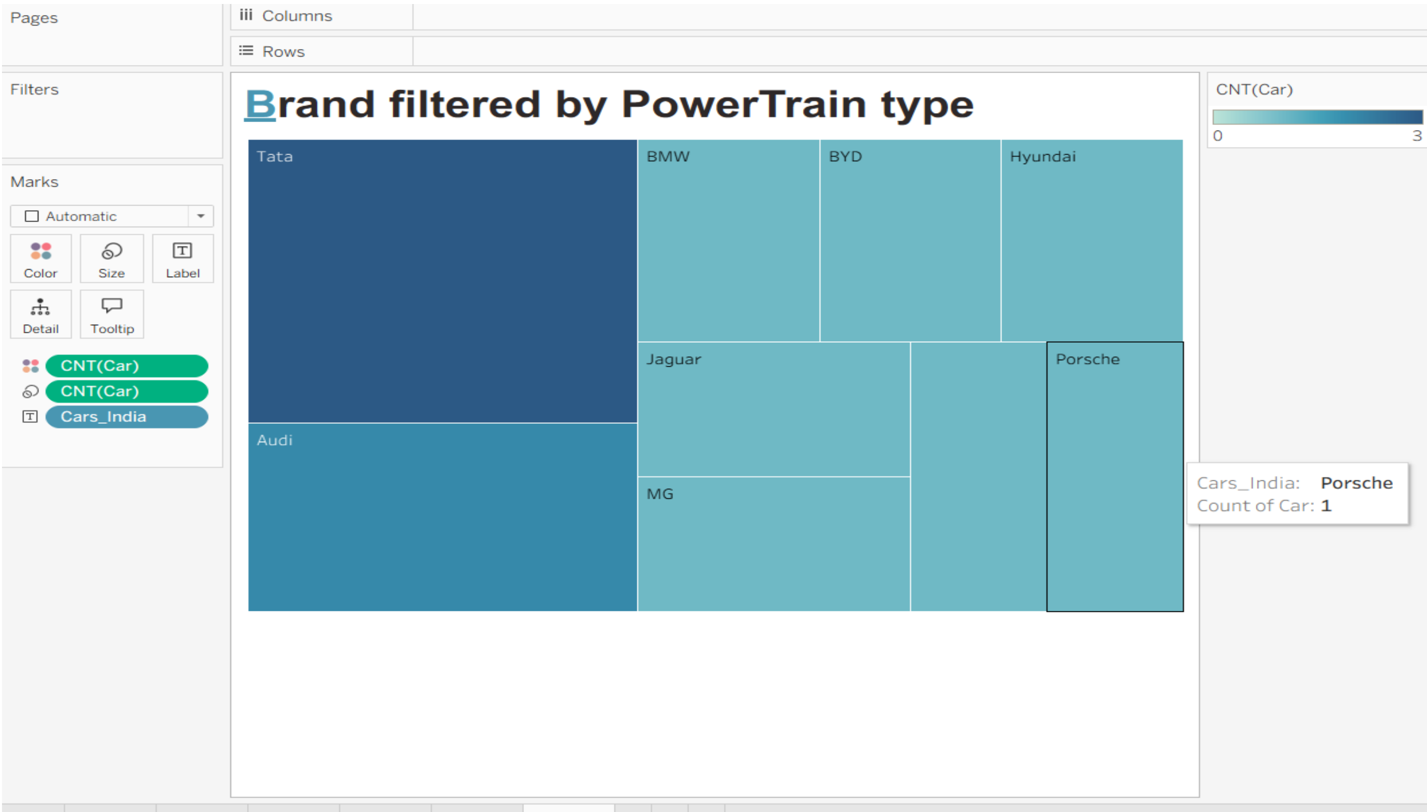

Pages
Columns
SUM(PriceRange(La..
Rows
Car
Filters
Car
Marks
Automatic
Color
Size
Label
Detail
Tooltip
Car
Price for different cars in India
Car
Audi E-Tron
Audi E-Tron GT
BMW iX
BYD E6
Hyundai Kona Electric
Jaguar I-Pace
Mercedes-Benz EQC
MG ZS EV
Porsche Taycan
Tata Nexon EV
Tata Nexon EV Max
Tata Tigor EV
0
20
40
60
80
100
120
140
160
180
PriceRange(Lakhs)

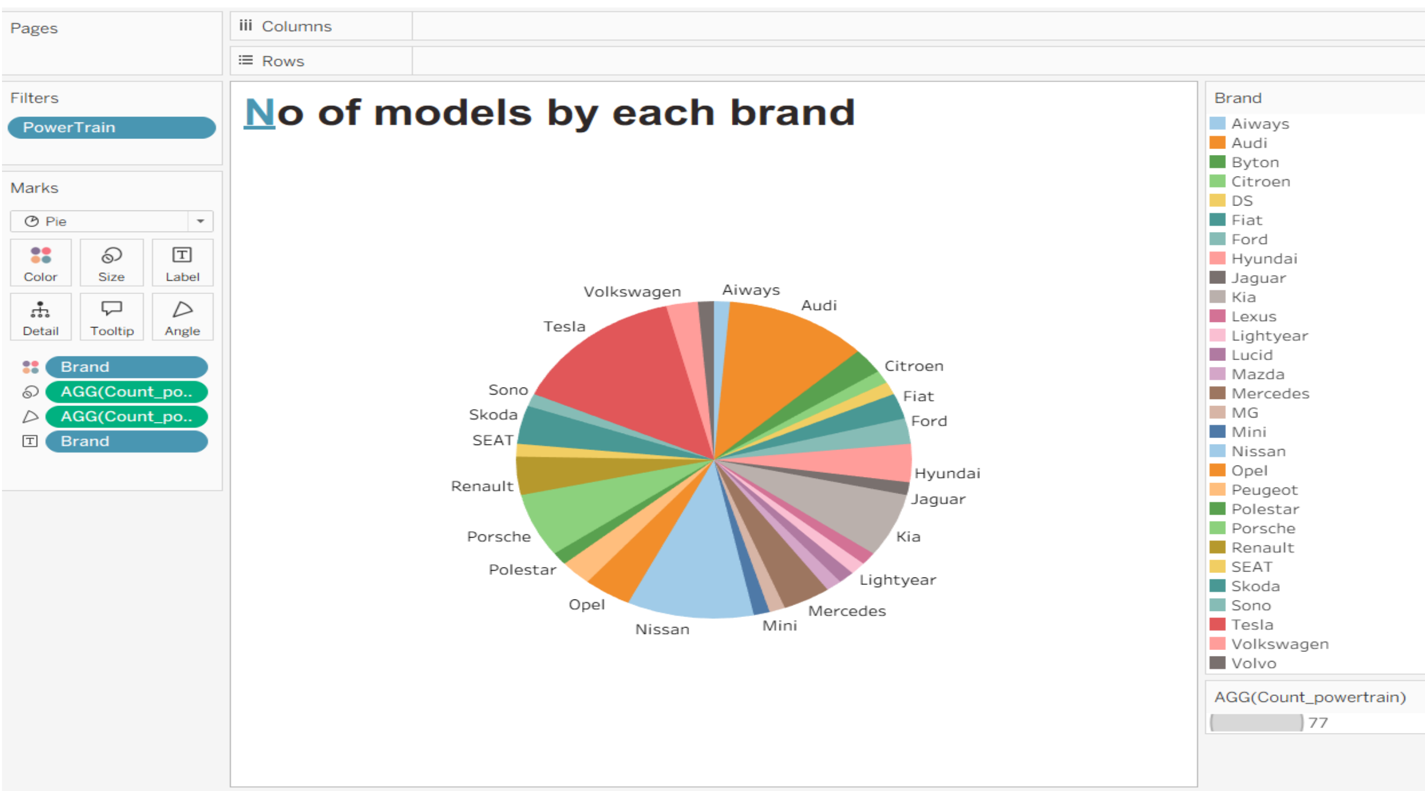

Pages
Columns
Brand
Rows
MAX(TopSpeed_Km..
Filters
Brand
Marks
Automatic
Color
Size
Label
Detail
Tooltip
Brand
Top speed for different Brands
Brand
Max. TopSpeed_KmH
400
350
300
250
200
150
100
50
0
Audi
Byton
CUPRA
Fiat
Honda
Jaguar
Lexus
Lucid
Mercedes
Mini
Opel
Polestar
Renault
Skoda
Tesla
Volvo
Brand
Aiways
Audi
BMW
Byton
Citroen
CUPRA
DS
Fiat
Ford
Honda
Hyundai
Jaguar
Kia
Lexus
Lightyear
Lucid
Mazda
Mercedes
MG
Mini
Nissan
Opel
Peugeot
Polestar
Porsche
Renault
SEAT
Skoda
Sono
Tesla
Volkswagen
Volvo


Pages
Columns
region
Rows
CNTD(aux addres)
Drag dimensions or measures here or double-click to start a new calculation.
Filters
Marks
Automatic
Color
Size
Label
Detail
Tooltip
type
Charging Stations by region and type in India
region
Distinct count of aux addres
60
55
50
45
40
35
30
25
20
15
10
5
0
Null
ANERT
CMRL
Maha ..
NDMC
NKDA
Noida ..
NRAN..
SDMC


Pages
Columns
Brand
Rows
MAX(Efficiency_Wh..
Filters
Brand
Marks
Automatic
Color
Size
Label
Detail
Tooltip
Brand
Top 10 most efficient EV Brands
Brand
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
Max. Efficiency_WhKm
Merce..
Audi
Tesla
Byton
Nissan
Jaguar
Porsche
Ford
BMW
Volvo
Brand
Audi
BMW
Byton
Ford
Jaguar
Mercedes
Nissan
Porsche
Tesla
Volvo


Pages
Columns
Rows
Filters
BodyStyle
Marks
Circle
Color
Size
Label
Detail
Tooltip
AGG(Bodystyle..
BodyStyle
Brand
BodyStyle
Brands according to Bodystyle
SUV
SUV Ford
SUV Audi
SUV
SUV
SUV
Hatchback Nissan
Hatchback Renault
Sedan Tesla
SUV Tesla
Pickup Tesla
SUV Kia
SPV
SPV
SUV
SUV
SUV Skoda
SUV
Liftback
SUV
Hatchback Volkswagen
SUV
MPV
SUV
SUV
Sedan
Sedan
Sedan
SUV Byton
SUV
SUV
Sedan Porsche
SUV
BodyStyle
Cabrio
Hatchback
Liftback
MPV
Pickup
Sedan
SPV
Station
SUV


Pages
Columns
Rows
Filters
Marks
Automatic
Color
Size
Label
Detail
Tooltip
CNT(Car)
CNT(Car)
Cars_India
Brand filtered by PowerTrain type
Tata
BMW
BYD
Hyundai
Jaguar
Porsche
Audi
MG
CNT(Car)
0
3
Cars_India: Porsche
Count of Car: 1


Pages
Columns
Rows
Filters
PowerTrain
Marks
Pie
Color
Size
Label
Detail
Tooltip
Angle
Brand
AGG(Count_po..
AGG(Count_po..
Brand
No of models by each brand
Volkswagen
Aiways
Audi
Tesla
Citroen
Fiat
Ford
Sono
Skoda
SEAT
Hyundai
Jaguar
Renault
Kia
Porsche
Polestar
Lightyear
Opel
Mercedes
Nissan
Mini
Brand
Aiways
Audi
Byton
Citroen
DS
Fiat
Ford
Hyundai
Jaguar
Kia
Lexus
Lightyear
Lucid
Mazda
Mercedes
MG
Mini
Nissan
Opel
Peugeot
Polestar
Porsche
Renault
SEAT
Skoda
Sono
Tesla
Volkswagen
Volvo
AGG(Count_powertrain)
77

4. ADVANTAGES & DISADVANTAGES:

4.1 ADVANTAGES:

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.
Electric vehicles have very low maintenance costs because they don't have as many moving parts as an internal combustion vehicle. The servicing requirements for electric vehicles are lesser than the conventional petrol or diesel vehicles. Therefore, the yearly cost of running an electric vehicle is significantly low.

The availability of fossil fuels is limited, and their use is destroying our planet. Toxic emissions from petrol and diesel vehicles lead to long-term, adverse effects on public health. The emissions impact of electric vehicles is much lower than petrol or diesel vehicles. From an efficiency perspective, electric vehicles can covert around 60% of the electrical energy from the grid to power the wheels, but petrol or diesel cars can only convert 17%-21% of the energy stored in the fuel to the wheels. That is a waste of around 80%. Fully electric vehicles have zero tailpipe emissions, but even when electricity production is taken into account, petrol or diesel vehicles emit almost 3 times more carbon dioxide than the average EV. To reduce the impact of charging electric vehicles, India is ambitious to achieve about 40 percent cumulative electric power installed capacity from non-fossil fuel-based energy resources by the year 2030. Therefore, electric vehicles are the way forward for Indian transport, and we must switch to them now.

4.2 Disadvantages:

Compared to standard automobiles with a one-time charge, electric vehicles have a shorter driving range. Furthermore, there are few charging stations accessible, and charging time is also quite long, so they are concerned about a breakdown if the car requires charging in the middle of the journey.

The disadvantages for the charging stations for electric cars:

- You are better to continuously "top up" the charge instead of draining the battery which can take between 4-8 hours to charge, depending on the charger.
- You need to research where the nearest EV charging points are.
- Environmental factors can affect the performance of the battery such as temperature.

Range anxiety refers to an EV owner's fear that the vehicle's battery does not have sufficient charge for it to reach the destination. It is linked to how far the EV can travel on a single battery charge and the availability of charging points.

5. APPLICATIONS:

OPERATING RANGE – TAKING IT ALL INTO ACCOUNT

So what is the actual operating range? Operating range takes this battery health factor into consideration and also accounts for weather (use of HVAC systems in extreme weather), varying terrain, driver behavior, frequency of stops, and any potential added weight of an agency's specific vehicle configuration that may differ from the base model. These elements can have a significant impact on vehicle efficiency and resulting operating range when buses are out on the road in real service scenarios.

OPERATING RANGE = Usable energy in batteries (kWh) ÷
Operating efficiency (kWh/mile)

- **Range**
  - Range refers to how far a vehicle can go on a single charge. Range is calculated by dividing the amount of energy in the batteries (kWh) by the efficiency of the vehicle (kWh/mile).
- **Efficiency**
  - Vehicle efficiency (kWh/mile) is defined by the amount of energy consumed per mile, measured in terms of kilowatt hours per mile.
- **Nominal range**
  - Nominal range is defined by taking the total nameplate energy within the battery pack as reported by the OEM and dividing this number by the vehicle efficiency score as reported by The Altoona Bus Research and Testing Center (Altoona).
- **Operating range**
  - Operating range is calculated by dividing the <u>usable</u> energy within the battery pack by the operating efficiency of the vehicle.
- **Usable energy**

o Usable energy refers to the amount of energy that is accessible after taking battery health limitations into account, which enables a more consistent and predictable energy draw over the lifetime of the battery. • **Altoona tested efficiency.** o Altoona tested efficiency refers to the vehicle efficiency as reported by the Altoona Bus Research and Testing Center, which is based on dynamometer testing on simulated courses that represent driving central business district, arterial, and commuter routes.

- **Operating efficiency**
  - Operating efficiency considers weather, varying terrain, driver behavior, frequency of stops, and vehicle weight.

Grid Infrastructure

Copper is an integral part of grid infrastructure because of its reliability, efficiency and performance. Copper's properties are vital to the interconnected network of plants, devices and lines that generate and distribute electricity and power throughout the country.

There are several key pieces of infrastructure that are built to support the delivery of electricity to consumers.

Underground Transmission

In underground power transmission, copper plays a very important role because of its unique mechanical and physical properties. Copper is a preferred underground cable material because of its high electrical and thermal conductivity, strength, formability, ease of joining, resistance to creep and resistance to corrosion.

CONCLUSION:

Both developed and developing countries have become more active in EV introduction and diffusion. In developed countries, the government has led the promotion of next-generation environment-friendly vehicles. In the industrial world, not only conventional auto manufacturers but also large and small enterprises have joined the EV business as new business opportunities. In accordance with the implementation of many pilot projects and EV related events, public expectation on EVs is high. However, there is no clear indication for full-fledged diffusion. This is because of high prices of EVs, limited models, lack of charging infrastructure, and lack of trust in the market in terms of life span of EVs and safety. On the other hand, big auto manufacturers have become bolder in EV development, which is seen to address the above-mentioned problems and accelerate EV diffusion.

6. FUTURE SCOPE:

The future of the electric vehicles global market is expanding at a CAGR of 21.7%, which is expected to continue. Growth from 8.1 million units is anticipated to reach 39.21 million by 2030. Multiple factors, including worries about pollution, are driving this rapid expansion.

This is consistent to reach net zero carbon emissions by 2070. The Indian electric vehicle market was worth USD 1,434.04 million in 2021, and it is predicted to grow to USD 15,397.19 million by 2027, at a CAGR of 47.09% during the forecast period (2022-2027).

An electric vehicle charging station is equipment that connects an electric vehicle (EV) to a source of electricity to recharge electric cars, neighborhood electric vehicles and plug-in hybrids.

The basic conclusion is that when it comes to climate change and air quality, electric cars are clearly preferable to petrol or diesel cars. Contrary to some public doubts and uncertainties about the environmental benefits of electric cars, science is increasingly clear.

7. Links :

Demo Video Link : https://drive.google.com/file/d/18cMu0YIzGca-IiD92_pUJYO0la-wZ7qR/view?usp=sharing

Tableau Dashboard Link:
https://public.tableau.com/app/profile/santhoshini.m/viz/ElectricCarsAnalysis_17715285119990/ElectriCarsAnalyticsDashboard

Tableau Story Link :
https://public.tableau.com/app/profile/santhoshini.m/viz/ElectricCarsAnalysis_17715285119990/StoryofElectricCars?publish=yes