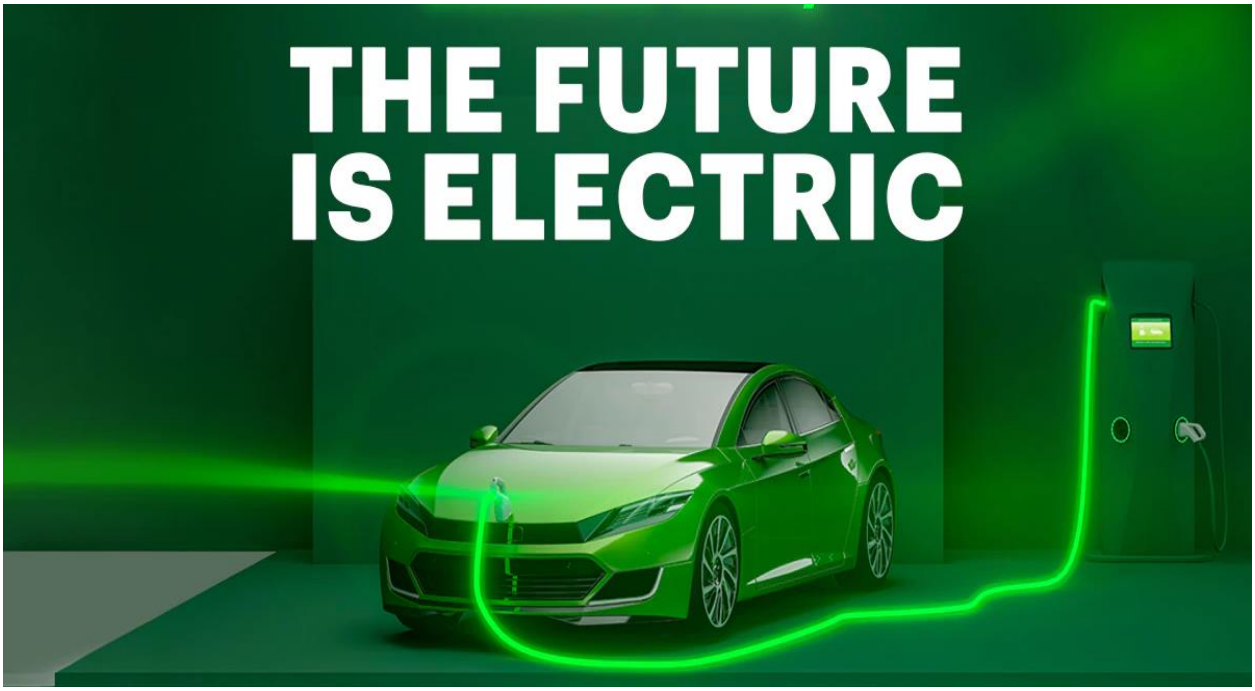
Segmenting the Market for Electric Vehicles in India



Team Members Github:

Mohd Sarfaraz Faiyaz (Leader):
https://github.com/bblackheart013/fyenn-labs-1r

Daksh Agiwal:
https://github.com/daksh-025/EVmarketanalysis

Pratyush Pao:
https://github.com/pickleprat/Feynn-Labs/tree/main/EVTask

Kaustubh Kishor Welde:
https://github.com/kaustubhhxxiii/EV-Market

Manish C:
https://github.com/Manishc1996/Feynn_labs_Electric_Vechicle_Market_Segmentation

Introduction: Segmenting the Market for Electric Vehicles in India

The global automotive industry is undergoing a transformative shift as the demand for sustainable transportation solutions grows. With concerns over environmental pollution, depleting fossil fuel reserves, and the need for energy-efficient alternatives, electric vehicles (EVs) have emerged as a promising solution. India, with its rapidly growing population and expanding automotive market, presents a unique opportunity for the development and adoption of electric vehicles.

This study aims to analyze the electric vehicle market in India and utilize segmentation analysis to formulate a strategic plan for a startup focused on developing an electric vehicle. By understanding the current market dynamics, consumer preferences, and competitive landscape, the startup can tailor its offerings to meet the demands of the Indian market effectively.

Section 1: Overview of Electric Vehicles in India

The first section of the analysis provides an overview of the electric vehicle industry in India, highlighting the key drivers and challenges. India, as one of the world's largest automotive markets, is witnessing a significant shift towards electric mobility. The section will explore the government's initiatives and policies aimed at promoting electric vehicles, such as the Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) scheme.

The FAME scheme, launched in 2015 and followed by FAME-II in 2019, provides incentives to manufacturers and buyers of electric vehicles to accelerate their adoption. These incentives include upfront subsidies, reduced taxes, and support for charging infrastructure development. The section will delve into the impact of these policies on the growth of the electric vehicle market in India.

Furthermore, the section will analyze the current market size and growth trends in the Indian electric vehicle industry. It will highlight the sales figures and projections, showcasing the increasing consumer interest in electric vehicles. The section will also discuss the major players in the market, both domestic and international, and their contributions to the industry's growth.

Section 2: Importance of Segmentation Analysis

The second section emphasizes the importance of segmentation analysis in developing an effective strategy for an electric vehicle startup. Segmentation analysis allows startups to understand the diverse needs, preferences, and behaviors of potential customers. By dividing the market into distinct segments, based on demographic, psychographic, and behavioral factors, startups can tailor their offerings to specific target groups.

The section will discuss how segmentation analysis helps in identifying target customer segments and understanding their motivations, needs, and pain points. It enables startups to create customized marketing messages, product features, and pricing strategies that resonate with the target audience. By recognizing the heterogeneity within the market, startups can maximize their chances of success by focusing their resources on the most promising segments.

Section 3: Segmentation Variables for Electric Vehicle Market

In this section, the analysis will delve into the various segmentation variables that can be employed to understand the Indian electric vehicle market better. Demographic variables such as age, income, occupation, and geographical location play a crucial role in segmenting the market. These variables help identify different customer profiles and their purchasing power, influencing their willingness to adopt electric vehicles.

Psychographic variables, including attitudes towards sustainability, environmental consciousness, and technology adoption, are also important in segmenting the market. Understanding consumers' values, beliefs, and lifestyle choices enables startups to tailor their marketing messages and positioning strategies accordingly.

Moreover, behavioral variables such as purchase behavior, usage patterns, and charging infrastructure accessibility are critical in segmenting the market. This includes factors such as the frequency of vehicle usage, driving patterns, charging requirements, and preferences for home or public charging stations.

Section 4: Segmentation Analysis Methodology

The fourth section outlines the methodology employed for conducting the segmentation analysis. It describes data collection methods, including primary and secondary research. Primary research may involve surveys, interviews, and focus groups to gather data directly from potential customers. Secondary research may involve analyzing existing market reports, industry publications, and government data to gain insights into the electric vehicle market.

The section will also discuss the statistical tools and analytical techniques utilized to analyze the collected data. These may include data mining, clustering algorithms, regression analysis, and other statistical methods. The objective is to identify distinct customer segments based on the chosen segmentation variables and derive meaningful insights from the data.

Section 5: Findings from Segmentation Analysis

Based on the conducted segmentation analysis, this section will present the findings regarding different customer segments in the Indian electric vehicle market. The analysis will identify the unique characteristics, preferences, and needs of each segment.

For example, one segment might consist of environmentally conscious consumers who prioritize sustainability and are willing to pay a premium for electric vehicles. Another segment might focus on cost-conscious individuals who are looking for affordable electric vehicle options with lower operating costs. By understanding these segments, startups can tailor their product offerings, marketing strategies, and distribution channels to cater to the specific needs of each segment effectively.

Section 6: Strategy Formulation for Electric Vehicle Startup

Building upon the insights gained from the segmentation analysis, the sixth section will focus on formulating a comprehensive strategy for the electric vehicle startup. This strategy will encompass product positioning, branding, pricing, and marketing strategies based on the identified customer segments.

For instance, if the analysis reveals a segment of environmentally conscious customers, the startup can position itself as a provider of eco-friendly and sustainable transportation solutions. This might involve emphasizing the green credentials of the electric vehicle, showcasing the reduced carbon footprint, and highlighting the environmental benefits. The pricing strategy can be designed to attract these customers by offering competitive pricing, affordable financing options, or leasing arrangements.

The section will also explore potential partnerships and collaborations that can facilitate the successful entry and growth of the startup in the Indian electric vehicle market. This may include collaborations with charging infrastructure providers, battery manufacturers, or renewable energy companies to create a holistic ecosystem for electric vehicle adoption.

Section 7: Challenges and Future Outlook

The final section of the analysis will discuss the challenges and barriers hindering the widespread adoption of electric vehicles in India. These challenges may include limited charging infrastructure, high initial costs, range anxiety, consumer perceptions, and the need for supportive government policies. Understanding these challenges is crucial for startups to develop strategies that mitigate these barriers and accelerate electric vehicle adoption.

Additionally, the section will explore the future outlook for the Indian electric vehicle market. It will consider anticipated technological advancements, policy changes, and evolving consumer trends. Factors such as the development of fast-charging infrastructure, advancements in battery technology, and increased affordability can significantly impact the future growth of the electric vehicle market in India.

In conclusion, this analysis focuses on the electric vehicle market in India and utilizes segmentation analysis to formulate a strategy for a startup aiming to develop electric vehicles. By understanding the market dynamics, consumer preferences, and competitive landscape through segmentation analysis, startups can effectively position themselves and tailor their offerings to specific target segments. Despite the challenges, the Indian electric vehicle market presents tremendous potential, and startups that leverage segmentation analysis to develop robust strategies can contribute to the growth of the industry and shape a greener and more sustainable future.

Fermi Estimation

Fermi estimation, named after the renowned physicist Enrico Fermi, is a method used to make rough but reasonable estimates of quantities and values. It is a back-of-the-envelope approach that allows for quick calculations and approximations based on limited information. Fermi estimation is particularly useful when precise data is unavailable or when time constraints prevent detailed analysis. It helps in gaining a ballpark figure or order of magnitude estimate to understand the scale or feasibility of a problem or situation.

The key idea behind Fermi estimation is to break down a complex problem into simpler, more manageable parts and make reasonable assumptions to arrive at an estimate. By making simplified assumptions, using basic knowledge and logic, and performing simple calculations, one can arrive at a rough estimate that is often surprisingly close to the actual value.

The process of Fermi estimation involves four main steps:

1. **Decompose the problem**: Begin by breaking down the problem into smaller, more understandable components. Identify the key variables or factors that influence the quantity or value being estimated. For example, if estimating the number of cars in a city, consider factors such as population, average household size, and car ownership rates.
2. **Make reasonable assumptions**: Since precise data is often unavailable or difficult to obtain, it is necessary to make reasonable assumptions based on general knowledge or experience. These assumptions should be simple, logical, and conservative. For instance, assuming that each household in the city has an average of two cars may be a reasonable starting point.
3. **Perform rough calculations**: Use basic arithmetic and simple calculations to combine the assumptions and variables identified in the previous steps. The calculations should be straightforward and aim to arrive at a rough estimate. It is often helpful to round numbers and use approximations to simplify the calculations. For example, multiplying the estimated population by the assumed average household size gives an initial estimate of the total number of households.
4. **Iterate and refine**: After obtaining an initial estimate, review the assumptions and calculations to see if they make sense and adjust them if necessary. Repeat the process of estimation, refining the assumptions and calculations as you gain more insight into the problem. This iterative process helps improve the accuracy of the estimate.

Fermi estimation is commonly used in a wide range of fields, including physics, engineering, economics, and everyday life situations. It allows individuals to quickly assess the feasibility of a project, evaluate the reasonableness of a claim, or make informed decisions with limited information.

One of the notable aspects of Fermi estimation is its emphasis on order of magnitude estimates. Rather than aiming for precise values, Fermi estimations focus on understanding the scale and relative magnitudes of quantities. This approach helps in quickly identifying unrealistic scenarios or making rough comparisons between different scenarios.

Let's consider the following example to understand Fermi estimation. The problem is to estimate the number of tennis balls that can fit inside a standard school bus.

To estimate the number of tennis balls, we need to consider the available space inside the school bus. We can break down the problem into the volume of the bus and the volume of a tennis ball.

Let's assume that the school bus is a rectangular prism with dimensions of approximately 12 meters in length, 2.5 meters in width, and 2 meters in height. Additionally, we assume that a standard tennis ball has a diameter of 6 centimeters.

Perform rough calculations:

a) Calculate the volume of the school bus:
Volume = Length x Width x Height
Volume = 12 m x 2.5 m x 2 m = 60 cubic meters

b) Calculate the volume of a tennis ball:
Since a tennis ball is spherical, its volume can be approximated using the formula for the volume of a sphere:
Volume of a sphere = (4/3) x π x (radius)^3
Considering the diameter of the tennis ball is 6 centimeters (or a radius of 3 centimeters = 0.03 meters):
Volume of a tennis ball = (4/3) x π x (0.03 m) ^3 ≈ 0.000090 cubic meters

c) Estimate the number of tennis balls:
Number of tennis balls = Volume of the school bus / Volume of a tennis ball
Number of tennis balls ≈ 60 cubic meters / 0.000090 cubic meters ≈ 666,667 tennis balls

In this step, we can reassess our assumptions and calculations to refine our estimate. For example, we might consider the irregular shape of the bus, the presence of seats, and other space constraints that may affect the number of tennis balls that can fit inside.

It's important to note that the estimate of approximately 666,667 tennis balls is a rough approximation based on our assumptions and calculations. The actual number may vary significantly, but this estimation provides us with a ballpark figure to understand the scale of the problem.

This mathematical example demonstrates how Fermi estimation can be used to estimate quantities even with limited information. By breaking down the problem, making reasonable assumptions, and performing simple calculations, we can arrive at an approximate answer that helps us understand the magnitude and feasibility of the situation.

Data Collection and Preparation

First, we cleaned the collected datasets by removing any irrelevant data, duplicates, and missing values and checked the consistency of the data in all datasets. Then we combine the cleaned datasets based on their common fields. Then we apply certain transformations to convert the raw datasets into a format suitable for analysis.After Transformation we added relevant information to the datasets to provide additional context for analysis.

In [51]:
```
df.head()
```

Out[51]:

	Unnamed: 0	Unnamed: 0.1	Age	City	Profession	Marital Status	Education	No. of Family members	Annual Income	Would you prefer replacing all your vehicles to Electronic vehicles?	If Yes/Maybe what type of EV would you prefer?	Do you think Electronic Vehicles are economical?	b cu
0	0	322	41	25	3	0	1	1	3.035679e+06	2	3	0	
1	1	566	19	7	3	1	0	4	6.940532e+05	2	4	2	
2	2	696	25	8	1	1	0	4	1.408973e+06	1	4	2	
3	3	761	25	18	3	0	1	5	5.565419e+05	2	4	1	
4	4	904	25	30	0	1	0	7	1.279026e+06	2	3	2	

The data is then used to segment the market based on various factors such as consumer preferences, sales trends, charging infrastructure, government policies and some environmental factors such as geographic location or climate change concerns etc.

In [6]:
```
df.head()
```

Out[6]:

	Unnamed: 0	Age	City	Profession	Marital Status	Education	No. of Family members	Annual Income	Would you prefer replacing all your vehicles to Electronic vehicles?	If Yes/Maybe what type of EV would you prefer?	Do you think Electronic Vehicles are economical?	Which brand of vehicle do you currently own?
0	0	30	Nabha	None	Single	Graduate	5	1.193876e+06	Maybe	SUV	Yes	Hyundai
1	1	27	Pune	None	Single	Graduate	4	1.844540e+06	Yes	SUV	Yes	Honda
2	2	32	Kashipur	None	Single	Graduate	4	2.948150e+06	Yes	Hatchback	Yes	KIA
3	3	55	Pune	Business	Single	Graduate	3	2.832380e+06	Maybe	Hatchback	No	Hyundai
4	4	26	Satara	None	Single	Graduate	4	2.638751e+06	Yes	Sedan	Yes	McLaren

In [8]:
```
df['Annual Income']=df['Annual Income'].mask(df['Annual Income']==0,df['Annual Income'].mean(skipna=True))
```

In [9]:
```
df=df.apply(lambda x: x.fillna(x.value_counts().index[0]))
```

DATA PREPROCESSING

In [53]:
```
df.isnull().sum()
```

Out[53]:
```
Unnamed: 0                                                          0
Unnamed: 0.1                                                        0
Age                                                                 0
City                                                                0
Profession                                                          0
Marital Status                                                      0
Education                                                           0
No. of Family members                                               0
Annual Income                                                       0
Would you prefer replacing all your vehicles to Electronic vehicles?  0
If Yes/Maybe what type of  EV would you prefer?                     0
Do you think Electronic Vehicles are economical?                    0
Which brand of vehicle do you currently own?                        0
How much money could you spend on an Electronic vehicle?            0
Preference for wheels in EV                                         0
Do you think Electronic vehicles will replace fuel cars in India?   0
label                                                               0
dtype: int64
```

In [11]:
```
# from sdv.tabular import GaussianCopula
# model = GaussianCopula()
# model.fit(df) ''' Enable For classical approach'''
```

In [12]:
```
df.columns
```

Out[12]:
```
Index(['Unnamed: 0', 'Age', 'City', 'Profession', 'Marital Status',
       'Education', 'No. of Family members', 'Annual Income',
       'Would you prefer replacing all your vehicles to Electronic vehicles?',
       'If Yes/Maybe what type of  EV would you prefer?',
       'Do you think Electronic Vehicles are economical?',
       'Which brand of vehicle do you currently own?',
       'How much money could you spend on an Electronic vehicle?',
       'Preference for wheels in EV',
       'Do you think Electronic vehicles will replace fuel cars in India?'],
      dtype='object')
```

In [15]:
```
df.shape
```

Out[15]:
```
(1000, 15)
```

In [16]:
```
#Data Preprocessing
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1000 entries, 0 to 999
Data columns (total 15 columns):
 #   Column                                                 Non-Null Count  Dtype  
---  ------                                                 --------------  -----  
 0   Unnamed: 0                                             1000 non-null   int64  
 1   Age                                                    1000 non-null   int64  
 2   City                                                   1000 non-null   object 
 3   Profession                                             1000 non-null   object 
 4   Marital Status                                         1000 non-null   object 
 5   Education                                              1000 non-null   object 
 6   No. of Family members                                  1000 non-null   int64  
 7   Annual Income                                          1000 non-null   float64
 8   Would you prefer replacing all your vehicles to Electronic vehicles?  1000 non-null   object 
 9   If Yes/Maybe what type of  EV would you prefer?        1000 non-null   object 
 10  Do you think Electronic Vehicles are economical?       1000 non-null   object 
 11  Which brand of vehicle do you currently own?           1000 non-null   object 
 12  How much money could you spend on an Electronic vehicle?  1000 non-null   object 
 13  Preference for wheels in EV                            1000 non-null   int64  
 14  Do you think Electronic vehicles will replace fuel cars in India?  1000 non-null   object 
dtypes: float64(1), int64(4), object(10)
memory usage: 117.3+ KB
```

In [17]:
```
df.dtypes
```

Out[17]:
```
Unnamed: 0                                                 int64
Age                                                        int64
City                                                      object
Profession                                                object
Marital Status                                            object
Education                                                 object
No. of Family members                                      int64
Annual Income                                            float64
Would you prefer replacing all your vehicles to Electronic vehicles?    object
If Yes/Maybe what type of  EV would you prefer?           object
Do you think Electronic Vehicles are economical?          object
Which brand of vehicle do you currently own?              object
How much money could you spend on an Electronic vehicle?  object
Preference for wheels in EV                                int64
Do you think Electronic vehicles will replace fuel cars in India?  object
dtype: object
```

In [18]:
```
df['Age'].unique()
```

Out[18]:
```
array([ 30,  27,  32,  55,  26,  28,  23,  25,  43,  59,  21,  29,  56,
        70,  50,  24,  61,  39,  31,  40,  18,  58,  22,  96,  64,  52,
        54,  42,  49,  57,  46,  36,  20,  19,  65,  17,  60,  44,  45,
        47,  82,  33,  37,  48,  69,  67,  86,  62,  66,  34,  63,  41,
        68,  16,  53,  15, 118,  38])
```

In [19]:
```
df['City'].unique()
```

Out[19]:
```
array(['Nabha', 'Pune', 'Kashipur ', 'Satara', 'Noida', 'Delhi', 'Mumbai',
       'pune', 'solapur', 'Haldwani ', 'Nellore ', 'Pune ', 'Haldwani',
       'Banglore ', 'Faridabad ', 'Nagpur', 'Chandrapur ', 'Chennai',
       'Gurugram ', 'Nashik', 'Bengaluru', 'Mumbai ', 'Hakdwani',
       'Patiyala', 'pUNE', 'Ahmedabad', 'Karnal', 'Rewari', 'New Delhi',
       'Serampore', 'Jhansi', 'New Delhi ', 'Jalandhar', 'Delhi ',
       'nashik'], dtype=object)
```

In [20]:
```
df['No. of Family members'].unique()
```

Out[20]:
```
array([5, 4, 3, 2, 8, 6, 0, 1, 7])
```

In [21]:
```
df.isnull().any()
```

Out[21]:
```
Unnamed: 0                                                      False
Age                                                             False
City                                                            False
Profession                                                      False
Marital Status                                                  False
Education                                                       False
No. of Family members                                           False
Annual Income                                                   False
Would you prefer replacing all your vehicles to Electronic vehicles?    False
If Yes/Maybe what type of  EV would you prefer?                 False
Do you think Electronic Vehicles are economical?                False
Which brand of vehicle do you currently own?                    False
How much money could you spend on an Electronic vehicle?        False
Preference for wheels in EV                                     False
Do you think Electronic vehicles will replace fuel cars in India?       False
dtype: bool
```

In [22]:
```
df.columns
```

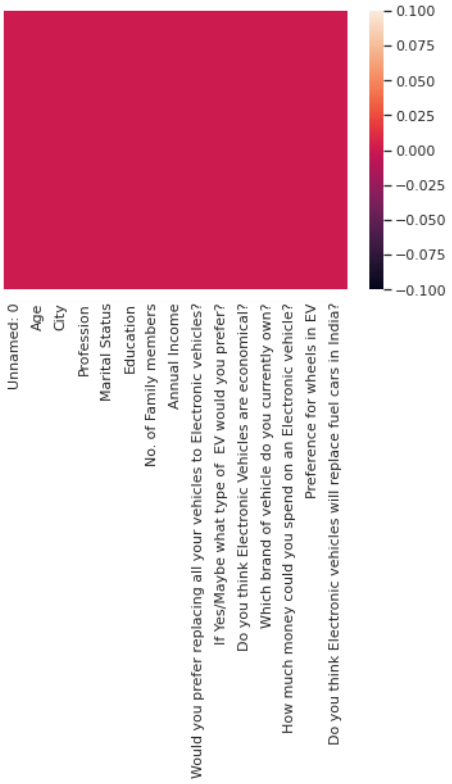
Out[22]:
```
Index(['Unnamed: 0', 'Age', 'City', 'Profession', 'Marital Status',
       'Education', 'No. of Family members', 'Annual Income',
       'Would you prefer replacing all your vehicles to Electronic vehicles?',
       'If Yes/Maybe what type of  EV would you prefer?',
       'Do you think Electronic Vehicles are economical?',
       'Which brand of vehicle do you currently own?',
       'How much money could you spend on an Electronic vehicle?',
       'Preference for wheels in EV',
       'Do you think Electronic vehicles will replace fuel cars in India?'],
      dtype='object')
```

Data Visualization

The Indian EV market is rapidly growing, driven by consumer preferences, sales trends, charging infrastructure, government policies, and environmental factors such as climate change concerns.

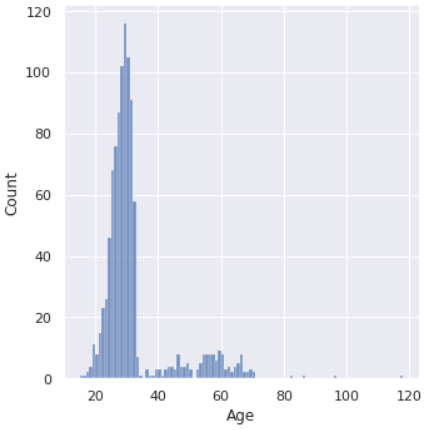
In [23]:
```
#Data Visualization
sns.heatmap(df.isnull(), yticklabels=False)
```

Out[23]: <matplotlib.axes._subplots.AxesSubplot at 0x7f02af8c5110>



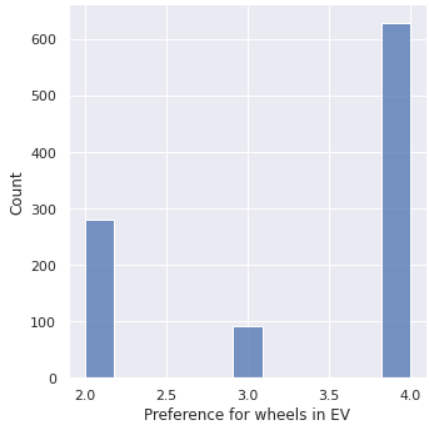
In [24]:
```
sns.displot(df['Age'])
```

Out[24]: <seaborn.axisgrid.FacetGrid at 0x7f02af80fc90>



In [25]:
```
sns.displot(df['Preference for wheels in EV'])
```

Out[25]:
```
<seaborn.axisgrid.FacetGrid at 0x7f02ac931750>
```



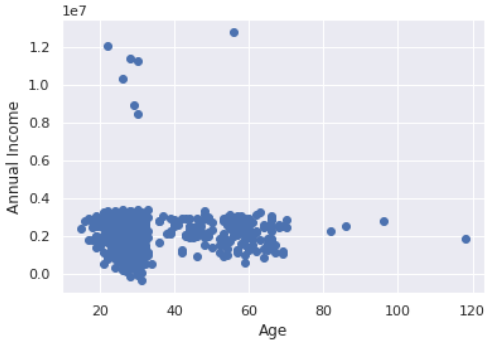
In [26]:
```
df.describe()
```

Out[26]:

	Unnamed: 0	Age	No. of Family members	Annual Income	Preference for wheels in EV
count	1000.000000	1000.000000	1000.000000	1.000000e+03	1000.000000
mean	499.500000	31.800000	4.118000	2.258342e+06	3.349000
std	288.819436	11.294847	1.469774	9.993558e+05	0.887686
min	0.000000	15.000000	0.000000	-3.761509e+05	2.000000
25%	249.750000	26.000000	4.000000	1.782116e+06	2.000000
50%	499.500000	29.000000	4.000000	2.329246e+06	4.000000
75%	749.250000	31.000000	5.000000	2.753170e+06	4.000000
max	999.000000	118.000000	8.000000	1.282128e+07	4.000000

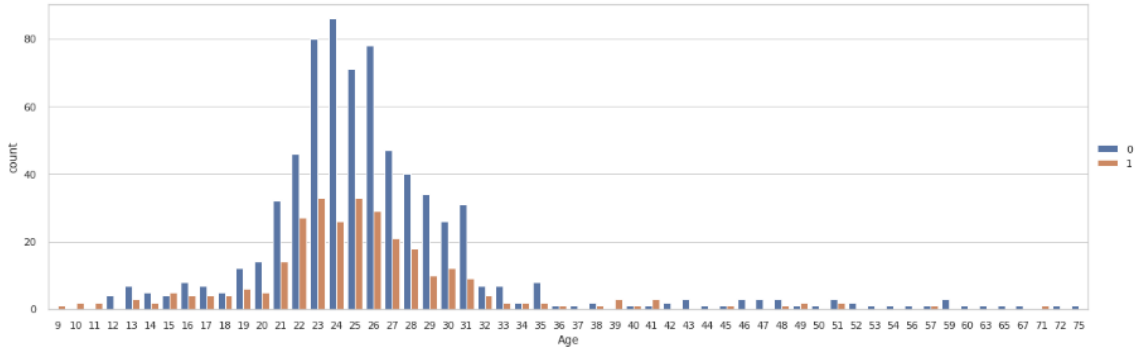
In [28]:
```
plt.xlabel('Age')
plt.ylabel('Annual Income')
plt.scatter(df['Age'],df['Annual Income'])
```

Out[28]:
```
<matplotlib.collections.PathCollection at 0x7f02ac80c250>
```



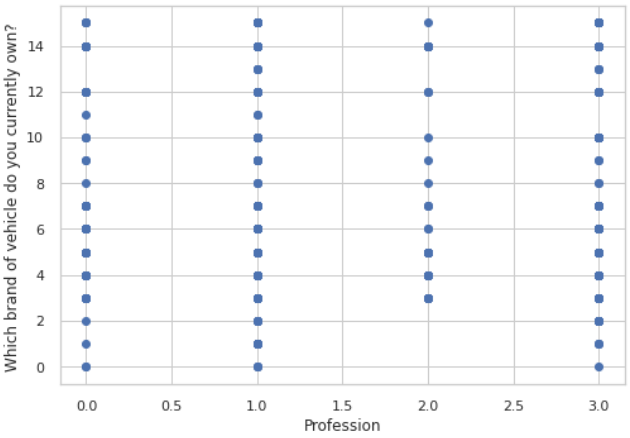
In [63]:
```
plt.figure(figsize=(20,6))
sns.countplot(x="Age", data=df, hue="Education")
plt.legend(loc='center left', bbox_to_anchor=(1, 0.5))
```

Out[63]: <matplotlib.legend.Legend at 0x7f0236f56090>



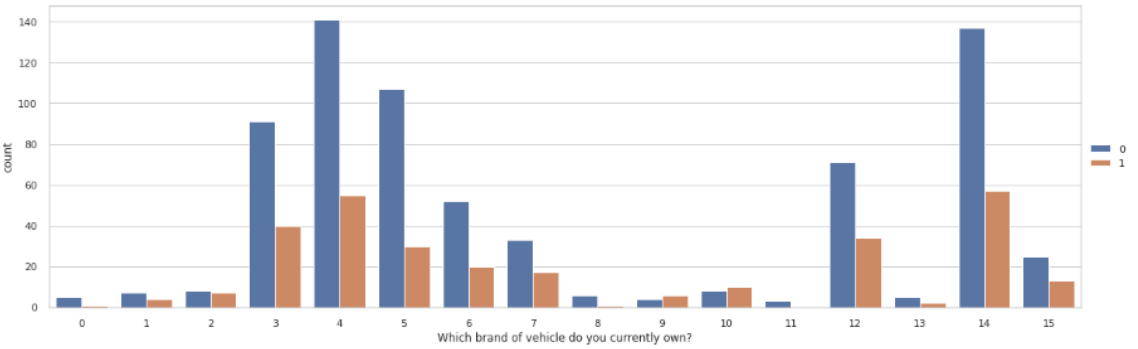
In [65]:
```
plt.xlabel('Profession')
plt.ylabel('Which brand of vehicle do you currently own? ')
plt.scatter(df['Profession'],df['Which brand of vehicle do you currently own?'])
```

Out[65]: <matplotlib.collections.PathCollection at 0x7f0236c954d0>



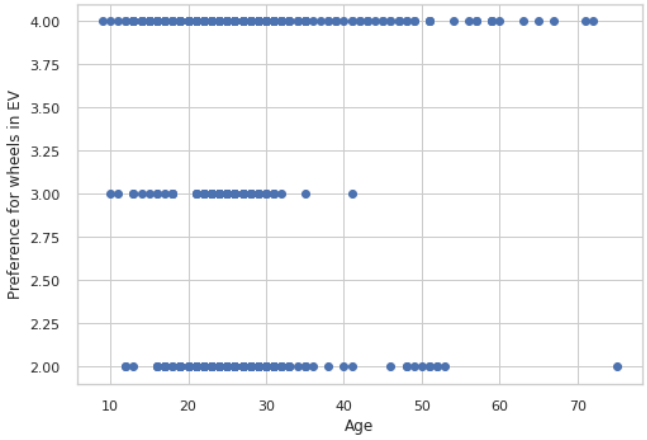
In [68]:
```
plt.figure(figsize=(20,6))
sns.countplot(x="Which brand of vehicle do you currently own?", data=df, hue="Education")
plt.legend(loc='center left', bbox_to_anchor=(1, 0.5))
```

Out[68]: <matplotlib.legend.Legend at 0x7f0236d0a0d0>



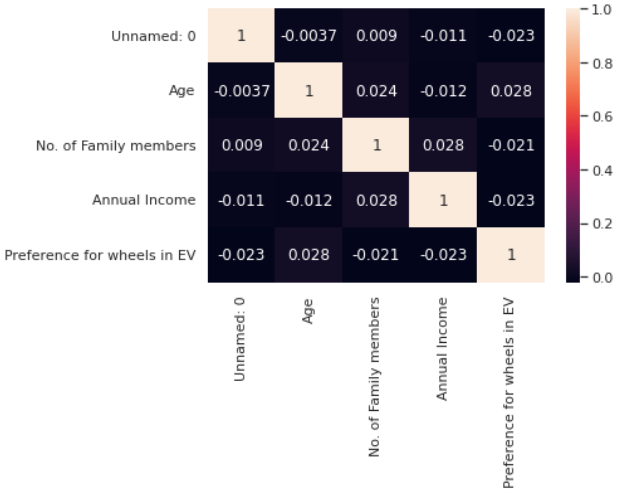
In [69]:
```
plt.xlabel('Age')
plt.ylabel('Preference for wheels in EV')
plt.scatter(df['Age'],df['Preference for wheels in EV'])
```

Out[69]: <matplotlib.collections.PathCollection at 0x7f0236b6d890>



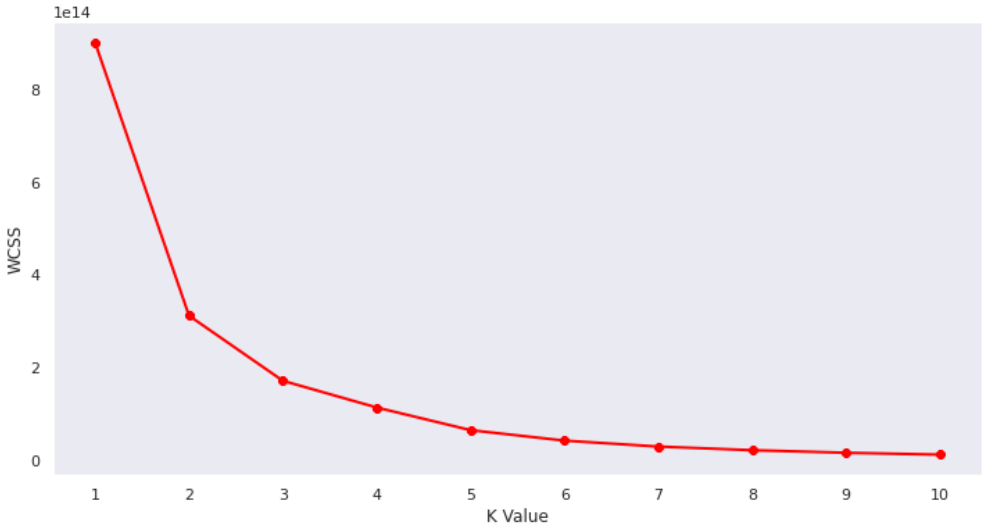
In [29]:
```
# Heatmap of Correlation
sns.heatmap(df.corr(), annot=True)
```

Out[29]: <matplotlib.axes._subplots.AxesSubplot at 0x7f02ac80c810>



K MEANS MODEL

```
from sklearn.cluster import KMeans
wcss = []
for k in range(1,11):
    kmeans = KMeans(n_clusters=k, init="k-means++")
    kmeans.fit(df)
    wcss.append(kmeans.inertia_)
plt.figure(figsize=(12,6))
plt.grid()
plt.plot(range(1,11),wcss, linewidth=2, color="red", marker ="8")
plt.xlabel("K Value")
plt.xticks(np.arange(1,11,1))
plt.ylabel("WCSS")
plt.show()
```

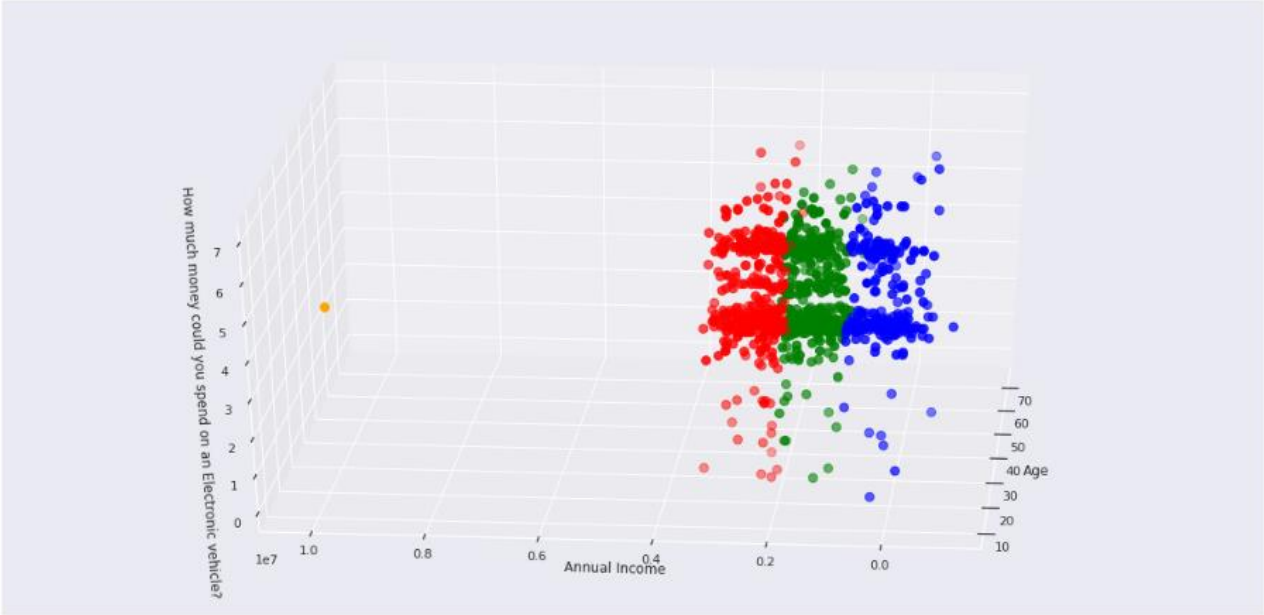



```
km = KMeans(n_clusters=4)
clusters = km.fit_predict(df)
df["label"] = clusters

from mpl_toolkits.mplot3d import Axes3D
import matplotlib.pyplot as plt
import numpy as np
import pandas as pd

fig = plt.figure(figsize=(20,10))
ax = fig.add_subplot(111, projection='3d')
ax.scatter(df.Age[df.label == 0], df["Annual Income"][df.label == 0], df["How much money could you spend on an Electronic \
ax.scatter(df.Age[df.label == 1], df["Annual Income"][df.label == 1], df["How much money could you spend on an Electronic \
ax.scatter(df.Age[df.label == 2], df["Annual Income"][df.label == 2], df["How much money could you spend on an Electronic \
ax.scatter(df.Age[df.label == 3], df["Annual Income"][df.label == 3], df["How much money could you spend on an Electronic \

ax.view_init(30, 185)
plt.xlabel("Age")
plt.ylabel("Annual Income")
ax.set_zlabel('How much money could you spend on an Electronic vehicle?')
plt.show()
```



Conclusions

The provided information highlights the segmentation and growth of the Indian Electric Vehicle (EV) market, along with insights into the sales trends in different states. Here are some key points to note:

1. Market Segmentation:
    a. Vehicle Type: The Indian EV market is segmented into three categories:
        - Passenger Cars
        - Commercial Vehicles
        - Two- and Three-wheelers
    b. Power Source Type: The market is further segmented based on power sources:
        - Battery Electric Vehicle (BEV)
        - Plug-in Electric Vehicle (PHEV)
        - Hybrid Electric Vehicle (HEV)
2. Market Value and Growth:
    - The Indian EV market was valued at USD 5 billion in 2020.
    - It is projected to reach USD 47 billion by 2026.
    - The market is expected to grow at a compound annual growth rate (CAGR) of over 44% during the forecast period (2021-2026).
    - The COVID-19 pandemic initially impacted the market due to supply chain disruptions and manufacturing halts, but it is expected to grow rapidly in the coming years.
3. Government Initiatives and Policies:
    - The Indian government has introduced various initiatives and policies to promote EV adoption.
    - E-commerce companies like Amazon are launching initiatives to use e-mobility for

last-mile deliveries, reducing carbon emissions.
- State governments are actively involved in deploying policies and encouraging the usage of EVs.

4. EV Adoption in Different Vehicle Segments:
   - Total EV sales in India are dominated by two- and three-wheelers (E2W and E3W) currently.
   - When starting an EV business, focusing on the two-wheeler and three-wheeler segments can lead to higher initial sales and faster growth.
5. State-wise Insights:
   - Uttar Pradesh (UP) leads in total EV sales, primarily in the three-wheeler segment for transportation purposes.
   - Tamil Nadu has the highest percentage of two-wheeler EV sales compared to other states, accounting for 86% of total EV sales in the state.
   - Maharashtra has the highest percentage of four-wheeler EV sales among the states, comprising 11% of total EV sales in the state.

Overall, the Indian EV market shows promising growth prospects, driven by government support, initiatives from companies, and increasing consumer awareness about environmental concerns. The two-wheeler and three-wheeler segments have witnessed significant adoption, while the four-wheeler segment is also showing potential for growth.