Market Segmentation of Electronic Vehicles in India

Dataset Details: **EV_cars_India**

Dataset Details:

1] Brands and models of EVs in India with their attributes

2] State wise distribution of 2,3,4 wheeler EV s and passenger cars in India

3] Electric Vehicle Charging Stations In INDIA Analysis

Imports

```
# importing the dependencies
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.decomposition import PCA
from sklearn.cluster import KMeans
import numpy as np
import warnings
warnings.filterwarnings("ignore")
```

Fetching Datasets

```
# fetching dataset - 1
df1=pd.read_csv('/content/EV_cars_India_2023 (3).csv')
df1
```

	Car_name	Car_price	Batter_cap	Drive_range	Power	Charge_time	transmission	Boot_space	Top_speed
0	MG Comet EV	7.98 lakh	17.3 kWh	230 km/full charge	41.42 Bhp	7 Hours	Automatic	NaN	NaN
1	Tata Tiago EV	8.69 - 11.99 lakh	19.2 KWh	250 km/full charge	60.34 - 73.75 Bhp	58 Min(10-80%)	240 L (Liters)	Automatic	NaN
2	Tata Tigor EV	12.49 - 13.75 lakh	26 kWh	315 km/full charge	73.75 Bhp	7.5h	316 L (Liters)	Automatic	NaN

3	MG ZS EV	23.38 - 27.40 lakh	50.3 kWh	461 km/full charge	174.33 Bhp	8.5 to 9 Hours	Automatic	NaN	NaN
4	BYD Atto 3	33.99 - 34.49 lakh	60.48 kWh	521 km/full charge	201.15 Bhp	9.5-10 Hours	440L L (Liters)	Automatic	NaN
5	Hyundai Kona Electric	23.84 - 24.03 lakh	39.2kWh	452 km/full charge	134.1 Bhp	6.16 Hours	Automatic	NaN	NaN
6	Mahindra XUV400 EV	15.99 - 18.99 lakh	34.5 kWh	375 s km/full charge	50min	Automatic	NaN	NaN	NaN
7	Tata Nexon EV Max	16.49 - 19.54 lakh	40.5 kWh	453 km/full charge	141.04 Bhp	15 Hours	350 L (Liters)	Automatic	NaN
8	Mercedes-Benz EQS	1.59 - 2.4 lakh	17.3 kWh	230 km/full charge	41.42 Bhp	7 Hours	Automatic	NaN	NaN
9	Audi e-tron GT	1.7 cr	19.2 KWh	250 km/full charge	60.34 - 73.75 Bhp	58 Min(10-80%)	240 L (Liters)	Automatic	NaN
10	BMW i4	73.90 - 77.50 lakh	26 kWh	315 km/full charge	73.75 Bhp	7.5h	316 L (Liters)	Automatic	NaN
11	BYD E6	29.15 lakh	50.3 kWh	461 km/full charge	174.33 Bhp	8.5 to 9 Hours	Automatic	NaN	NaN
12	Porsche Taycan	1.53 - 2.3 lakh	60.48 kWh	521 km/full charge	201.15 Bhp	9.5-10 Hours	440L L (Liters)	Automatic	NaN
13	Audi RS e-tron GT	1.9 cr	39.2kWh	452 km/full charge	134.1 Bhp	6.16 Hours	Automatic	NaN	NaN
14	Mahindra E Verito	9.13 - 9.46 lakh	34.5 kWh	375 s km/full charge	50min	Automatic	NaN	NaN	NaN
15	Strom Motors R3	4.50 lakh	40.5 kWh	453 km/full charge	141.04 Bhp	15 Hours	350 L (Liters)	Automatic	NaN
16	Tata Nexon EV Prime	14.49 - 17.19 lakh	71.7 kWh	415 km/full charge	93.87 Bhp	1.5H	580 L (Liters)	Automatic	NaN
17	Hyundai			320 km/full					

17	IONIQ 5	44.95 lakh	29.2 kWh	charge	56.22 Bhp	10.5 Hours	315 L (Liters)	Automatic	NaN
18	Kia EV6	60.95 - 65.95 lakh	77.4 kWh	708 km/full charge	225.86 - 320.55 Bhp	18 Min (0-80%)	Automatic	NaN	NaN

```
df1.shape
```

```
(30, 9)
```

```
df1.columns
```

```
Index(['Car_name', 'Car_price', 'Batter_cap', 'Drive_range', 'Power',
       'Charge_time', 'transmission', 'Boot_space', 'Top_speed'],
      dtype='object')
```

```
df1.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 30 entries, 0 to 29
Data columns (total 9 columns):
 #   Column        Non-Null Count  Dtype 
---  ------        --------------  ----- 
 0   Car_name      30 non-null     object
 1   Car_price     30 non-null     object
 2   Batter_cap    27 non-null     object
 3   Drive_range   30 non-null     object
 4   Power         30 non-null     object
 5   Charge_time   30 non-null     object
 6   transmission  28 non-null     object
 7   Boot_space    12 non-null     object
 8   Top_speed     6 non-null      object
dtypes: object(9)
memory usage: 2.2+ KB
```

finding null values in the dataset

```
# finding null values in the dataset
df1.isnull().sum()
```

```
Car_name         0
Car_price        0
Batter_cap       3
Drive_range      0
Power            0
Charge_time      0
transmission     2
Boot_space      18
Top_speed       24
dtype: int64
```

```
df1.describe()
```

	Car_name	Car_price	Batter_cap	Drive_range	Power	Charge_time	transmission	Boot_space	Top_speed
count	30	30	27	30	30	30	28	12	6
unique	30	29	16	18	18	14	12	2	4
top	MG Comet EV	1.9 cr	17.3 kWh	230 km/full charge	41.42 Bhp	Automatic	Automatic	Automatic	200kmph
freq	1	2	2	2	2	7	12	10	3

```
def charge(dataframe):
    sbn.countplot(x=dataframe['Power'])
    plt.title('Count Plot of a Power')
    plt.xlabel('Power')
    plt.ylabel('Count')
charge
```

charge
def charge(dataframe)

<no docstring>

```
df2 = pd.read_csv("/content/EV Stats-1 (1).csv")
```

```
df2.shape
```

```
(30, 10)
```

```
df2.columns
```

```
Index(['Sl. No', 'State',
       'Two Wheelers (Category L1 & L2 as per Central Motor Vehicles Rules',
       'Two Wheelers (Category L2 (CMVR))',
       'Two Wheelers (Max power not exceeding 250 Watts)',
       'Three Wheelers (Category L5 slow speed as per CMVR)',
       'Three Wheelers (Category L5 as per CMVR)',
       'Passenger Cars (Category M1 as per CMVR)', 'Buses', 'Total in state'],
      dtype='object')
```

```
df2.describe()
```

	Sl. No	Two Wheelers (Category L1 & L2 as per Central Motor Vehicles Rules	Two Wheelers (Category L2 (CMVR))	Two Wheelers (Max power not exceeding 250 Watts)	Three Wheelers (Category L5 slow speed as per CMVR)	Three Wheelers (Category L5 as per CMVR)	Passenger Cars (Category M1 as per CMVR)	Buses	Total in state
count	30.000000	30.000000	30.000000	30.000000	30.000000	30.000000	30.000000	30.000000	30.000000
mean	15.500000	918.300000	468.966667	3751.266667	12.966667	24.000000	3519.033333	0.900000	8695.433333
std	8.803408	1482.441466	625.711098	4383.917198	30.737468	41.484521	4860.187299	3.835856	9911.814513
min	1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	6.000000
25%	8.250000	19.000000	18.500000	65.000000	0.000000	0.000000	222.250000	0.000000	589.500000

```
df2.info()
```

```
<class 'pandas.core.frame.DataFrame'>
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 30 entries, 0 to 29
Data columns (total 10 columns):
 #   Column                                                        Non-Null Count  Dtype 
---  ------                                                        --------------  ----- 
 0   Sl. No                                                        30 non-null     int64 
 1   State                                                         30 non-null     object
 2   Two Wheelers (Category L1 & L2 as per Central Motor Vehicles Rules  30 non-null     int64 
 3   Two Wheelers (Category L2 (CMVR))                             30 non-null     int64 
 4   Two Wheelers (Max power not exceeding 250 Watts)              30 non-null     int64 
 5   Three Wheelers (Category L5 slow speed as per CMVR)           30 non-null     int64 
 6   Three Wheelers (Category L5 as per CMVR)                      30 non-null     int64 
 7   Passenger Cars (Category M1 as per CMVR)                      30 non-null     int64 
 8   Buses                                                         30 non-null     int64 
 9   Total in state                                                30 non-null     int64 
dtypes: int64(9), object(1)
memory usage: 2.5+ KB
```

```
# finding null values in the dataset
df2.isnull().sum()
```

```
Sl. No                                                        0
State                                                         0
Two Wheelers (Category L1 & L2 as per Central Motor Vehicles Rules    0
Two Wheelers (Category L2 (CMVR))                             0
Two Wheelers (Max power not exceeding 250 Watts)              0
Three Wheelers (Category L5 slow speed as per CMVR)           0
Three Wheelers (Category L5 as per CMVR)                      0
Passenger Cars (Category M1 as per CMVR)                      0
Buses                                                         0
Total in state                                                0
dtype: int64
```

Performing Exploratory Data Analysis(EDA)

Data Description and analysis for both datasets

```
# getting a statistical summary of the datasets
d1 = df1.describe()
d2 = df2.describe()
display('<<< DATASET 1 >>>', d1, '<<< DATASET 2 >>>', d2)
```

'<<< DATASET 1 >>>'

	Car_name	Car_price	Batter_cap	Drive_range	Power	Charge_time	transmission	Boot_space	Top_speed
count	30	30	27	30	30	30	28	12	6
unique	30	29	16	18	18	14	12	2	4
top	MG Comet EV	1.9 cr	17.3 kWh	230 km/full charge	41.42 Bhp	Automatic	Automatic	Automatic	200kmph
freq	1	2	2	2	2	7	12	10	3

'<<< DATASET 2 >>>'

	Sl. No	Two Wheelers (Category L1 & L2 as per Central Motor Vehicles Rules	Two Wheelers (Category L2 (CMVR))	Two Wheelers (Max power not exceeding 250 Watts)	Three Wheelers (Category L5 slow speed as per CMVR)	Three Wheelers (Category L5 as per CMVR)	Passenger Cars (Category M1 as per CMVR)	Buses	Total in state
count	30.000000	30.000000	30.000000	30.000000	30.000000	30.000000	30.000000	30.000000	30.000000
mean	15.500000	918.300000	468.966667	3751.266667	12.966667	24.000000	3519.033333	0.900000	8695.433333
std	8.803408	1482.441466	625.711098	4383.917198	30.737468	41.484521	4860.187299	3.835856	9911.814513
min	1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	6.000000
25%	8.250000	10.000000	18.500000	65.000000	0.000000	0.000000	232.250000	0.000000	580.500000

```
# checking the shape (# of rows and columns) of the datasets
print('DF1 Shape: ', df1.shape)
print('DF2 Shape: ', df2.shape)
```

```
DF1 Shape:  (30, 9)
```

```
DF2 Shape:  (30, 10)
```

```
# checking the info (columns, datatypes, nulls) of the datasets
print(' <<< DATASET 1 >>> ')
print(df1.info())
print('\n <<< DATASET 2 >>>')
print(df2.info())
```

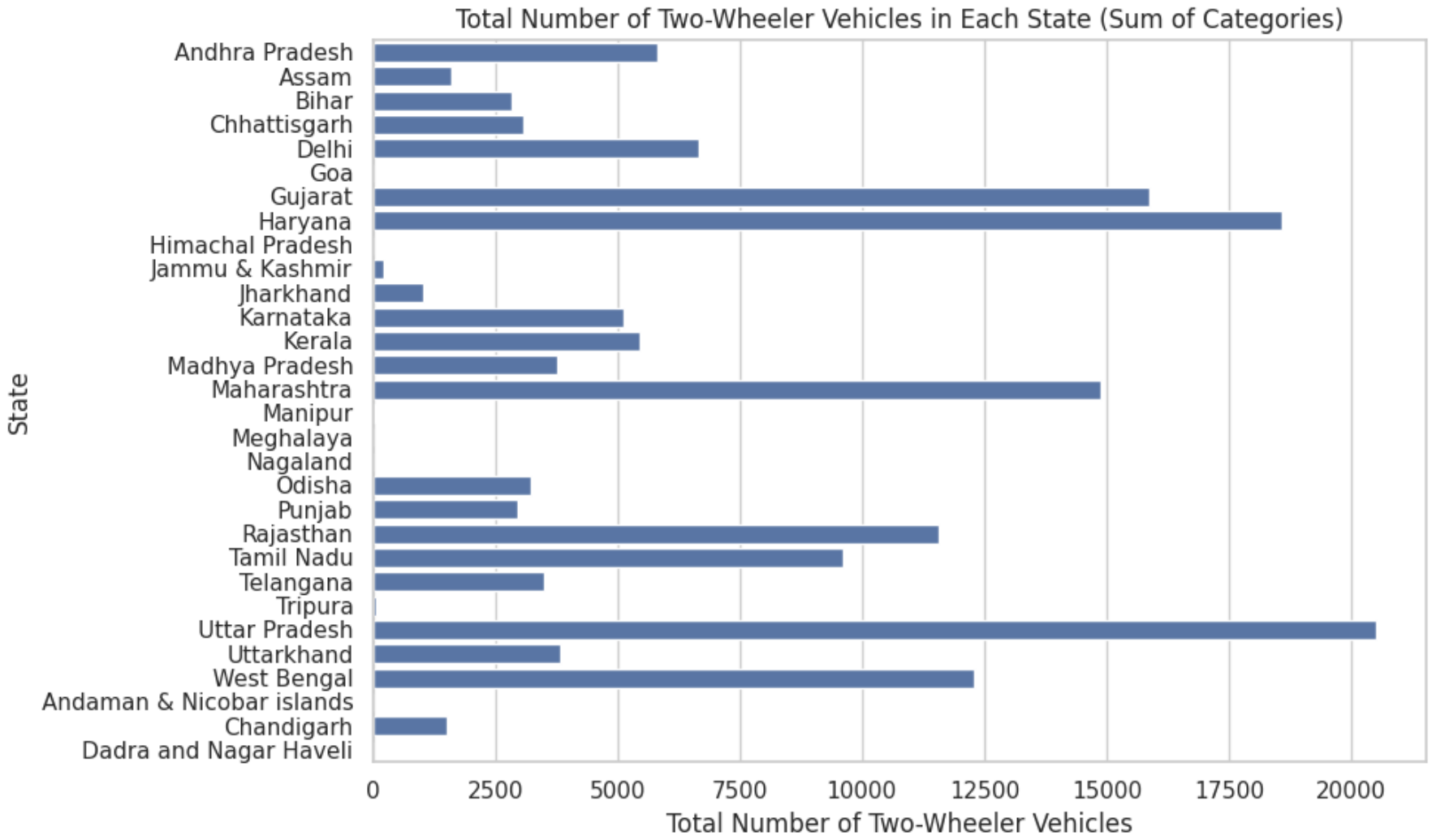
```
 <<< DATASET 1 >>>
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 30 entries, 0 to 29
Data columns (total 9 columns):
 #   Column        Non-Null Count  Dtype 
---  ------        --------------  ----- 
 0   Car_name      30 non-null     object
 1   Car_price     30 non-null     object
 2   Batter_cap    27 non-null     object
 3   Drive_range   30 non-null     object
 4   Power         30 non-null     object
 5   Charge_time   30 non-null     object
 6   transmission  28 non-null     object
 7   Boot_space    12 non-null     object
 8   Top_speed     6 non-null      object
dtypes: object(9)
memory usage: 2.2+ KB
None

 <<< DATASET 2 >>>
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 30 entries, 0 to 29
Data columns (total 10 columns):
 #   Column                                                          Non-Null Count  Dtype 
---  ------                                                          --------------  ----- 
 0   Sl. No                                                          30 non-null     int64 
 1   State                                                           30 non-null     object
 2   Two Wheelers (Category L1 & L2 as per Central Motor Vehicles Rules  30 non-null     int64 
 3   Two Wheelers (Category L2 (CMVR))                               30 non-null     int64 
 4   Two Wheelers (Max power not exceeding 250 Watts)                30 non-null     int64 
 5   Three Wheelers (Category L5 slow speed as per CMVR)             30 non-null     int64 
 6   Three Wheelers (Category L5 as per CMVR)                        30 non-null     int64 
 7   Passenger Cars (Category M1 as per CMVR)                        30 non-null     int64 
```

```
 7   Passenger Cars (Category M1 as per CMVR)                30 non-null     int64
 8   Buses                                                   30 non-null     int64
 9   Total in state                                          30 non-null     int64
dtypes: int64(9), object(1)
memory usage: 2.5+ KB
None
```

Analysis of 2 Wheeler EVs

UttarPradesh, Gujrat, Haryana are among the top states with the majority of EV 2W vehicles, while the remaining states have less number .

```
# Sum the three columns to get the total number of two-wheeler vehicles

df2['Total Two Wheelers'] = df2[['Two Wheelers (Category L1 & L2 as per Central Motor Vehicles Rules',
                                 'Two Wheelers (Category L2 (CMVR))',
                                 'Two Wheelers (Max power not exceeding 250 Watts)']].sum(axis=1)

# Create a barplot using seaborn
plt.figure(figsize=(10, 6))
sns.set(style="whitegrid")  # Optional: Set the style of the plot

# Plot the total number of two-wheeler vehicles using sns.barplot
sns.barplot(x="Total Two Wheelers", y="State", data=df2, orient="h")

# Customize plot labels and appearance
plt.xlabel("Total Number of Two-Wheeler Vehicles")
plt.ylabel("State")
plt.title("Total Number of Two-Wheeler Vehicles in Each State (Sum of Categories)")

# Show the plot
plt.tight_layout()
plt.show()
```



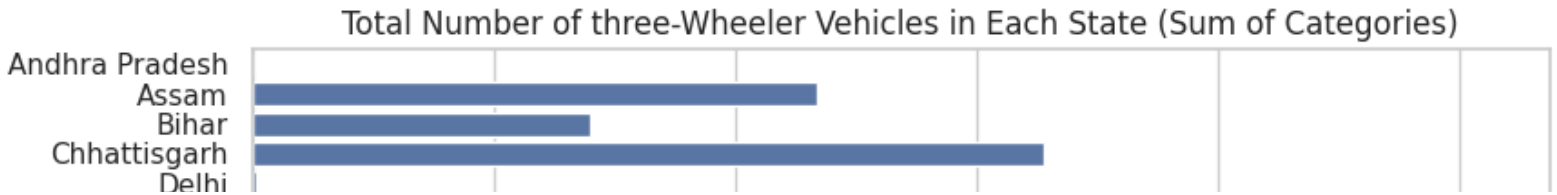
OBSERVATION

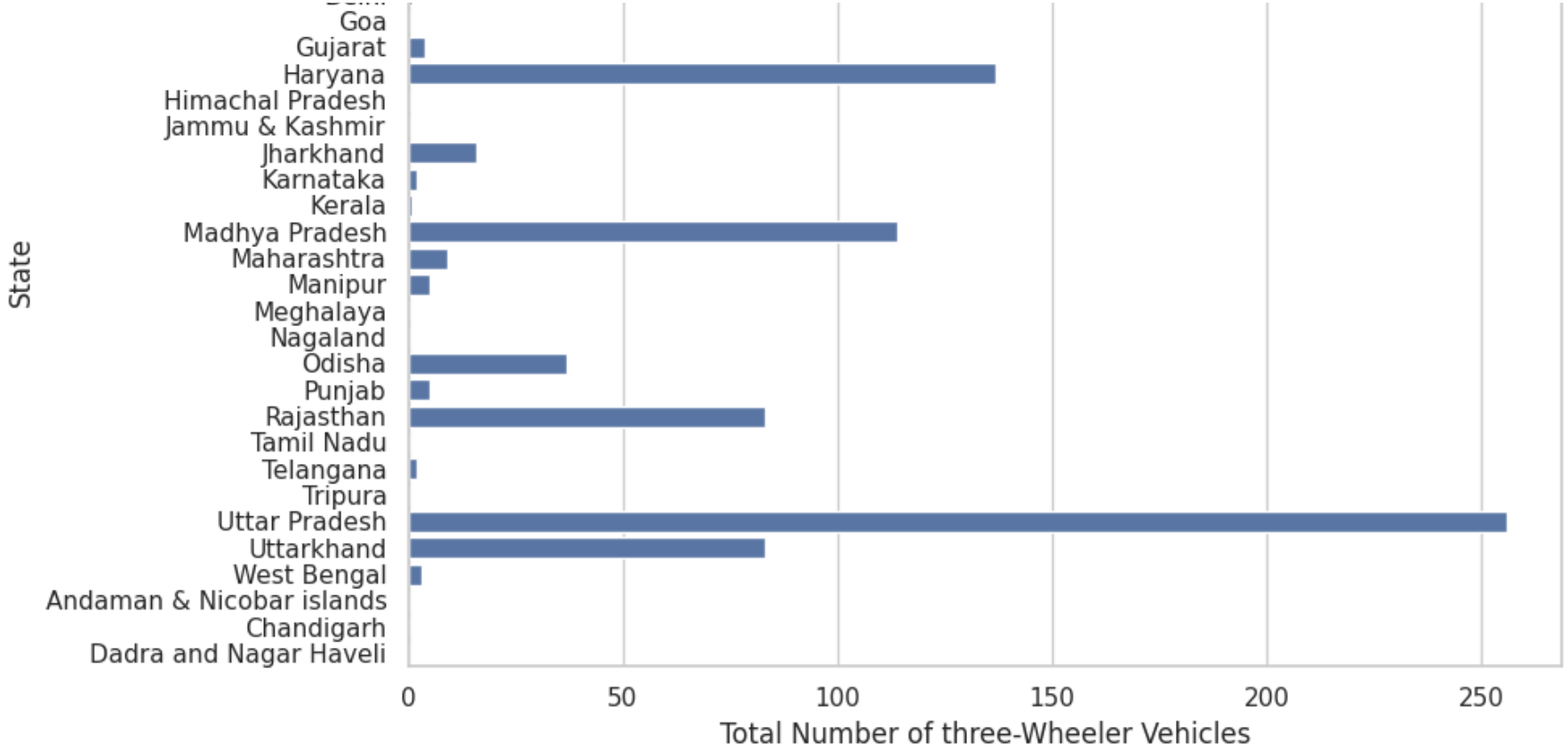
UttarPradesh, Gujrat, Haryana are among the top states with the majority of EV 2W vehicles, while the remaining states have less number .

Analysis of 3 wheeler EV s

UttarPradesh, Chattisgarh, Haryana are among the top states with the majority of EV 3W vehicles, while the remaining states have less **number**

```
# Sum the three columns to get the total number of two-wheeler vehicles
df2['Total Three Wheelers'] = df2[['Three Wheelers (Category L5 slow speed as per CMVR)',
                                   'Three Wheelers (Category L5 as per CMVR)']].sum(axis=1)

# Create a barplot using seaborn
plt.figure(figsize=(10, 6))
sns.set(style="whitegrid")  # Optional: Set the style of the plot

# Plot the total number of two-wheeler vehicles using sns.barplot
sns.barplot(x="Total Three Wheelers", y="State", data=df2, orient="h")

# Customize plot labels and appearance
plt.xlabel("Total Number of three-Wheeler Vehicles")
plt.ylabel("State")
plt.title("Total Number of three-Wheeler Vehicles in Each State (Sum of Categories)")

# Show the plot
plt.tight_layout()
plt.show()
```





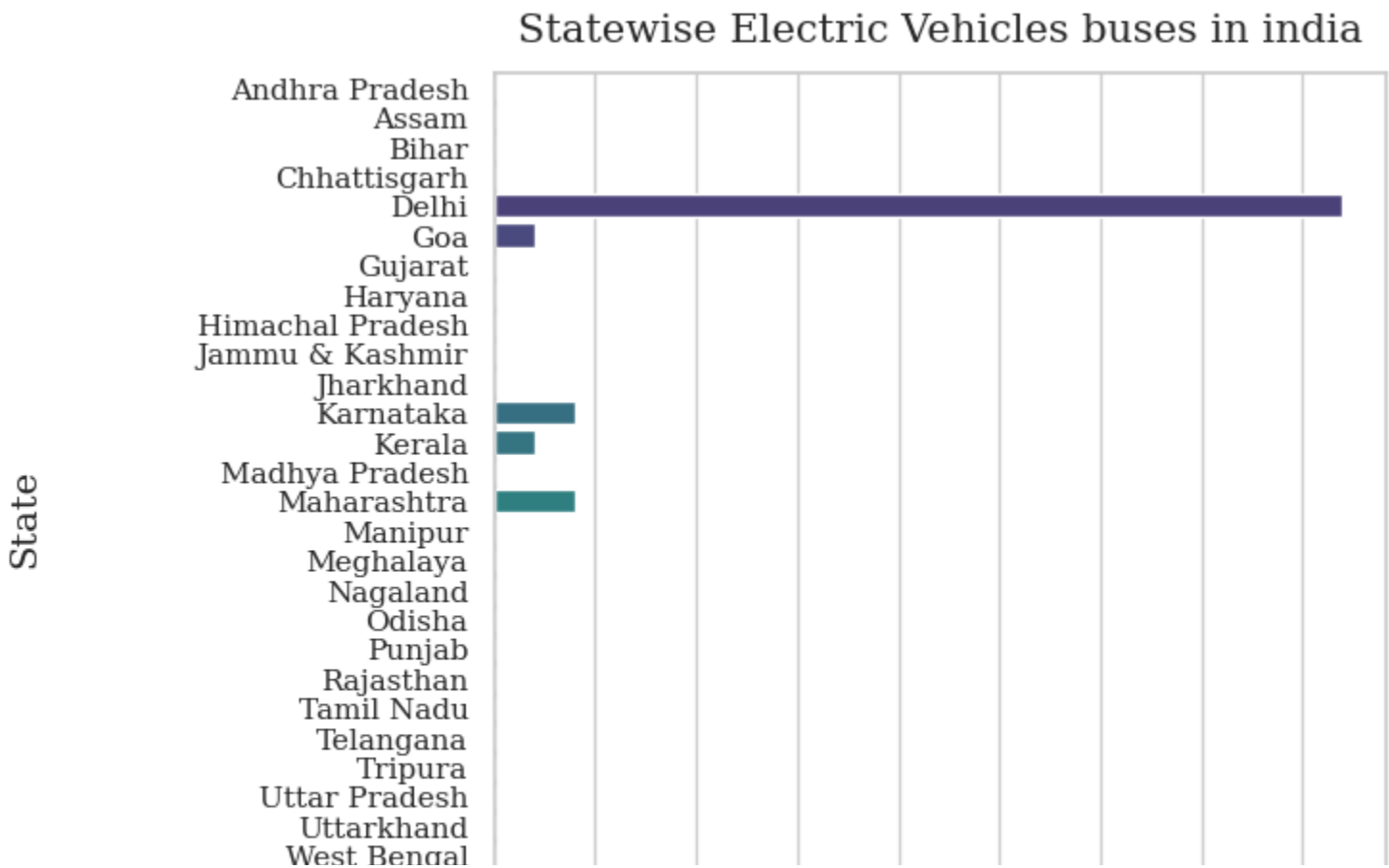
OBSERVATION

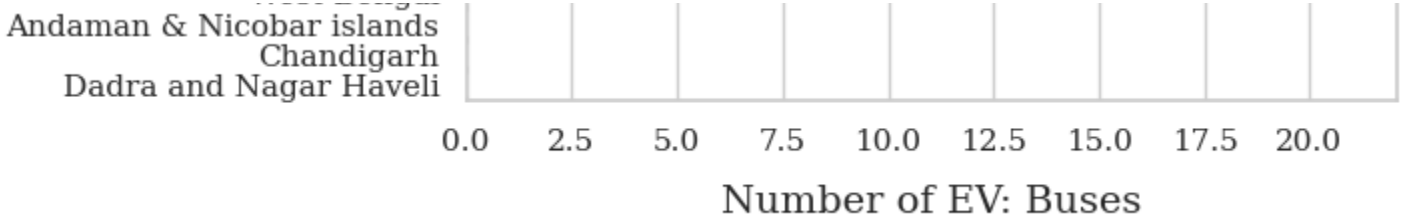
UttarPradesh, Chattisgarh, Haryana are among the top states with the majority of EV 3W vehicles, while the remaining states have less number

Analysis of Buses

Delhi, Goa, Maharashtra, Kerela and Karnataka are among the only states with EV buses in India .

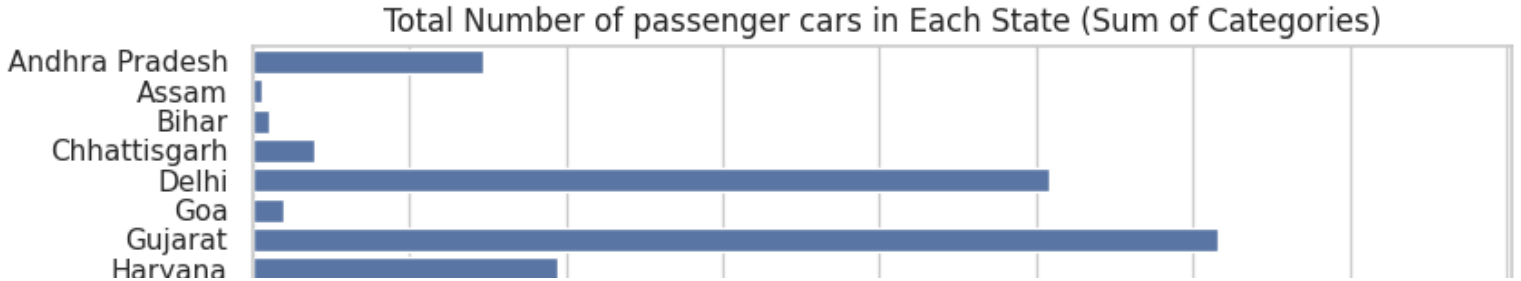
```
# 4 wheelers data visualization from dataset 1
plt.figure(figsize=(6, 6))
sns.barplot(data=df2, y=df2['State'].sort_values(ascending=True), x='Buses', palette='viridis')
plt.ylabel('State', fontsize=14, family='serif')
plt.xlabel('Number of EV: Buses', family='serif', fontsize=14, labelpad=10)
plt.xticks(family='serif')
plt.yticks(family='serif')
plt.title(label='Statewise Electric Vehicles buses in india', weight=200, family='serif', size=15, pad=12)
plt.show()
```

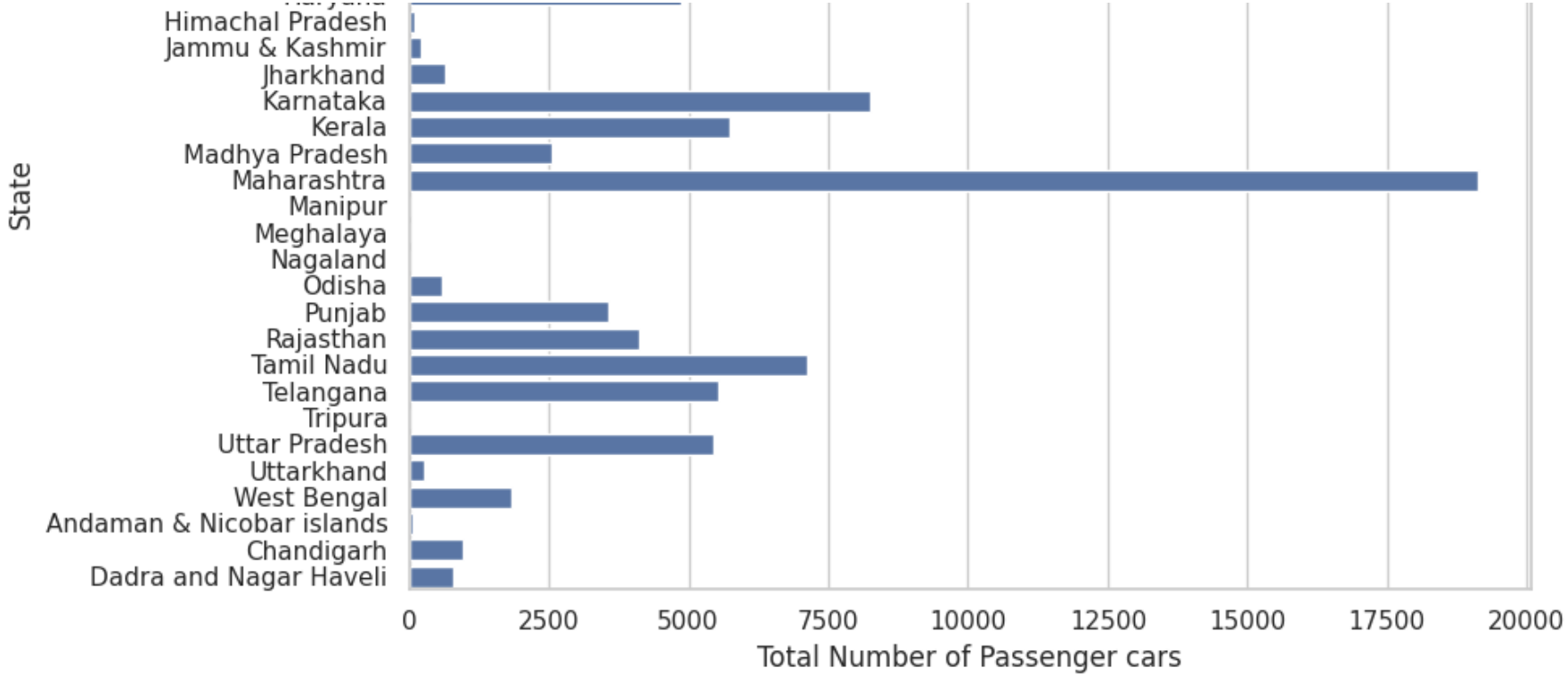




Analysis of Passenger Cars

```
# Sum the three columns to get the total number of two-wheeler vehicles
df2['Total Passenger cars'] = df2[['Passenger Cars (Category M1 as per CMVR)']].sum(axis=1)

# Create a barplot using seaborn
plt.figure(figsize=(10, 6))
sns.set(style="whitegrid")  # Optional: Set the style of the plot

# Plot the total number of two-wheeler vehicles using sns.barplot
sns.barplot(x="Total Passenger cars", y="State", data=df2, orient="h")

# Customize plot labels and appearance
plt.xlabel("Total Number of Passenger cars")
plt.ylabel("State")
plt.title("Total Number of passenger cars in Each State (Sum of Categories)")

# Show the plot
plt.tight_layout()
plt.show()
```

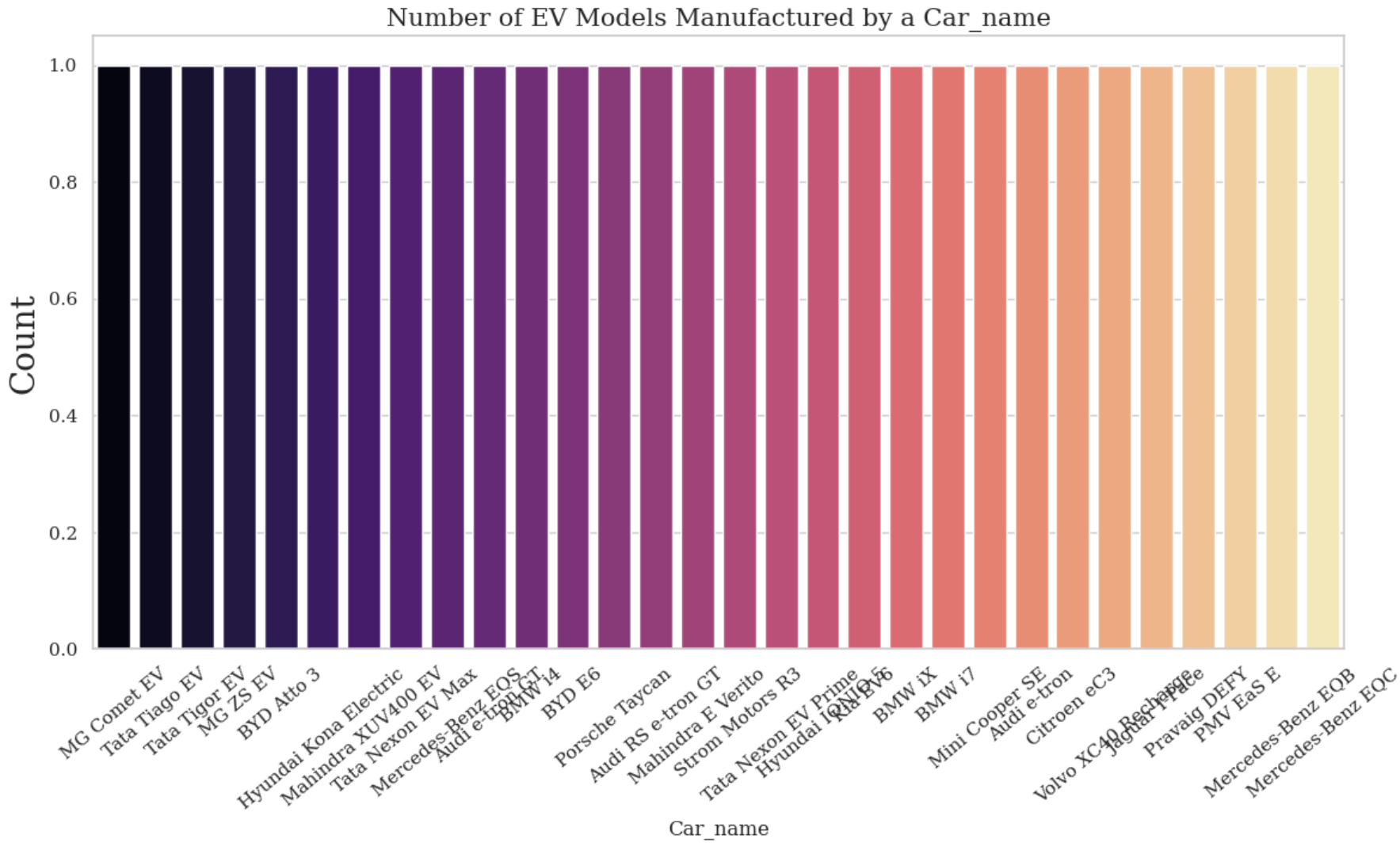




Brand wise EV analysis

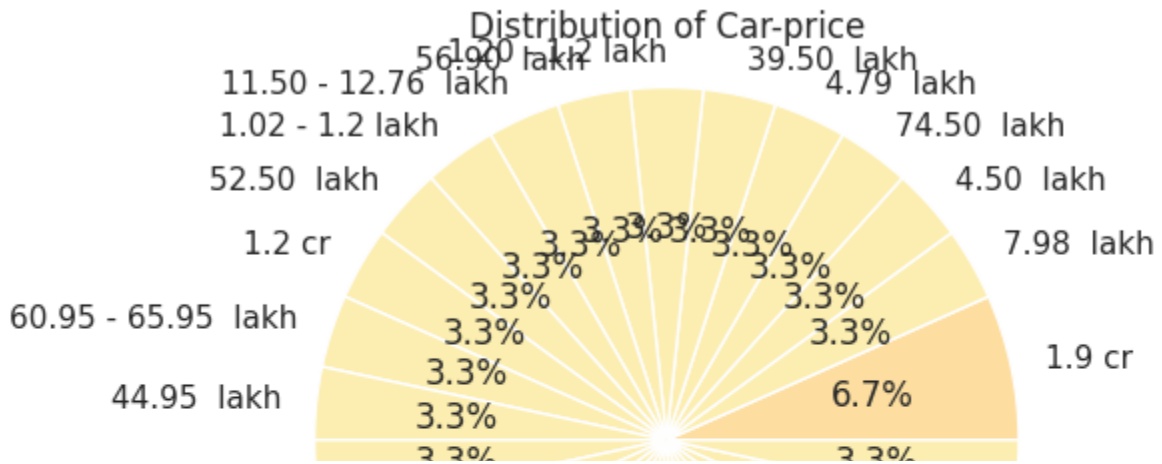
```
# brand-wise count of EV models
sns.catplot(data=df1, x= 'Car_name', kind='count',palette='magma' , height=6, aspect=2)
sns.despine(right=False, top=False)
plt.tick_params(axis='x', rotation=40)
plt.xlabel('Car_name',family='serif', size=12)
plt.ylabel('Count', family='serif', size=20)
plt.xticks(family='serif')
plt.yticks(family='serif')
plt.title('Number of EV Models Manufactured by a Car_name', family='serif', size=15)
```

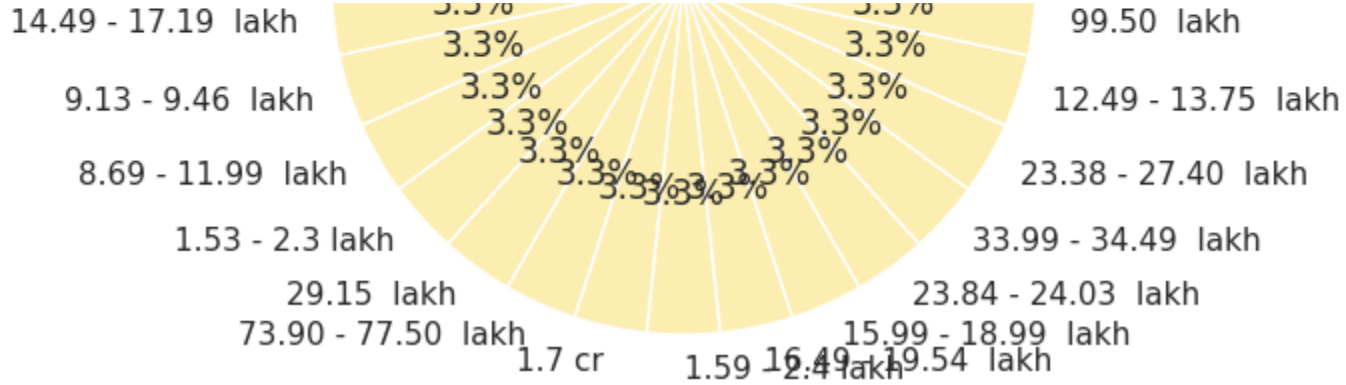
```
plt.show()
```


Number of EV Models Manufactured by a Car_name
Count
1.0
0.8
0.6
0.4
0.2
0.0
MG Comet EV
Tata Tiago EV
Tata Tigor EV
MG ZS EV
BYD Atto 3
Hyundai Kona Electric
Mahindra XUV400 EV
Tata Nexon EV Max
Mercedes-Benz EQS
Audi e-tron GT
BMW i4
BYD E6
Porsche Taycan
Audi RS e-tron GT
Mahindra E Verito
Strom Motors R3
Tata Nexon EV Prime
Kia EV6
BMW iX
BMW i7
Mini Cooper SE
Audi e-tron
Citroen eC3
Pravaig DEFY
PMV EaS E
Mercedes-Benz EQB
Mercedes-Benz EQC
Car_name

ANALYSIS OF DISTRIBUTION OF DIFFERNT CAR PRICE IN EV

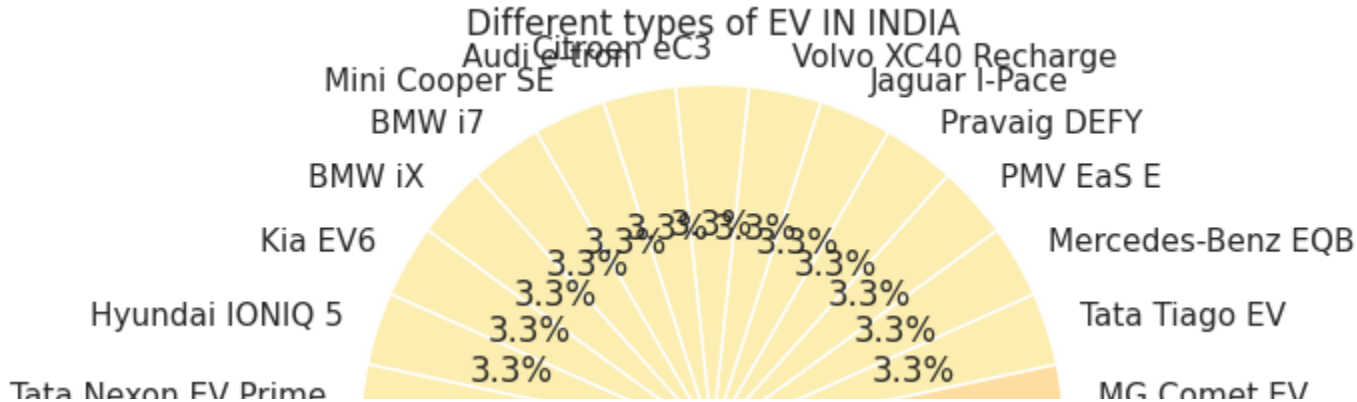
```
from matplotlib import cm
dataset = df1['Car_price'].value_counts()


plt.show()
# Calculate the percentage of each price
total_count = len(df1)  # Total count of records
percentages = (dataset / total_count) * 100

# Define a custom color palette using the "magma" colormap
colors = cm.magma_r(percentages / 100)  # Map colors to percentages

plt.figure(figsize=(5,5))
plt.pie(dataset, labels=dataset.index, autopct='%1.1f%%', colors=colors)
plt.title('Distribution of Car-price')
plt.axis('equal')  # Equal aspect ratio ensures that pie is drawn as a circle.

plt.show()
```

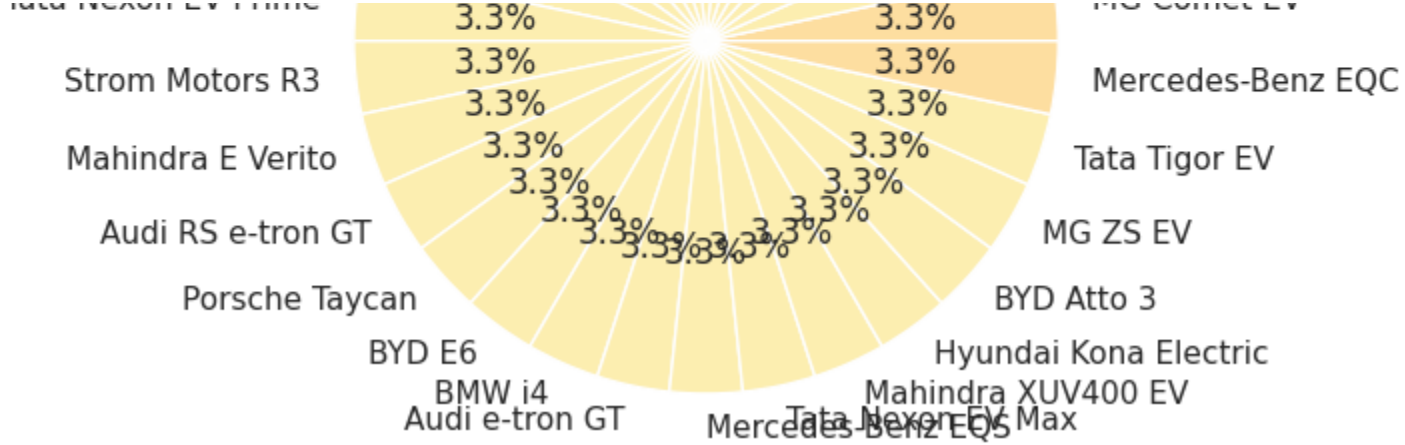




EV available in india

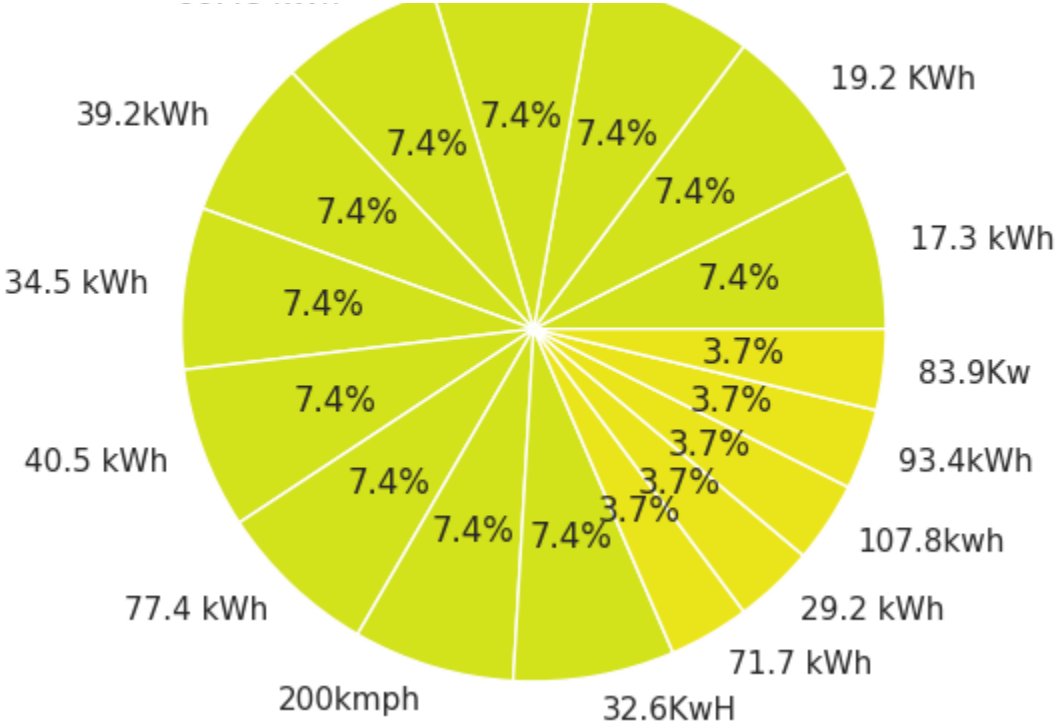
```
from matplotlib import cm
dataset = df1['Car_name'].value_counts()


plt.figure(figsize=(5,5))
plt.pie(dataset, labels=dataset.index, autopct='%1.1f%%', colors=colors)
plt.title('Different types of EV IN INDIA')
plt.axis('equal')  # Equal aspect ratio ensures that pie is drawn as a circle.

plt.show()
```





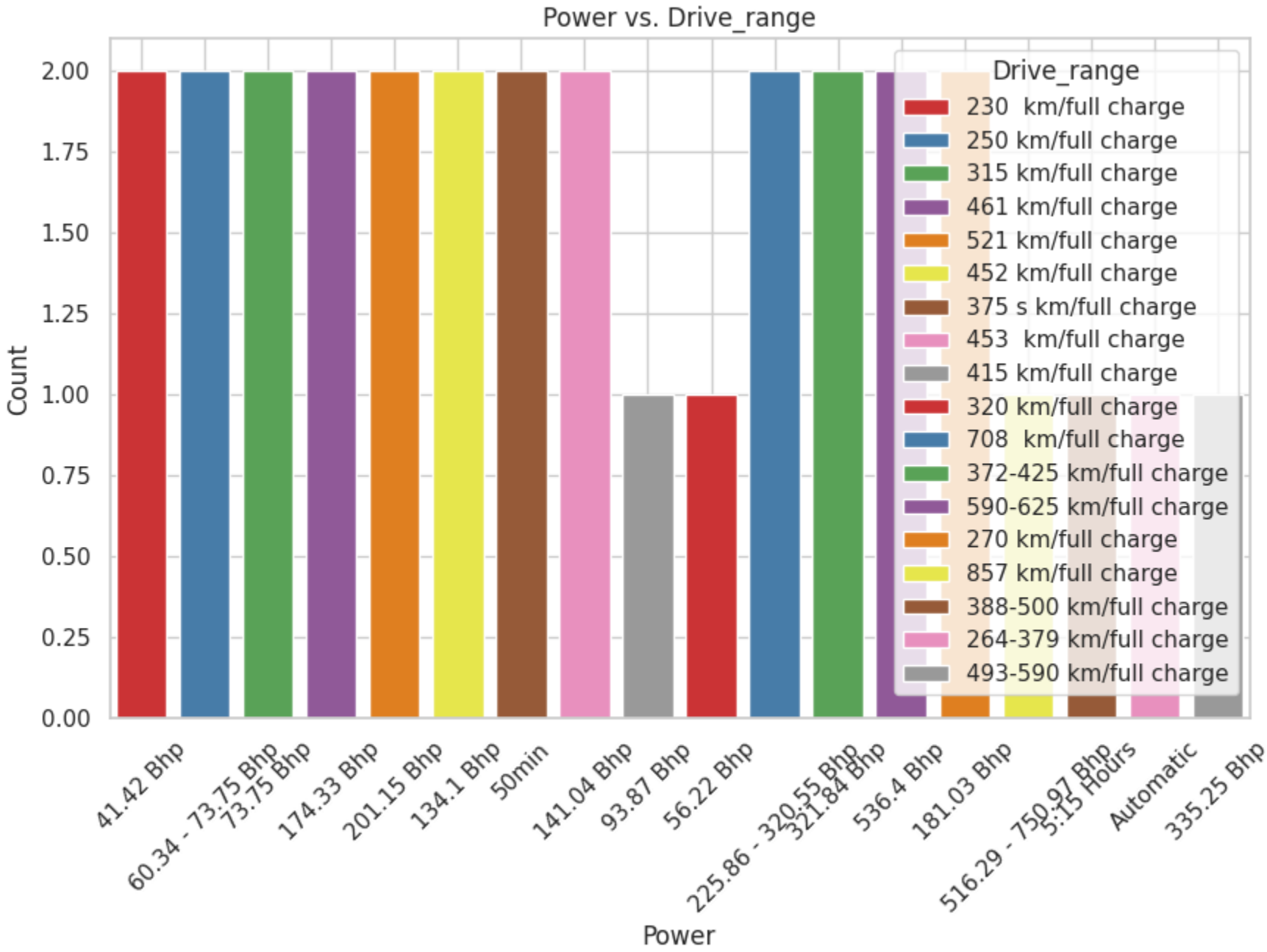
Electric Vehicles of Different Battery Capacity in India

```
dataset = df1['Batter_cap'].value_counts()

# Calculate the percentage of each body style
total_count = len(df1)  # Total count of records
percentages = (dataset / total_count) * 100

# Define a custom color palette using the "magma" colormap
colors = cm.viridis_r(percentages / 100)  # Map colors to percentages

plt.figure(figsize=(5,5))
plt.pie(dataset, labels=dataset.index, autopct='%1.1f%%', colors=colors)
plt.title('Electric Vehicles of Different Battery Capacity in India')
plt.axis('equal')  # Equal aspect ratio ensures that pie is drawn as a circle.

plt.show()
```



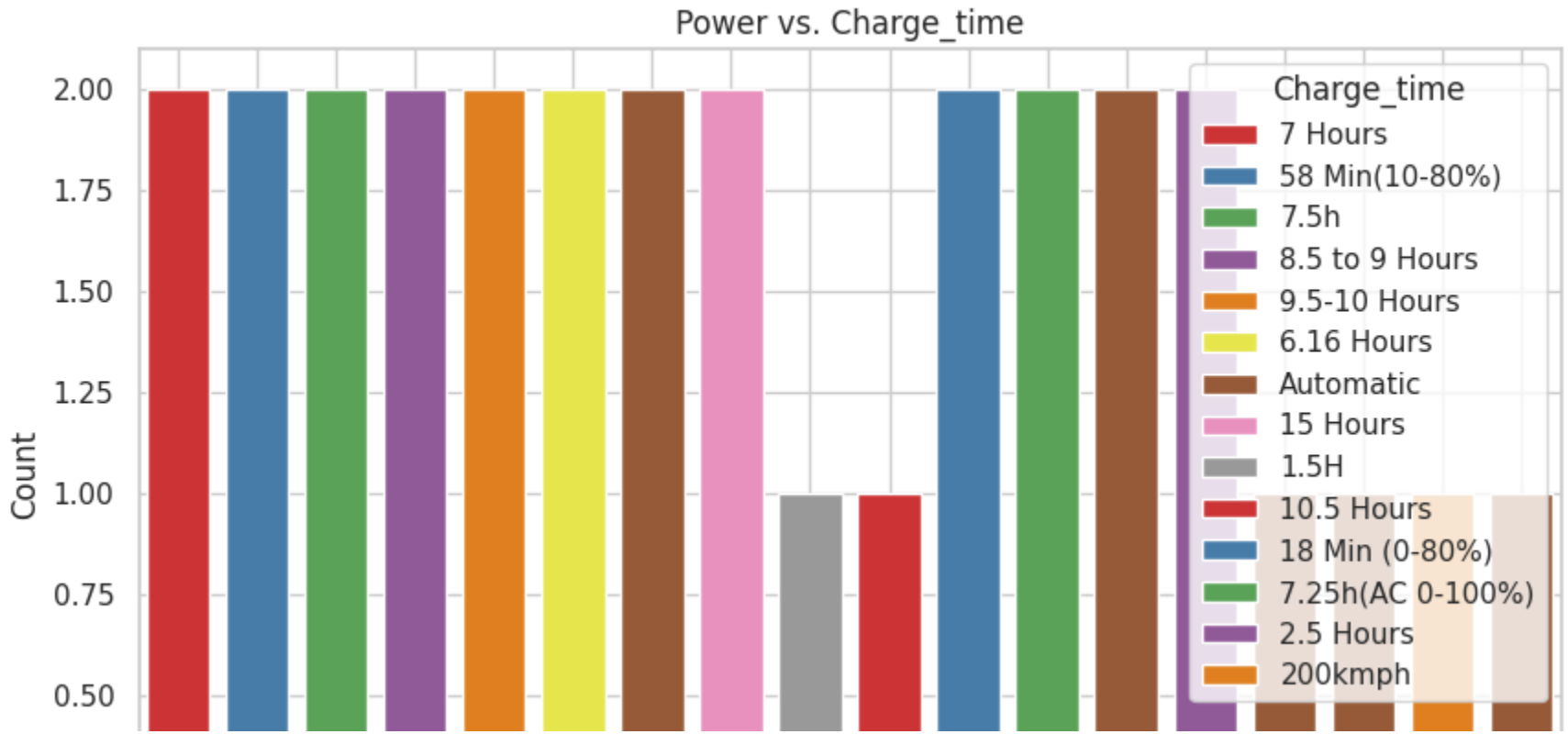
Power vs. Drive_range

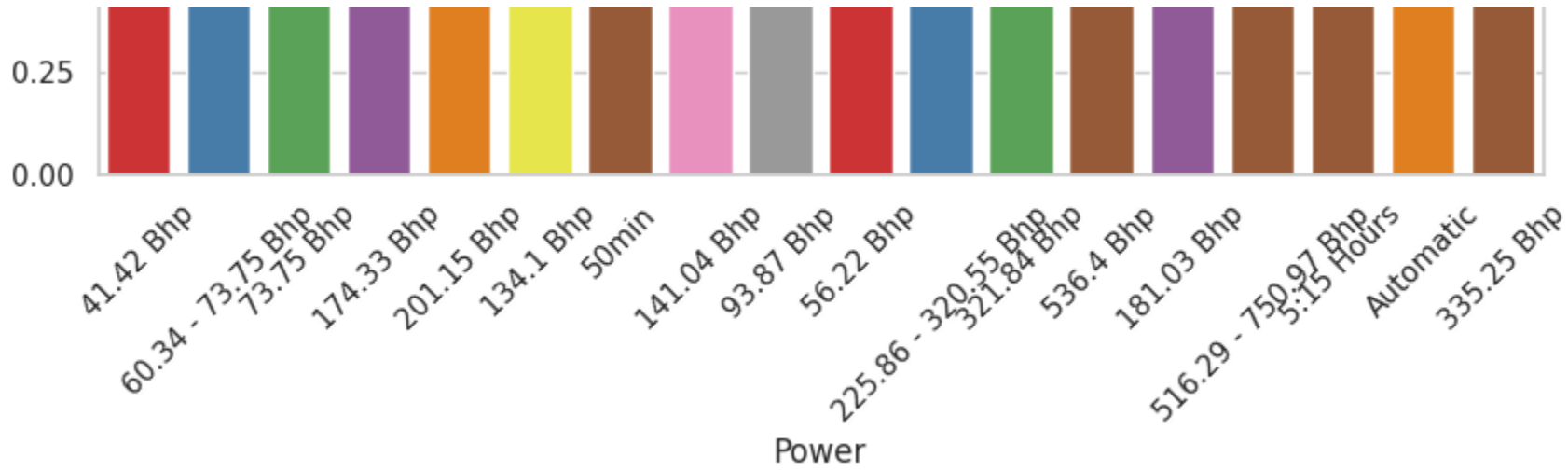
```
# Categorical plot: Power vs. Drive_range
plt.figure(figsize=(10, 6))
custom_palette = sns.color_palette("Set1")
sns.countplot(data=df1, x='Power', hue='Drive_range', palette=custom_palette)
plt.title('Power vs. Drive_range')
plt.xlabel('Power')
plt.ylabel('Count')
plt.legend(title='Drive_range', loc='upper right')
plt.xticks(rotation=45)
plt.grid(True)
plt.show()
```


Power vs. Drive_range
Count
Power
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
41.42 Bhp
60.34 - 73.75 Bhp
73.75 Bhp
174.33 Bhp
201.15 Bhp
134.1 Bhp
50min
141.04 Bhp
93.87 Bhp
56.22 Bhp
225.86 - 320.55 Bhp
321.84 Bhp
536.4 Bhp
181.03 Bhp
516.29 - 750.97 Bhp
5:15 Hours
Automatic
335.25 Bhp
Drive_range
230 km/full charge
250 km/full charge
315 km/full charge
461 km/full charge
521 km/full charge
452 km/full charge
375 s km/full charge
453 km/full charge
415 km/full charge
320 km/full charge
708 km/full charge
372-425 km/full charge
590-625 km/full charge
270 km/full charge
857 km/full charge
388-500 km/full charge
264-379 km/full charge
493-590 km/full charge

Power vs. Drive_range

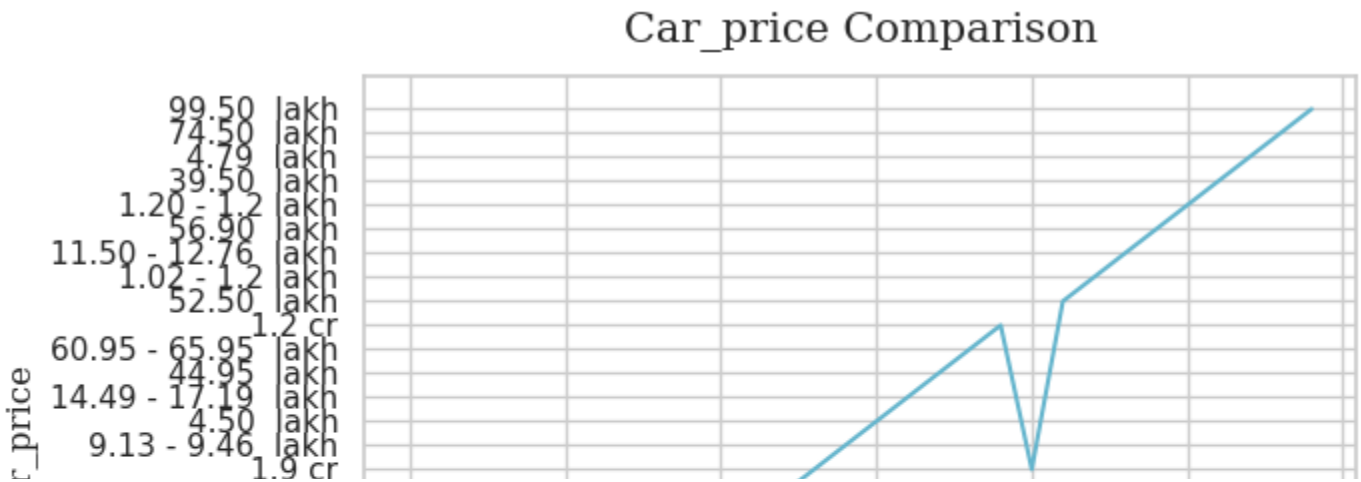
```
# Categorical plot: Power vs. Charge_time
plt.figure(figsize=(10, 6))
custom_palette = sns.color_palette("Set1")
sns.countplot(data=df1, x='Power', hue='Charge_time', palette=custom_palette)
plt.title('Power vs. Charge_time')
plt.xlabel('Power')
plt.ylabel('Count')
plt.legend(title='Charge_time', loc='upper right')
plt.xticks(rotation=45)
plt.grid(True)
plt.show()
```

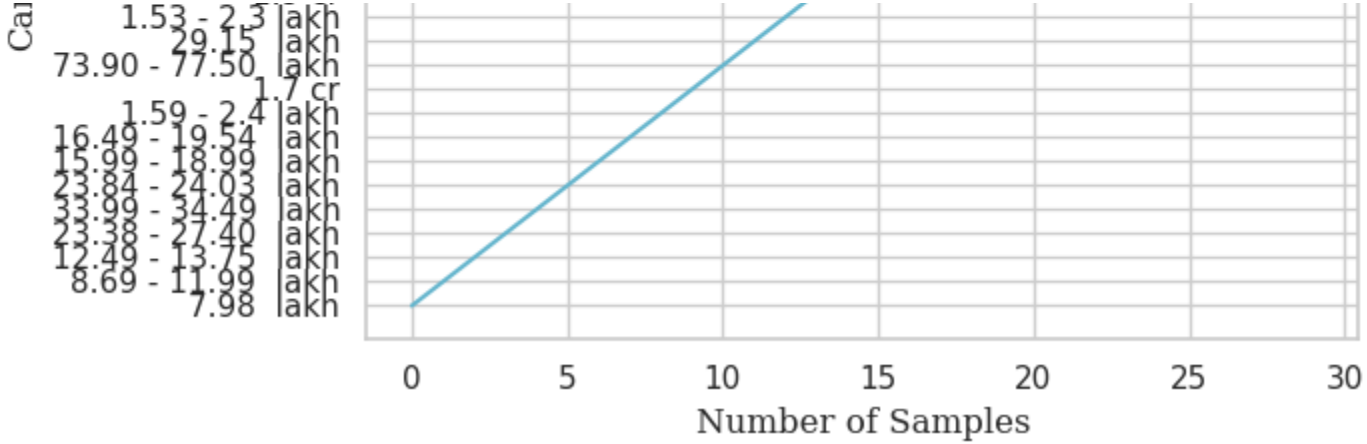




Car_price Comparison

```
# plotting the price from dataset 2
plt.plot(df1['Car_price'], color='c')
plt.xlabel('Number of Samples', family='serif', size=12)
plt.ylabel('Car_price', family='serif', size=12)
plt.title('Car_price Comparison', family='serif', size=15, pad=12);
```

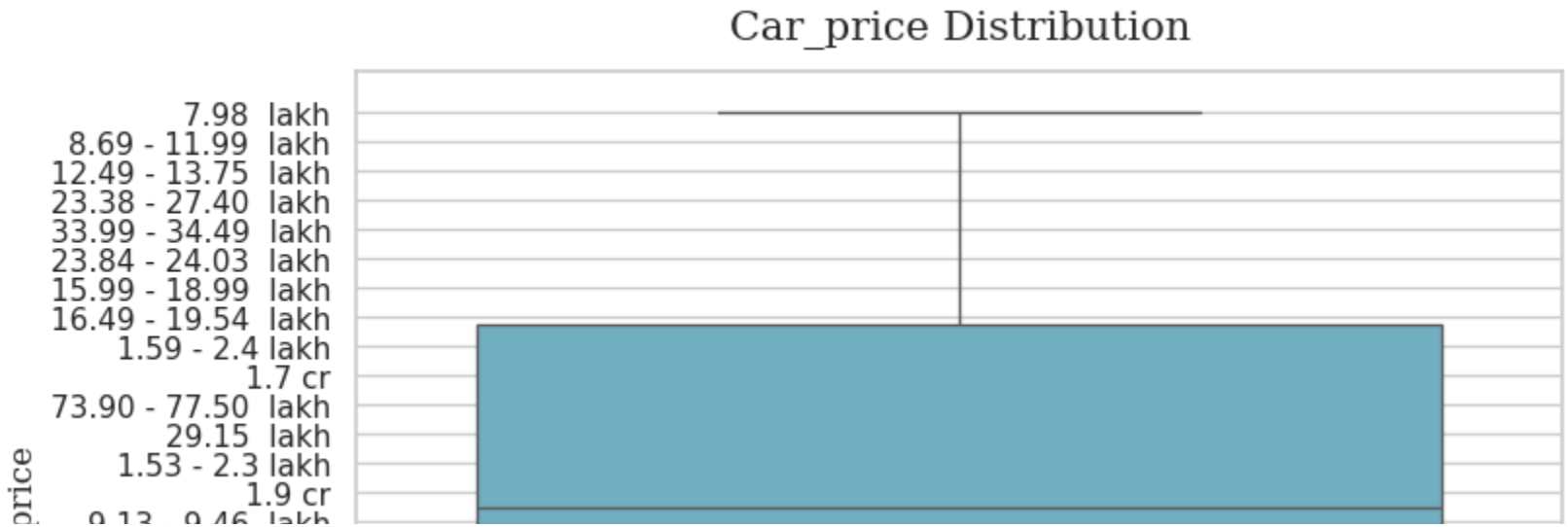


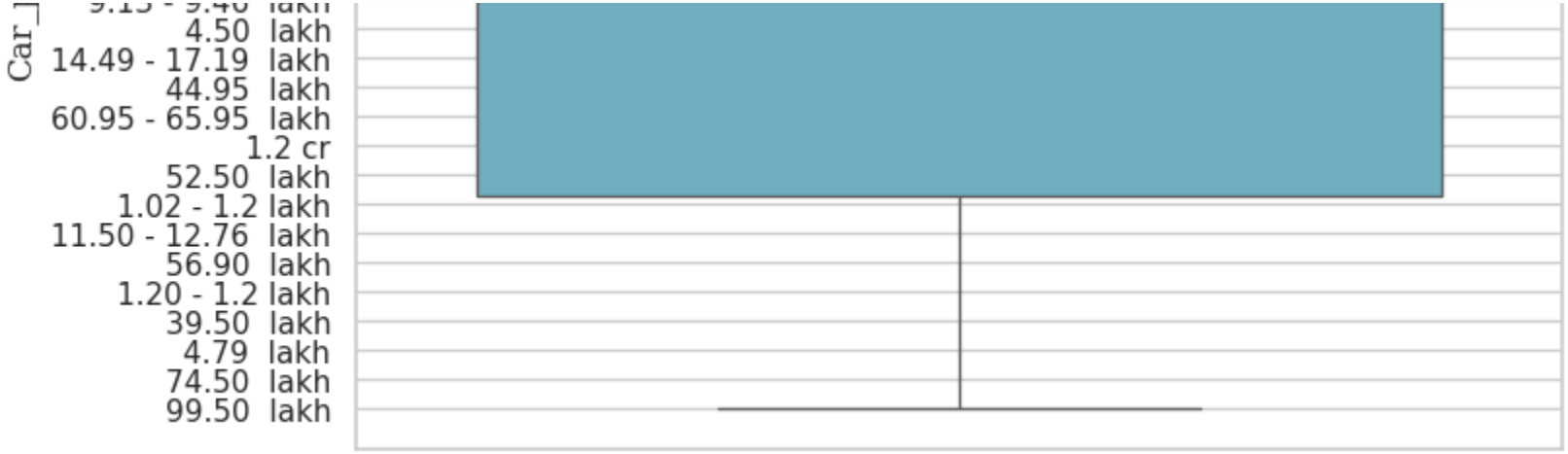


Car_price Distribution

```
plt.figure(figsize=(8, 6))
sns.boxplot(data=df1, y='Car_price', color='c')
plt.ylabel('Car_price', family='serif', size=12)
plt.title ('Car_price Distribution', family='serif', size=15, pad=12)
```

```
Text(0.5, 1.0, 'Car_price Distribution')
```





Importing another dataset for analysis of electric charging stations in (INDIA).

```
df3 = pd.read_csv("/content/electric_vehicle_charging_station_list (2).csv")
df3.head()
```

	no	region	address	aux addres	latitude	longitude	type	power	service
0	1	NDMC	Prithviraj Market, Rabindra Nagar, New Delhi- ...	Electric Vehicle Charger, Prithviraj Market, R...	28.600725	77.226252	DC-001	15 kW	Self Service
1	2	NDMC	Prithviraj Market, Rabindra Nagar, New Delhi- ...	Electric Vehicle Charger, Prithviraj Market, R...	28.600725	77.226252	DC-001	15 kW	Self Service
2	3	NDMC	Outside RWA Park, Jor Bagh Market, Jor Bagh Co...	Electric Vehicle Charger, Outside RWA Park, Jo...	28.588303	77.217697	DC-001	15 kW	Self Service
			Opposite Dory Pharmacy,	Electric Vehicle Charger,				15	Self

```
print('DF3 Shape: ', df3.shape)
```

```
DF3 Shape:  (202, 9)
```

```
d3 = df3.describe()
```

```
display('<<< DATASET 3 >>>', d3, '<<< DATASET 3 >>>')
```

'<<< DATASET 3 >>>'

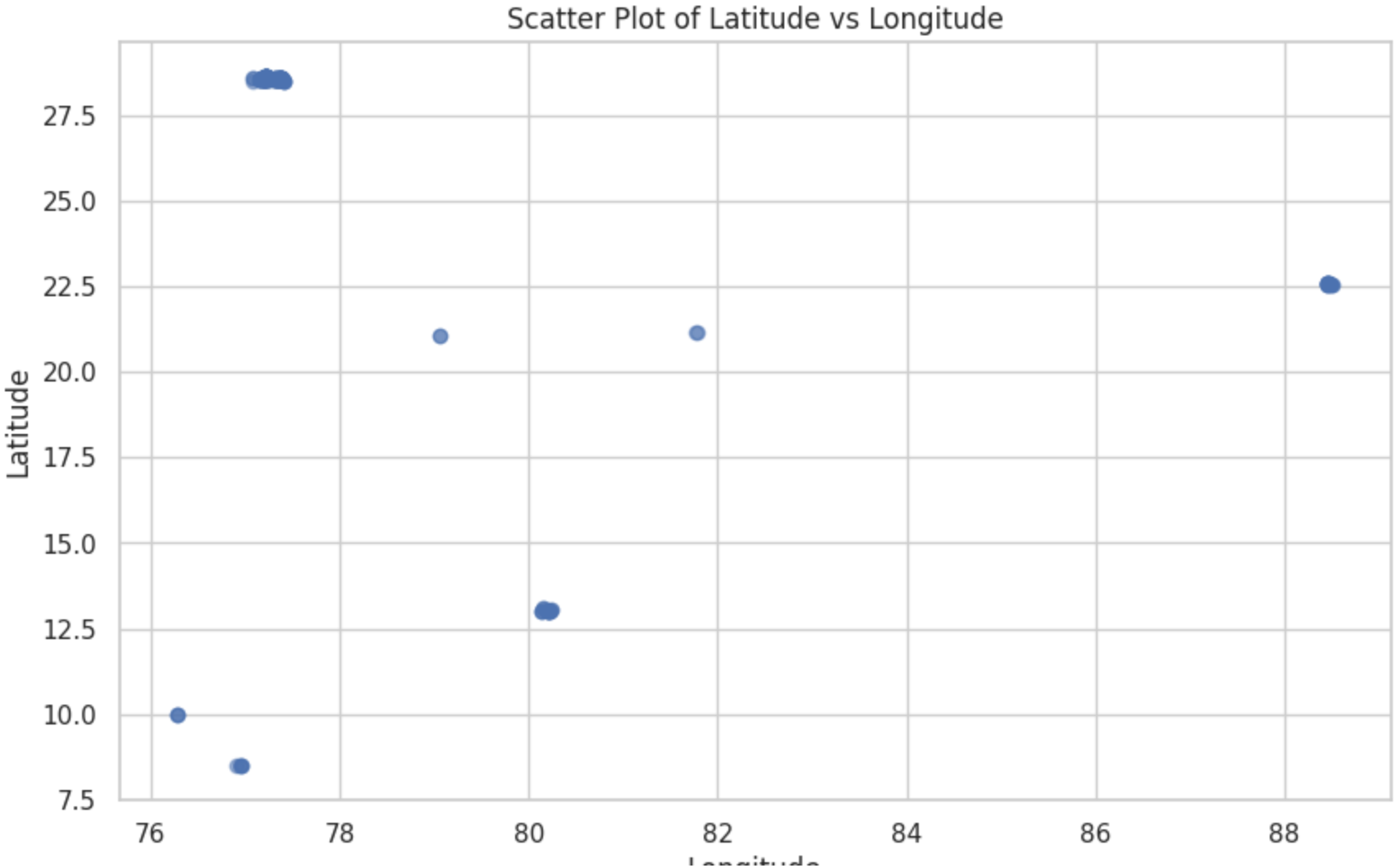
	no	latitude	longitude
count	202.000000	202.000000	202.000000
mean	101.500000	25.960987	78.418002
std	58.456537	5.616108	3.097664
min	1.000000	8.481051	76.277781
25%	51.250000	28.535516	77.212996
50%	101.500000	28.580286	77.226252
75%	151.750000	28.617783	77.375216
max	202.000000	28.642892	88.509064

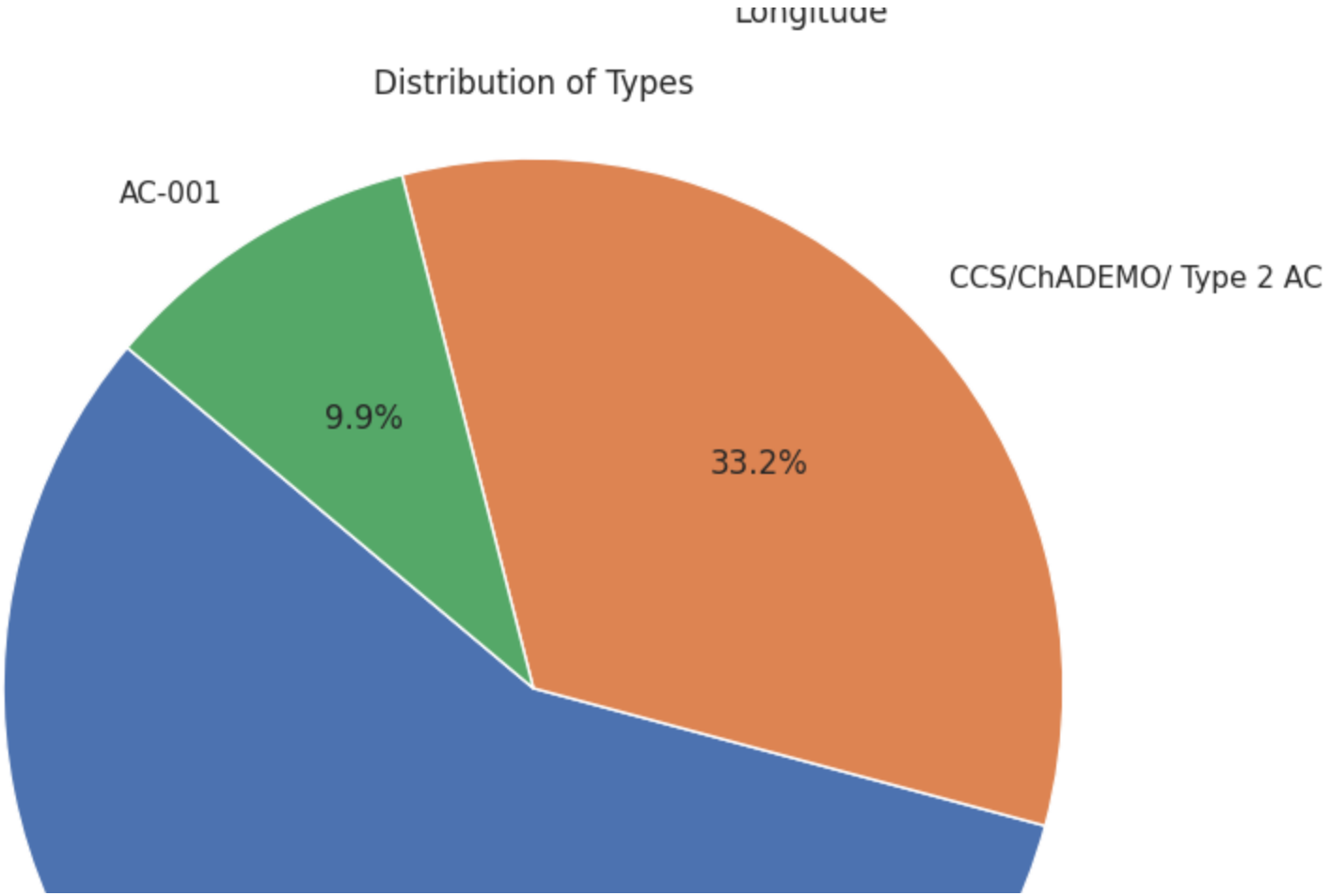
'<<< DATASET 3 >>>'

Scatter plot for Latitude and Longitude Charging Station in INDIA

```
# Scatter plot for Latitude and Longitude
plt.figure(figsize=(10, 6))
plt.scatter(df3['longitude'], df3['latitude'], alpha=0.5)
plt.title('Scatter Plot of Latitude vs Longitude')
plt.xlabel('Longitude')
plt.ylabel('Latitude')
plt.grid(True)
plt.show()

# Pie chart for 'type' column
type_counts = df3['type'].value_counts()
plt.figure(figsize=(8, 8))
plt.pie(type_counts, labels=type_counts.index, autopct='%1.1f%%', startangle=140)
plt.title('Distribution of Types')
```

```
plt.title('Distribution of Types')
plt.axis('equal')  # Equal aspect ratio ensures that pie is drawn as a circle.
plt.show()

# Basic Analysis
print("Basic Analysis:")
print("Total number of data points:", len(df3))
print("Unique types:", df3['type'].nunique())
print("\nTypes Distribution:")
print(type_counts)
```





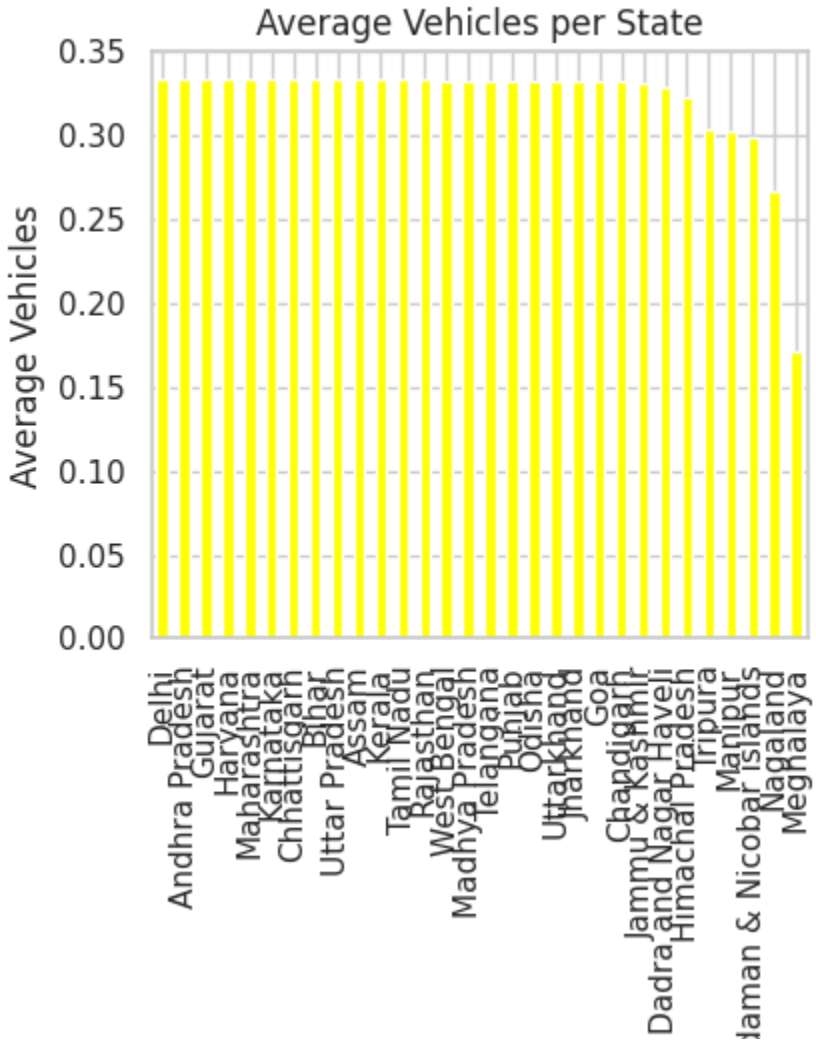

```
# Group data by state
state_grouped = df2.groupby('State').sum()

# Add additional analysis
state_grouped['Total Vehicles'] = state_grouped.sum(axis=1)
state_grouped['Average Vehicles'] = state_grouped['Total in state'] / state_grouped['Total Vehicles']

# Display state-wise analysis
print("State-wise Analysis:")
print(state_grouped[['Total in state', 'Total Vehicles', 'Average Vehicles']])
```

```
State-wise Analysis:
                            Total in state  Total Vehicles  Average Vehicles
State
```

State			
Andaman & Nicobar islands	82	274	0.299270
Andhra Pradesh	9492	28477	0.333322
Assam	1875	5627	0.333215
Bihar	3171	9516	0.333228
Chandigarh	2500	7529	0.332049
Chhattisgarh	4234	12706	0.333228
Dadra and Nagar Haveli	816	2478	0.329298
Delhi	19381	58127	0.333425
Goa	514	1547	0.332256
Gujarat	31267	93808	0.333308
Haryana	23589	70775	0.333296
Himachal Pradesh	98	303	0.323432
Jammu & Kashmir	438	1324	0.330816
Jharkhand	1710	5141	0.332620
Karnataka	13386	40168	0.333250
Kerala	11202	33618	0.333214
Madhya Pradesh	6461	19397	0.333093
Maharashtra	34013	102052	0.333291
Manipur	52	172	0.302326
Meghalaya	6	35	0.171429
Nagaland	24	90	0.266667
Odisha	3863	11608	0.332788
Punjab	6538	19634	0.332994
Rajasthan	15763	47310	0.333185
Tamil Nadu	16746	50260	0.333187
Telangana	9034	27125	0.333051
Tripura	81	267	0.303371
Uttar Pradesh	26209	78652	0.333227
Uttarkhand	4178	12560	0.332643
West Bengal	14140	42447	0.333121

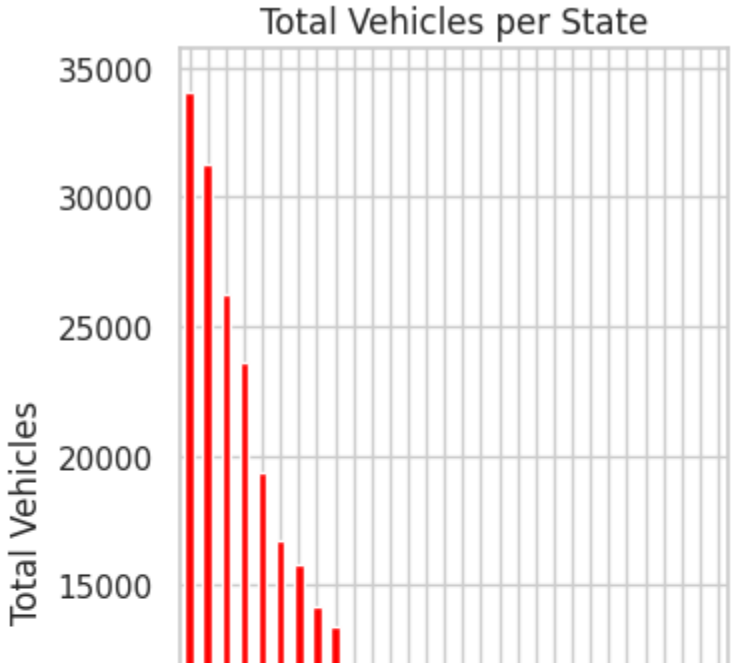
```
state_grouped = df2.groupby('State').sum()

# Add additional analysis
state_grouped['Total Vehicles'] = state_grouped.sum(axis=1)
state_grouped['Average Vehicles'] = state_grouped['Total in state'] / state_grouped['Total Vehicles']

# Visual representation with diagrams and graphs
plt.figure(figsize=(12, 6))
```

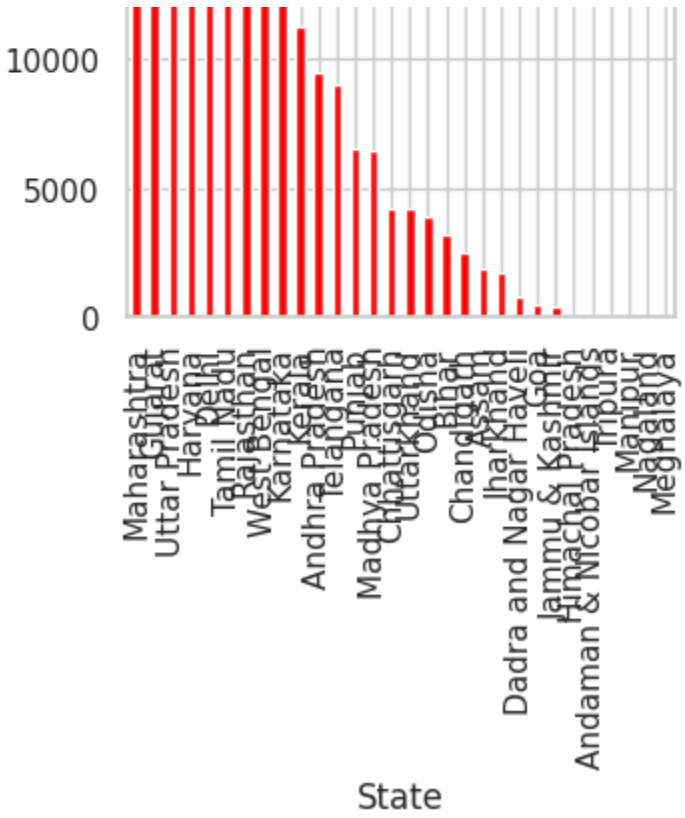
```
# Bar plot for average vehicles per state
plt.subplot(1, 3, 3)
state_grouped['Average Vehicles'].sort_values(ascending=False).plot(kind='bar', color='Yellow')
plt.title('Average Vehicles per State')
plt.xlabel('State')
plt.ylabel('Average Vehicles')

plt.tight_layout()
plt.show()
```




```
state_grouped = df2.groupby('State').sum()

# Add additional analysis
state_grouped['Total Vehicles'] = state_grouped.sum(axis=1)
state_grouped['Average Vehicles'] = state_grouped['Total in state'] / state_grouped['Total Vehicles']

# Visual representation with diagrams and graphs
plt.figure(figsize=(12, 6))
# Bar plot for total vehicles per state
plt.subplot(1, 3, 1)
state_grouped['Total in state'].sort_values(ascending=False).plot(kind='bar', color='red')
plt.title('Total Vehicles per State')
plt.xlabel('State')
plt.ylabel('Total Vehicles')
```

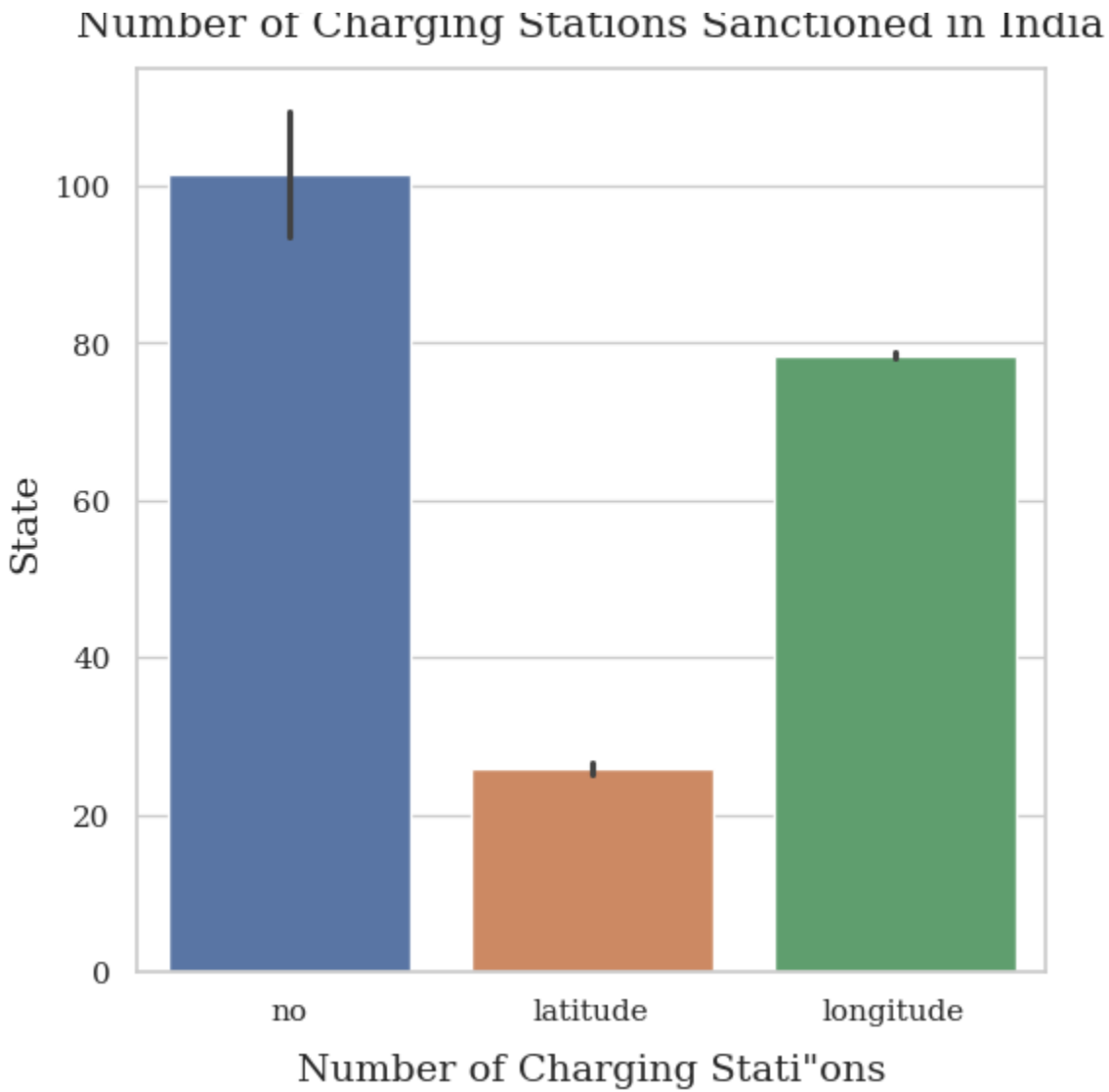
```
Text(0, 0.5, 'Total Vehicles')
```





Charging Stations Sanctioned

```
# charging stations sanctioned visualization from dataset
plt.figure(figsize=(6, 6))
sns.barplot(data=df3)
plt.ylabel('State', fontsize=14, family='serif')
plt.xlabel('Number of Charging Stati"ons', family='serif', fontsize=14, labelpad=10)
plt.xticks(family='serif')
plt.yticks(family='serif')
plt.title(label='Number of Charging Stations Sanctioned in India', weight=200, family='serif', size=15, pad=12)
plt.show()
```

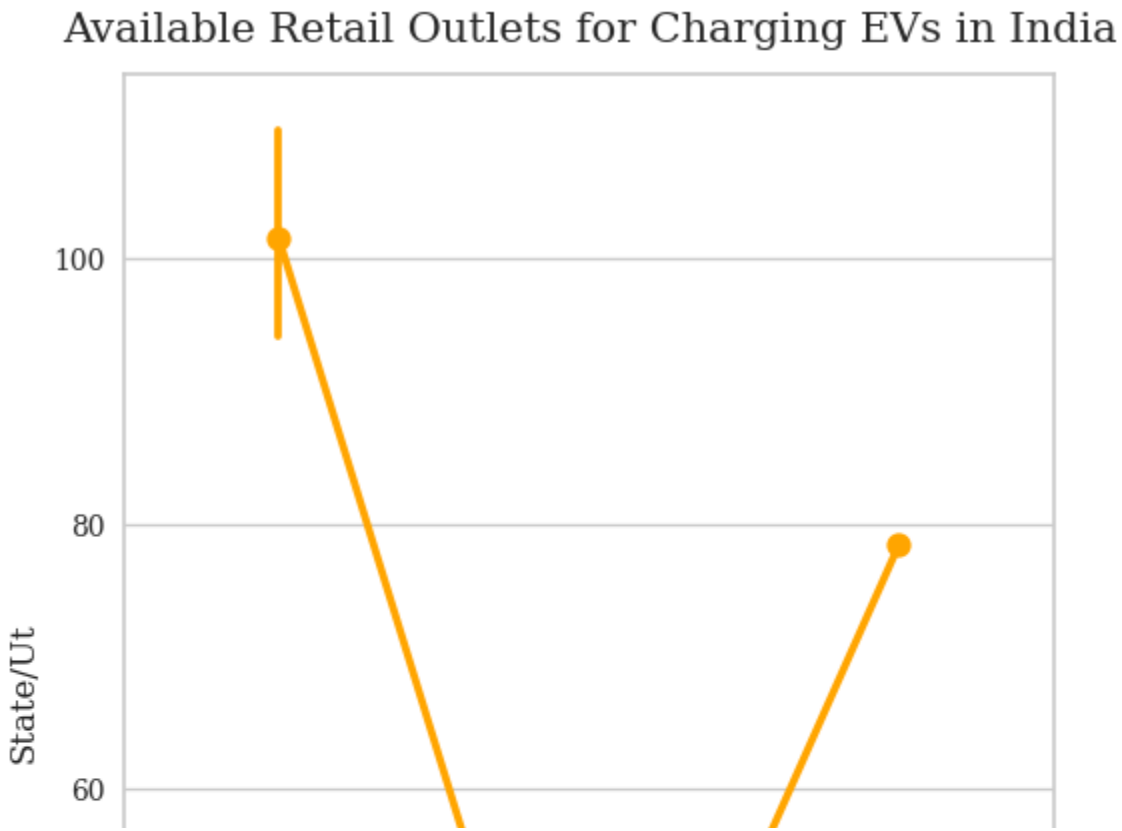


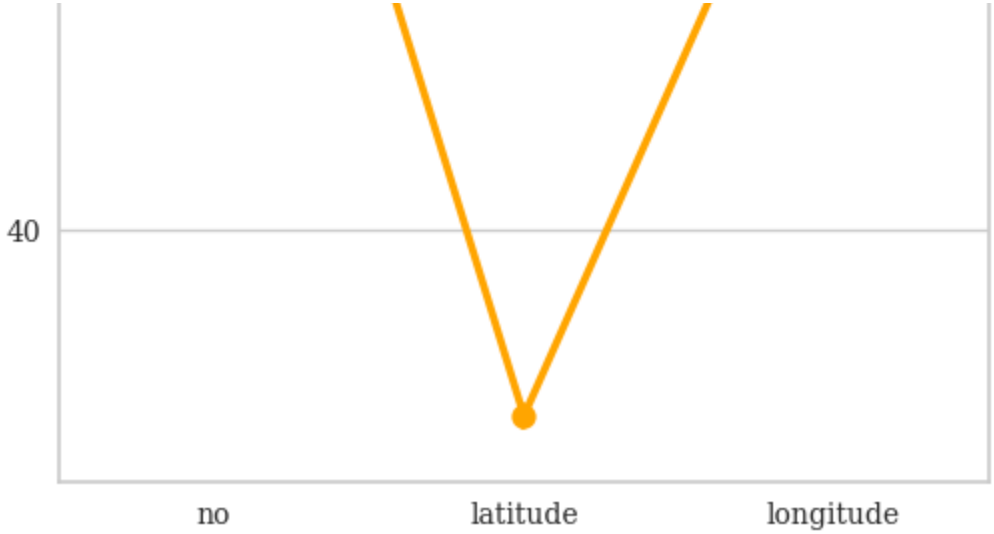
OBSERVATION

Observation: Maharashtra, Gujarat, Karnataka, Kerala, Uttar Pradesh, Rajasthan, and Andhra Pradhesh are among the top states with the majority of EV charging stations sanctioned while the remaining states have less number of the same.

Retail Outlets For Charging EVs In INDIA

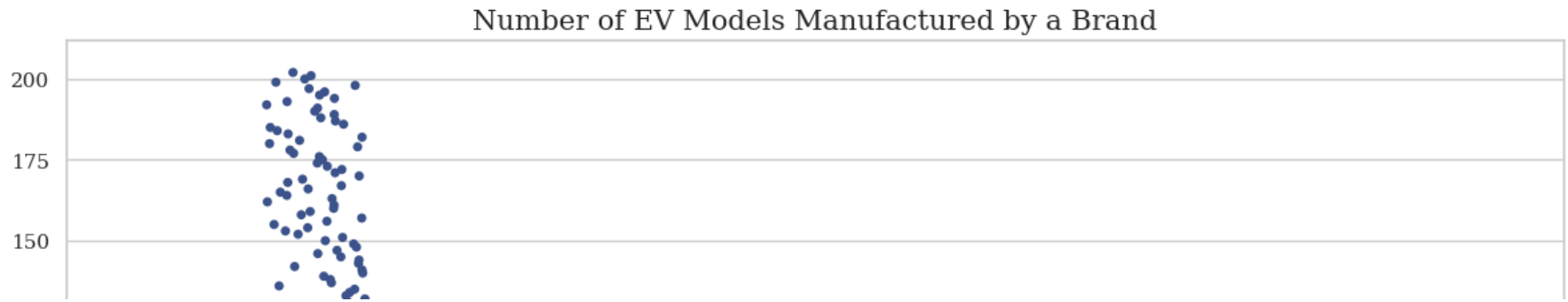
```
# retail outlets visualization from dataset - 2
plt.figure(figsize=(6, 8))
sns.pointplot(data=df3, color='orange')
plt.xlabel('Number of Retail Outlets for Charging EVs', family='serif', size=12, labelpad=10)
plt.ylabel('State/Ut', family='serif', size=12)
plt.tick_params(direction='inout')
plt.xticks(family='serif', size=10)
plt.yticks(family='serif', size=10)
plt.title(label='Available Retail Outlets for Charging EVs in India', weight=200, family='serif', size=15, pad=12)
plt.show()
```





Number of Retail Outlets for Charging EVs

```
# brand-wise count of EV models
sns.catplot(data=df3, palette='viridis', height=6, aspect=2)
sns.despine(right=False, top=False)
plt.tick_params(axis='x', rotation=40)
plt.xlabel('Brand',family='serif', size=12)
plt.ylabel('Count', family='serif', size=12)
plt.xticks(family='serif')
plt.yticks(family='serif')
plt.title('Number of EV Models Manufactured by a Brand', family='serif', size=15)
plt.show()
```



*Conclusion *

Based on the above analysis and visualizations, it would be really helpful for any company which is looking to open up an EV startup in India . In this report the analysis of diferent datasets related to EV have been done on

1] Brands and models of EVs in India with their attributes

2] State wise distribution of 2,3,4 wheeler EV s and passenger cars in India

3] Electric Vehicle Charging Stations In INDIA Analysis.

-The study concludes that understanding the different segments in the Indian EV market is crucial for EV manufactures and marketers to effectively target their customers and promote adoption of EV in India. We have came up with conclusions are as follows related to EV

- UttarPradesh, Gujrat, Haryana are among the top states with the majority of EV 2W vehicles, while the remaining states have less number
- UttarPradesh, Chattisgarh, Haryana are among the top states with the majority of EV 3W vehicles, while the remaining states have less number
- Delhi, Goa, Maharashtra, Kerela and Karnataka are among the only states with EV buses in India .
- Maharashtra, Gujarat, Karnataka, Kerala, Uttar Pradesh, Rajasthan, and Andhra Pradhesh are among the top states with the majority of EV charging stations sanctioned while the remaining states have less number of the same.

Start coding or generate with AI.