Electric Vehicle Sales by State in India — Data Analysis and Visualization

1. IMPORTING LIBRARIES ---

In [44]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
warnings.filterwarnings("ignore", category=FutureWarning)
```

2. READING DATASET ---

In [6]:
```
# Import dataset into Python using pandas:
df = pd.read_csv("EV_Dataset.csv")

df.head(11)
```

Out[6]:

	Year	Month_Name	Date	State	Vehicle_Class	Vehicle_Category	Vehicle_Type
0	2014.0	jan	1/1/2014	Andhra Pradesh	ADAPTED VEHICLE	Others	Others
1	2014.0	jan	1/1/2014	Andhra Pradesh	AGRICULTURAL TRACTOR	Others	Others
2	2014.0	jan	1/1/2014	Andhra Pradesh	AMBULANCE	Others	Others
3	2014.0	jan	1/1/2014	Andhra Pradesh	ARTICULATED VEHICLE	Others	Others
4	2014.0	jan	1/1/2014	Andhra Pradesh	BUS	Bus	Bus
5	2014.0	jan	1/1/2014	Andhra Pradesh	CASH VAN	Others	Others
6	2014.0	jan	1/1/2014	Andhra Pradesh	CRANE MOUNTED VEHICLE	Others	Others
7	2014.0	jan	1/1/2014	Andhra Pradesh	EDUCATIONAL INSTITUTION BUS	Bus	Institution Bus
8	2014.0	jan	1/1/2014	Andhra Pradesh	EXCAVATOR (COMMERCIAL)	Others	Others
9	2014.0	jan	1/1/2014	Andhra Pradesh	FORK LIFT	Others	Others
10	2014.0	jan	1/1/2014	Andhra Pradesh	GOODS CARRIER	Others	Others

3. DATA CLEANING AND PROCESSING --

In [13]:
```
# To get the number of rows and columns --
df.shape
```

Out[13]: (96845, 8)

a) Information of the type of data --

In [12]:
```
# Info about the dataset --
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 96845 entries, 0 to 96844
Data columns (total 8 columns):
 #   Column             Non-Null Count  Dtype  
---  ------             --------------  -----  
 0   Year               96845 non-null  float64
 1   Month_Name         96845 non-null  object 
 2   Date               96845 non-null  object 
 3   State              96845 non-null  object 
 4   Vehicle_Class      96845 non-null  object 
 5   Vehicle_Category   96845 non-null  object 
 6   Vehicle_Type       96845 non-null  object 
 7   EV_Sales_Quantity  96845 non-null  float64
dtypes: float64(2), object(6)
memory usage: 5.9+ MB
```

b) Finding out the number of null values --

In [16]:
```
# Any missing value --
df.isnull().sum()
```

Out[16]:
```
Year                0
Month_Name          0
Date                0
State               0
Vehicle_Class       0
Vehicle_Category    0
Vehicle_Type        0
EV_Sales_Quantity   0
dtype: int64
```

c) Finding Out any duplicate value --

In [18]:
```
# Any Duplicate values --
df.duplicated().sum()
```

Out[18]:
```
np.int64(0)
```

d) Converting the data types --

In [22]:
```
# changing the datatype of Year column
df['Year'] = df['Year'].astype(int)

# changing the datatype of Date column
df["Date"] = pd.to_datetime(df["Date"],errors='coerce')

df.head()
```

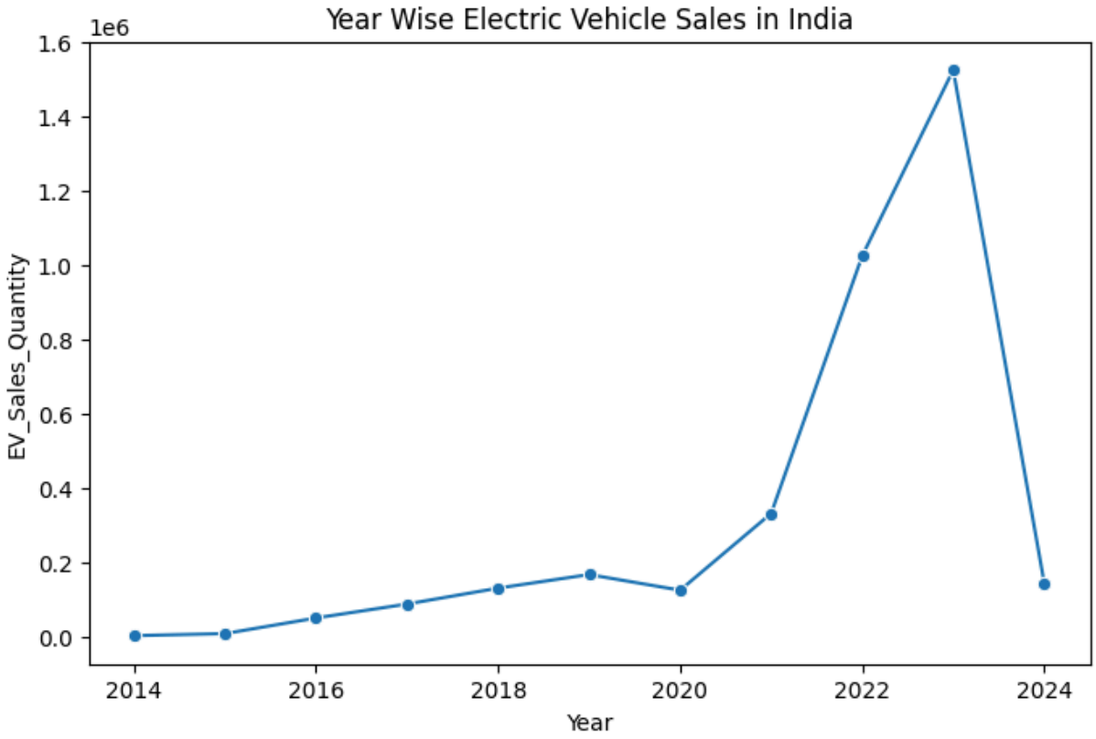
Out[22]:

	Year	Month_Name	Date	State	Vehicle_Class	Vehicle_Category	Vehicle_Type	EV_
0	2014	jan	2014-01-01	Andhra Pradesh	ADAPTED VEHICLE	Others	Others	
1	2014	jan	2014-01-01	Andhra Pradesh	AGRICULTURAL TRACTOR	Others	Others	
2	2014	jan	2014-01-01	Andhra Pradesh	AMBULANCE	Others	Others	
3	2014	jan	2014-01-01	Andhra Pradesh	ARTICULATED VEHICLE	Others	Others	
4	2014	jan	2014-01-01	Andhra Pradesh	BUS	Bus	Bus	

4. Exploratory Data Analysis (EDA)

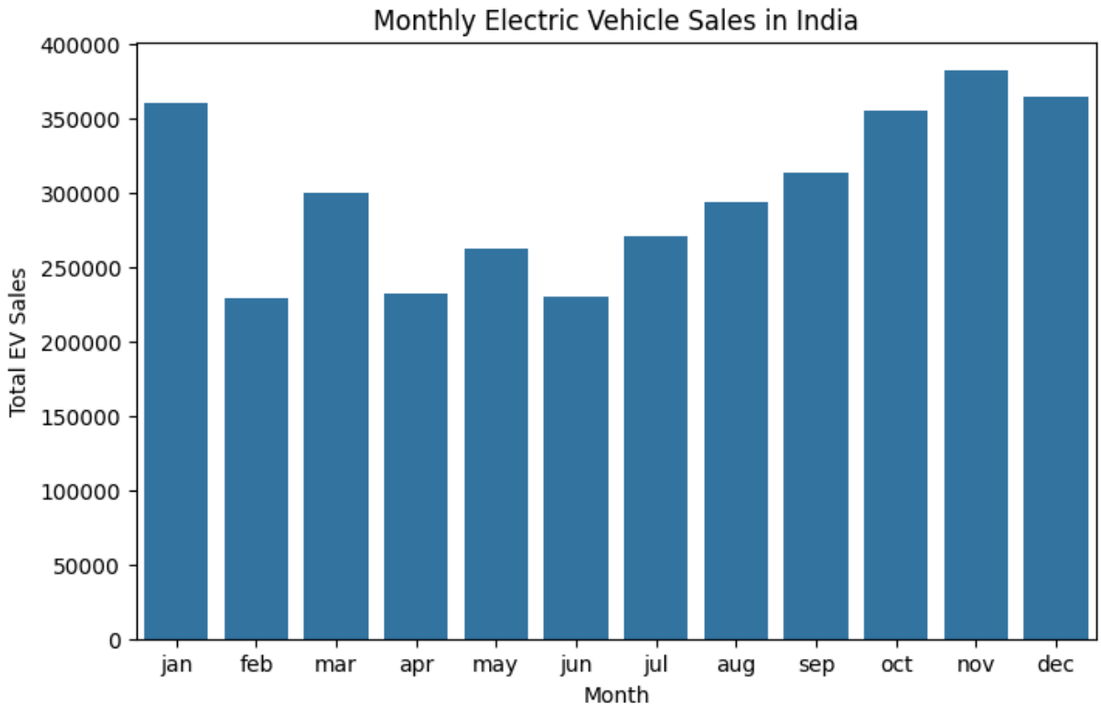
a) Yearly EV Sales Trends --

In [31]:
```
yearly_sales = df.groupby('Year')["EV_Sales_Quantity"].sum().reset_index()

plt.figure(figsize=(8,5))
sns.lineplot(x="Year",y = "EV_Sales_Quantity", data=yearly_sales,marker="o")
plt.title("Year Wise Electric Vehicle Sales in India")
plt.show()
```



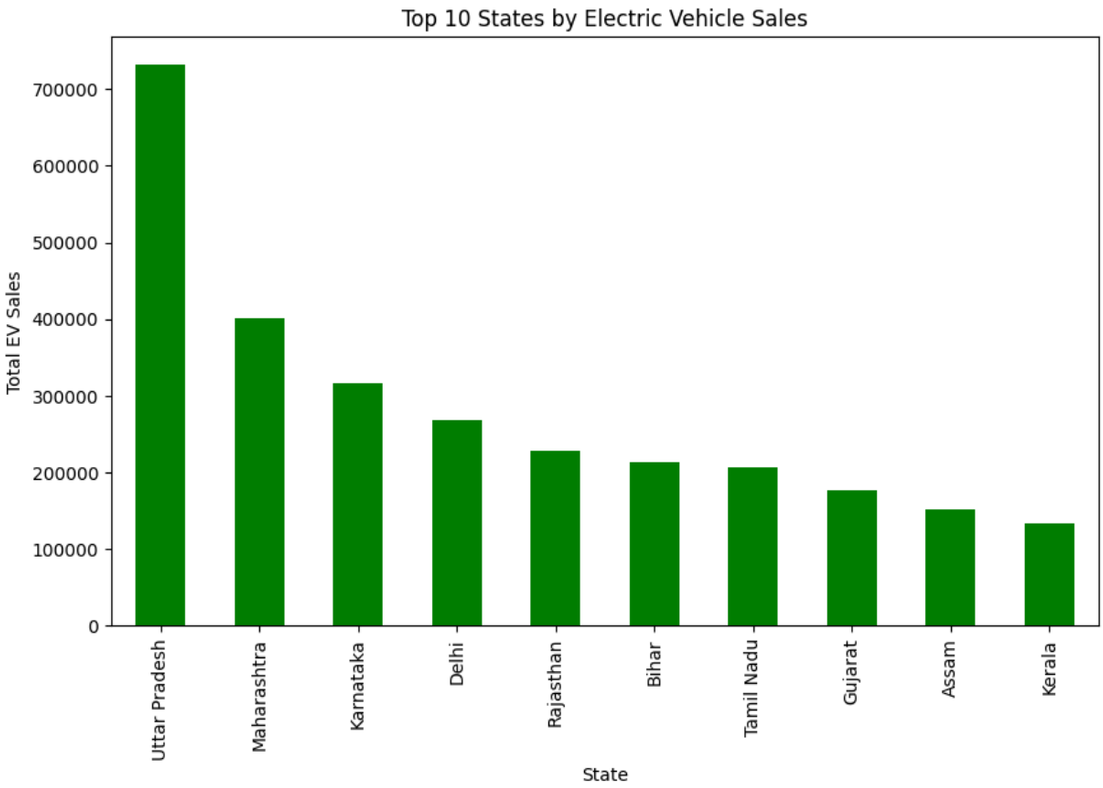
b) Monthly EV sales Trends --

In [45]:
```
monthly_sales = df.groupby('Month_Name')['EV_Sales_Quantity'].sum().reset_index()

plt.figure(figsize=(8,5))
sns.barplot(x='Month_Name', y='EV_Sales_Quantity', data=monthly_sales,
            order=['jan','feb','mar','apr','may','jun','jul','aug','sep','oct','nov
plt.title('Monthly Electric Vehicle Sales in India')
plt.xlabel('Month')
plt.ylabel('Total EV Sales')
plt.show()
```



c) State-wise EV Sales Analysis--

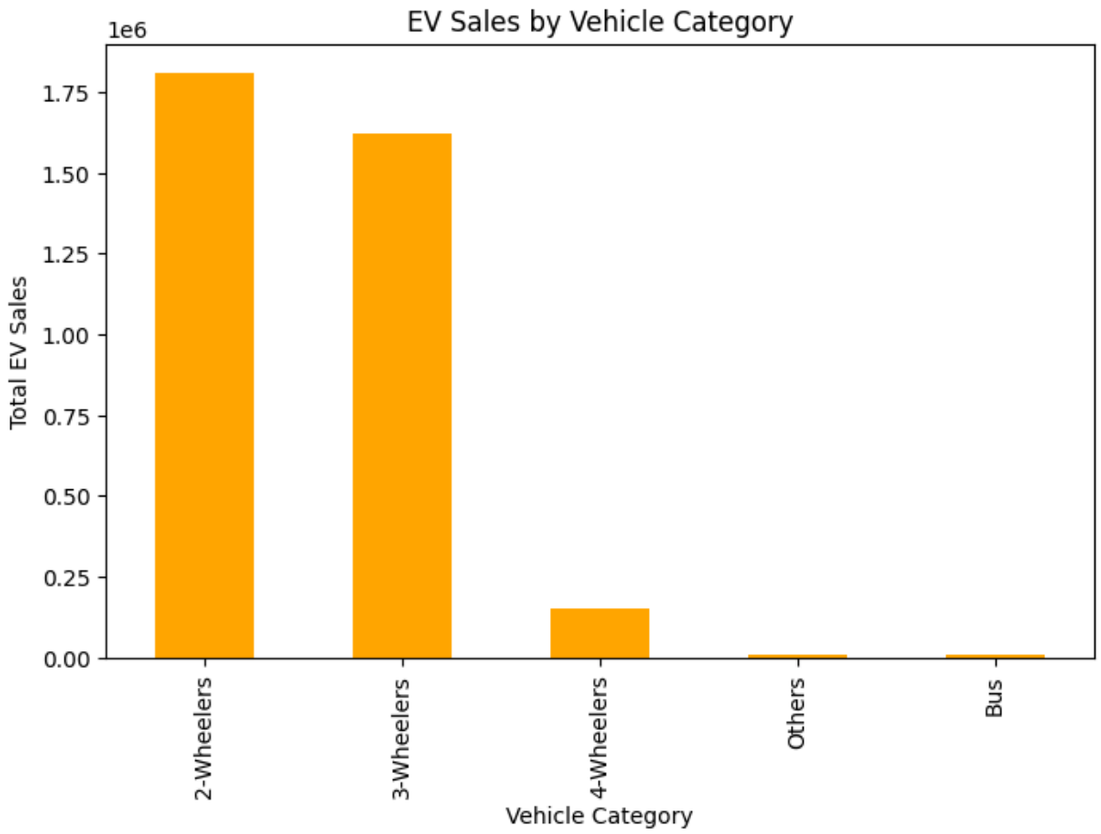
In [46]:
```
state_sales = df.groupby('State')['EV_Sales_Quantity'].sum().sort_values(ascending=

plt.figure(figsize=(10,6))
state_sales.plot(kind='bar', color='green')
plt.title('Top 10 States by Electric Vehicle Sales')
plt.xlabel('State')
plt.ylabel('Total EV Sales')
plt.show()
```



d) EV Sales by Vehicle Category--

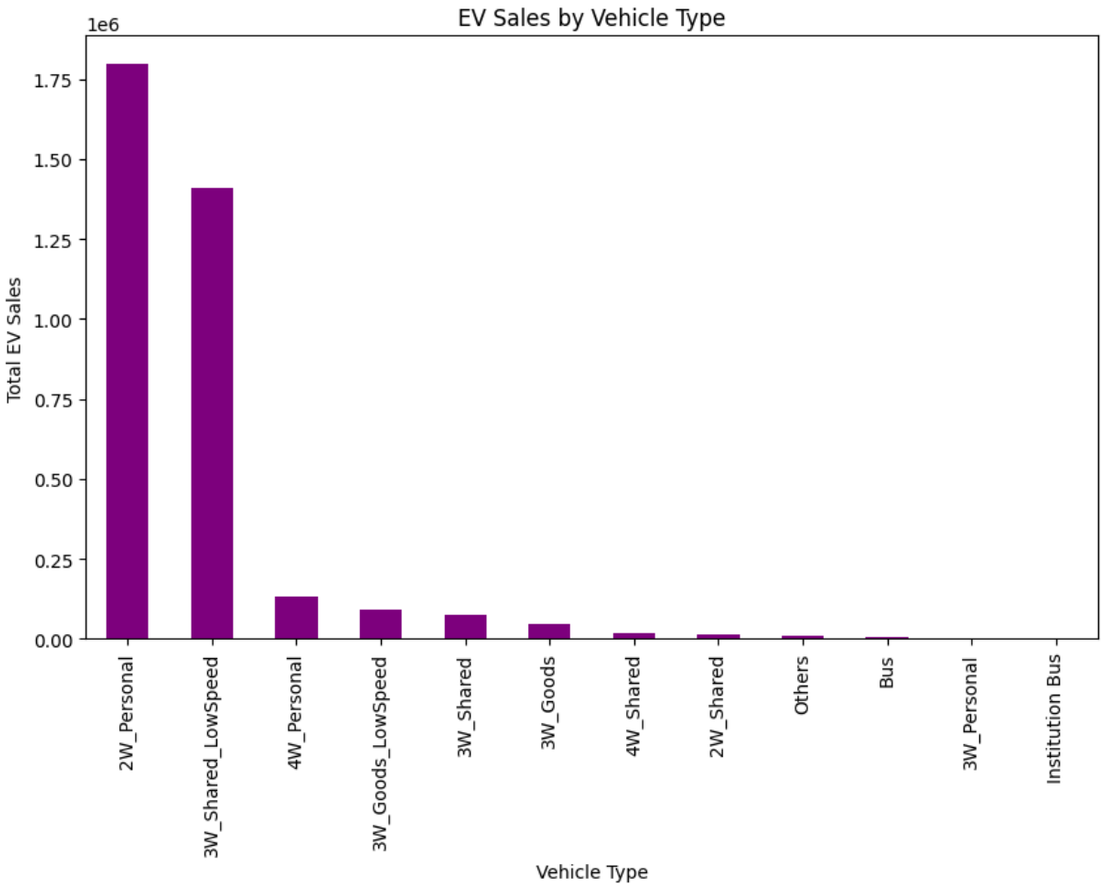
In [47]:
```
category_sales = df.groupby('Vehicle_Category')['EV_Sales_Quantity'].sum().sort_val

plt.figure(figsize=(8,5))
category_sales.plot(kind='bar', color='orange')
plt.title('EV Sales by Vehicle Category')
plt.xlabel('Vehicle Category')
```

```
plt.ylabel('Total EV Sales')
plt.show()
```



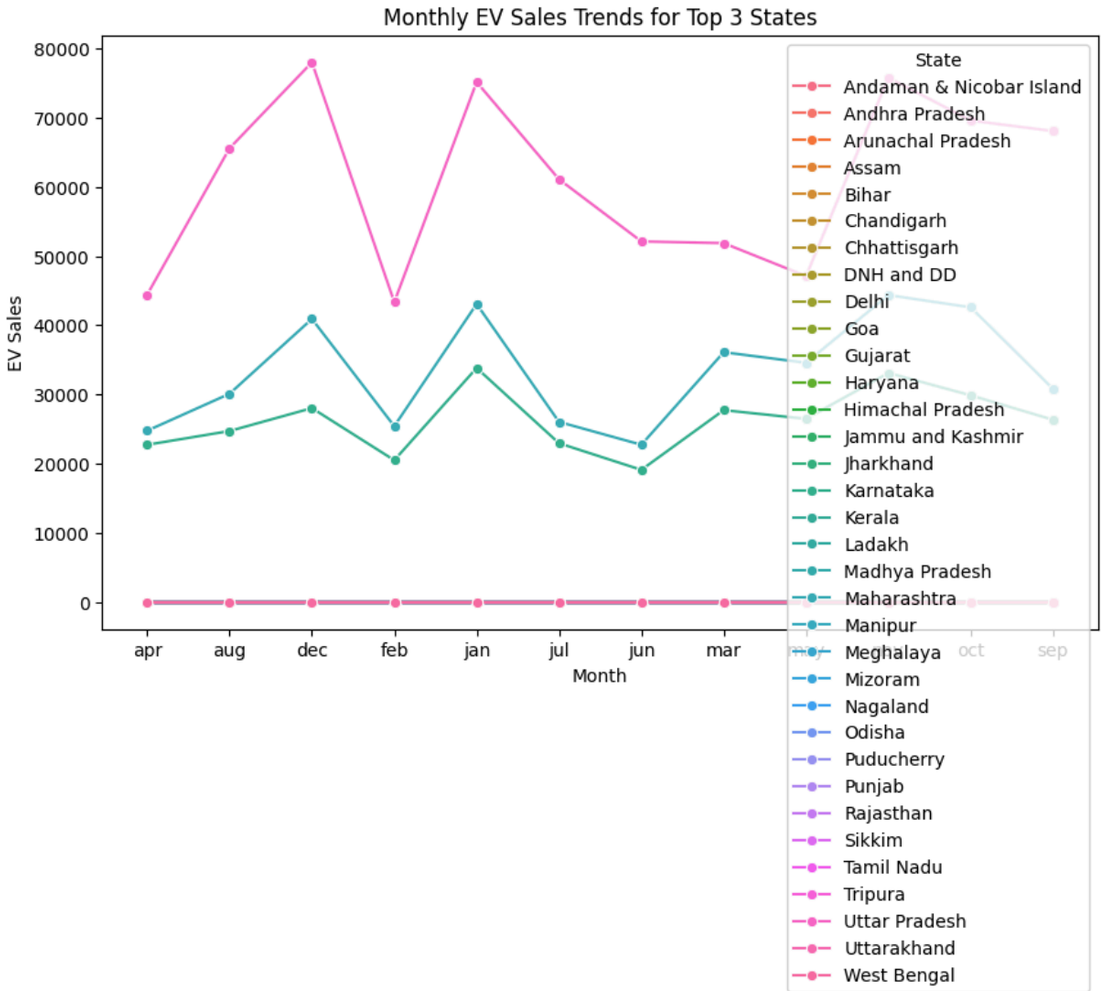
e) EV Sales by Vehicle Type--

In [48]:
```
type_sales = df.groupby('Vehicle_Type')['EV_Sales_Quantity'].sum().sort_values(asce

plt.figure(figsize=(10,6))
type_sales.plot(kind='bar', color='purple')
plt.title('EV Sales by Vehicle Type')
plt.xlabel('Vehicle Type')
plt.ylabel('Total EV Sales')
plt.show()
```



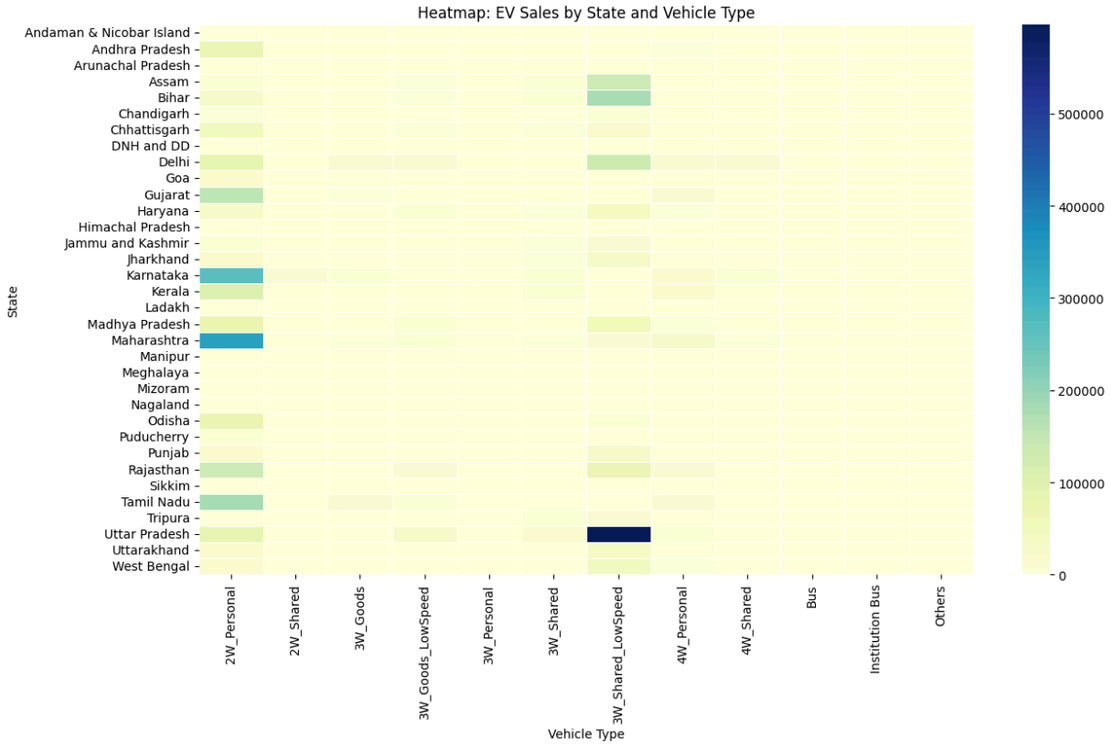
f) Monthly Trends for Top States--

In [49]:
```
top_states = df.groupby('State')['EV_Sales_Quantity'].sum().sort_values(ascending=F

monthly_state_sales = df[df['State'].isin(top_states)].groupby(['Month_Name','State

plt.figure(figsize=(10,6))
sns.lineplot(
    data=monthly_state_sales,
    x='Month_Name',
    y='EV_Sales_Quantity',
    hue='State',
    marker='o')
plt.title('Monthly EV Sales Trends for Top 3 States')
plt.xlabel('Month')
plt.ylabel('EV Sales')
plt.show()
```



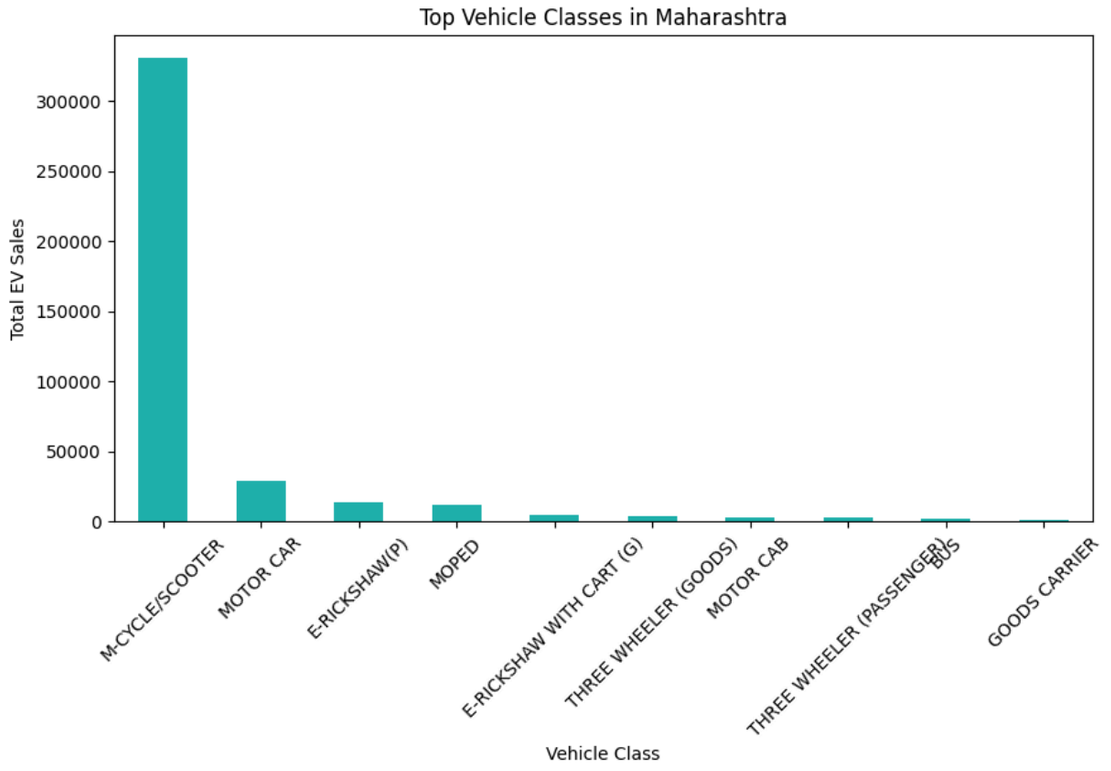
g) States vs Vehicle Types--

In [50]:
```
heatmap_data = df.groupby(['State','Vehicle_Type'])['EV_Sales_Quantity'].sum().unst

plt.figure(figsize=(14,8))
sns.heatmap(heatmap_data, cmap='YlGnBu', linewidths=0.5)
plt.title('Heatmap: EV Sales by State and Vehicle Type')
plt.xlabel('Vehicle Type')
plt.ylabel('State')
plt.show()
```



h) Top Vehicle Classes in a Specific State--

In [51]:
```
state_df = df[df['State'] == 'Maharashtra']

top_vehicle_classes = state_df.groupby('Vehicle_Class')['EV_Sales_Quantity'].sum().

plt.figure(figsize=(10,5))
top_vehicle_classes.plot(kind='bar', color='lightseagreen')
plt.title('Top Vehicle Classes in Maharashtra')
plt.xlabel('Vehicle Class')
plt.ylabel('Total EV Sales')
plt.xticks(rotation=45)
plt.show()
```



In [ ]:

Summary

- EV sales have consistently increased from 2014 to 2023, showing strong adoption across India.
- Sales are relatively higher in months like March, September, and December, possibly aligning with fiscal year-end or festive purchases.
- Maharashtra, Karnataka, and Uttar Pradesh lead the country in EV adoption.
- Two-wheelers dominate the EV market, making up the largest share.
- Uttar Pradesh shows seasonal spikes, indicating demand is not consistent throughout the year.
- Goods carriers and buses have minor contribution in that state.

“I analyzed EV sales data to identify state-level trends, vehicle type popularity, and yearly growth. I discovered that two-wheelers are the dominant segment, with Maharashtra leading in sales. I recommended focusing infrastructure investments on high-adoption regions.”
