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SUMMER INTERNSHIP

Report

SET, SU

Session: 2024-25 **Dept- Computer Science and Engineering** **Date of Evaluation:**

SUMMER INTERNSHIP
B. TECH 2nd YEAR PASSING STUDENTS

ELECTRIC VEHICLE POPULATION

Summer Internship Report

Submitted to

Sharda University

In partial fulfilment of the requirements of the award of the

Degree of Bachelor of Technology

in

Computer Science & Engineering

by

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Under the mentorship of

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Greater Noida

August, 2024

Session: 2024-25 **Dept- Computer Science and Engineering** **Date of Evaluation:**

DECLARATION OF THE STUDENT

We hereby declare that the project entitled is an outcome of our own efforts under the guidance of Mr. Tapas Kumar Mishra. The project is submitted to the Sharda University for the partial fulfilment of the Bachelor of Technology Examination 2024-25.

We also declare that this project report has not been previously submitted to any other university.

Aman Sinha 2201010078

Session: 2024-25 **Dept- Computer Science and Engineering** **Date of Evaluation:**

CERTIFICATE

This is to inform that Aman Sinha of Sharda University has successfully completed the project work titled Electric Vehicle Population in partial fulfilment of the Bachelor of Technology Examination 2023-2024 by Sharda University.

This project report is the record of authentic work carried out by them during the period from

Aman Sinha

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Tapas Kr Mishra

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Asst. Professor

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ABSTRACT

This report represents the US population of electric vehicles (EVs) in detail, focusing on the current state of Washington in particular. Through the given EV registration data, the paper serves to assess the market penetration, to venture future growth trends, and identify key factors driving the economy to success. Various aspects have been covered in the collection, including geographical information, utility service details, vehicle specifications, and vehicle identification numbers. Through detailed data analysis, the report evaluates insights into the present state of the EV market, that assess the most common models and manufacturers, and examines the influence of legislative districts on EV registrations. The outcome offers useful information for individuals working in production, infrastructural development, and policy-making.

ACKNOWLEDGEMENT

I would like to express my deepest appreciation to all those who provided me the possibility to complete this report. Apart from the efforts of myself, the success of any project depends largely on the encouragement and guidelines of many others. We take this opportunity to express my gratitude to the people who have been instrumental in the successful completion of this project. We would like to show my greatest appreciation to **Mr. Tapas Kumar Mishra**. We can't say thank you enough for her/his tremendous support and help. We feel motivated and encouraged every time we attend her meeting. Without her encouragement and guidance this project would not have materialized. The guidance and support received from all the members who contributed and who are contributing to this project, was vital for the success of the project. We are grateful for their constant support and help. Besides, we would like to thank the authority of Sharda University for providing us with a good environment and facilities to complete this project. Finally, an honourable mention goes to our families and friends for their understandings and supports on us in completing this project. Without helps of the particular that mentioned above, we would face many difficulties while doing this.

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Introduction

This report presents a comprehensive market size analysis of the electric vehicle (EV) population in the United States, with a focus on the state of Washington. By leveraging historical EV registration data, the study aims to assess market penetration, predict future growth trends, and identify key factors driving market expansion. The dataset comprises various attributes including vehicle identification numbers, geographic information, vehicle specifications, and utility service details. Through detailed data analysis, the report provides insights into the current state of the EV market, highlights the most common models and manufacturers, and examines the influence of legislative districts on EV registrations. The findings offer valuable information for stakeholders involved in production, infrastructure development, and policy-making.

Problem

Market Size Analysis is the process of estimating the potential sales for a product or service within a particular market segment. In the context of electric vehicles (EVs), it involves assessing the total volume of EV registrations to understand the growth of the market, forecast future trends, and help stakeholders make informed decisions regarding production, infrastructure development, and policy-making

The provided dataset contains the following columns, each representing different aspects of the electric vehicle (EV) population in the United States:

- VIN (1-10): Partial Vehicle Identification Number.
- County: The county in which the vehicle is registered.
- City: The city in which the vehicle is registered.
- State: The state in which the vehicle is registered. It appears that this dataset may be focused on Washington (WA) state.
- Postal Code: The postal code where the vehicle is registered.
- Model Year: The year of the vehicle model
- Make: The manufacturer of the vehicle.
- Model: The model of the vehicle.
- Electric Vehicle Type: The type of electric vehicle, e.g., Battery Electric Vehicle (BEV).
- Clean Alternative Fuel Vehicle (CAFV) Eligibility: Eligibility status for clean alternative fuel vehicle programs.
- Electric Range: The maximum range of the vehicle on a single charge (in miles).
- Base MSRP: The Manufacturer's Suggested Retail Price.
- Legislative District: The legislative district where the vehicle is registered.
- DOL Vehicle ID: Department of Licensing Vehicle Identification.
- Vehicle Location: Geographic coordinates of the vehicle location.
- Electric Utility: The electric utility service provider for the vehicle's location.
- 2020 Census Tract: The census tract for the vehicle's location.

The primary objective of this analysis is to leverage historical EV registration data to understand the current market penetration of EVs, predict future market growth, and identify key trends and factors driving market expansion.

Dataset

	0	1	2	3	4
VIN (1-10)	5YJYGDEE1L	7SAYGDEE9P	5YJSA1E4XK	5YJSA1E27G	5YJYGDEE5M
County	King	Snohomish	King	King	Kitsap
City	Seattle	Bothell	Seattle	Issaquah	Suquamish
State	WA	WA	WA	WA	WA
Postal Code	98122.0	98021.0	98109.0	98027.0	98392.0
Model Year	2020	2023	2019	2016	2021
Make	TESLA	TESLA	TESLA	TESLA	NaN
Model	MODEL Y	MODEL Y	MODEL S	MODEL S	MODEL Y
Electric Vehicle Type	Battery Electric Vehicle (BEV)	Battery Electric Vehicle (BEV)	Battery Electric Vehicle (BEV)	Battery Electric Vehicle (BEV)	Battery Electric Vehicle (BEV)
Clean Alternative Fuel Vehicle (CAFV) Eligibility	Clean Alternative Fuel Vehicle Eligible	Eligibility unknown as battery range has not b...	NaN	Clean Alternative Fuel Vehicle Eligible	Eligibility unknown as battery range has not b...
Electric Range	291	0	270	210	0
Base MSRP	0	0	0	0	0
Legislative District	37	1	36	5	23
DOL Vehicle ID	125701579	244285107	156773144	165103011	205138552
Vehicle Location	POINT (-122.30839 47.610365)	POINT (-122.179458 47.802589)	POINT (-122.34848 47.632405)	POINT (-122.03646 47.534065)	POINT (-122.55717 47.733415)
Electric Utility	CITY OF SEATTLE - (WA)|CITY OF TACOMA - (WA)	PUGET SOUND ENERGY INC	CITY OF SEATTLE - (WA)|CITY OF TACOMA - (WA)	PUGET SOUND ENERGY INC||CITY OF TACOMA - (WA)	PUGET SOUND ENERGY INC
2020 Census Tract	53033007800.0	53061051938.0	53033006800.0	53033032104.0	53035940100.0

Observations

1. Descriptive Statistics:

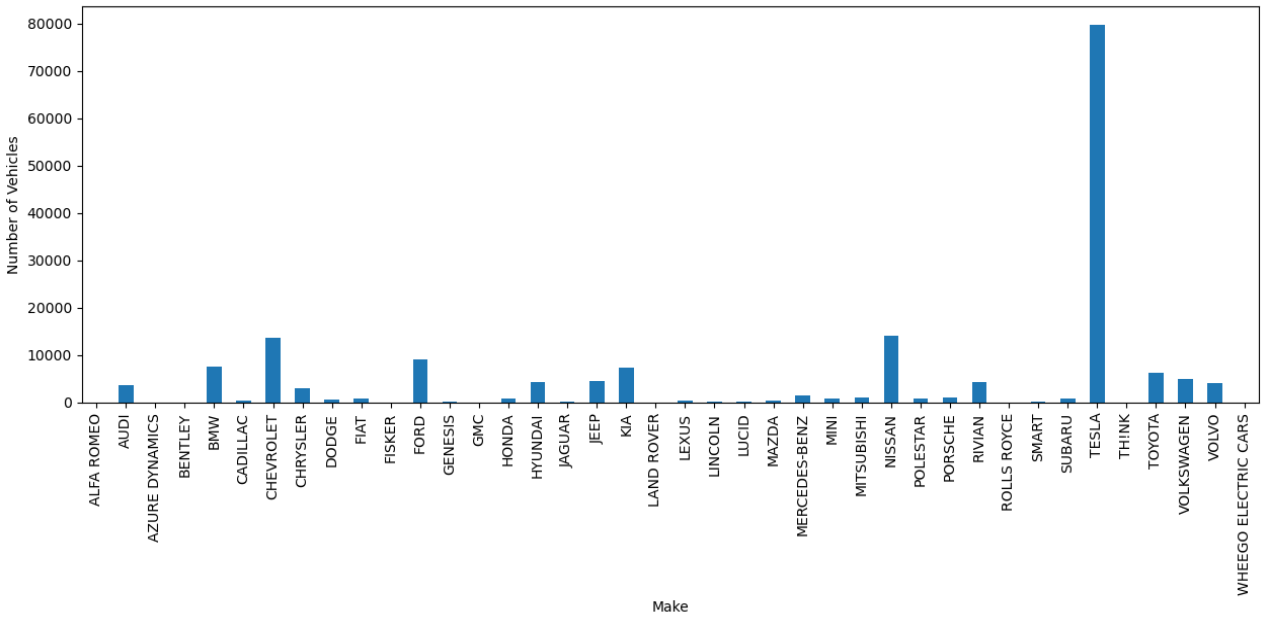
• What are the mean, median, and standard deviation of the base MSRP for the vehicles in the dataset?

Observation

- The Mean of Base MSRP is 0.00
- The Median of Base MSRP is 0.0
- The Standard Deviation of Base MSRP is 0.00

2. Data Distribution:

• What is the distribution of vehicle makes in the dataset? Represent it using a bar chart.



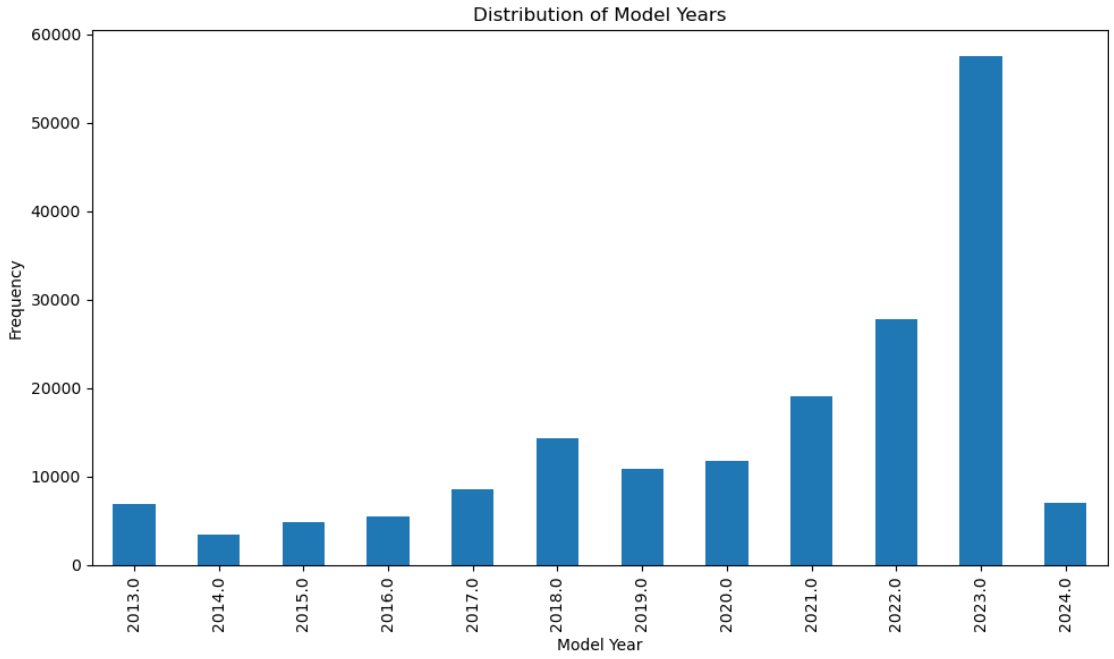
3. Model Year Analysis:

• What are the most common model years in the dataset? Provide

1. A frequency table
2. histogram.

Observation

- Model Year
  2013.0 6862
  2014.0 3509
  2015.0 4844
  2016.0 5483
  2017.0 8562
  2018.0 14323
  2019.0 10940
  2020.0 11768
  2021.0 19132
  2022.0 27776
  2023.0 57587
  2024.0 7080



Observation

- The year between 2023 had seen the most common modles in a year.

4. Electric Vehicle Type:

• What is the proportion of Battery Electric Vehicles (BEV) versus other types of electric vehicles?

Observation

- The raito of Battery Electric Vehicles (BEV) to other types of electric vehicles is 13921 : 177866.
- Or Battery Electric Vehicles (BEV) is 78.26% more compared to other electric vehicles.

5. Electric Range Analysis:

• What is the average electric range for vehicles of different makes? Provide a summary tabe.

12

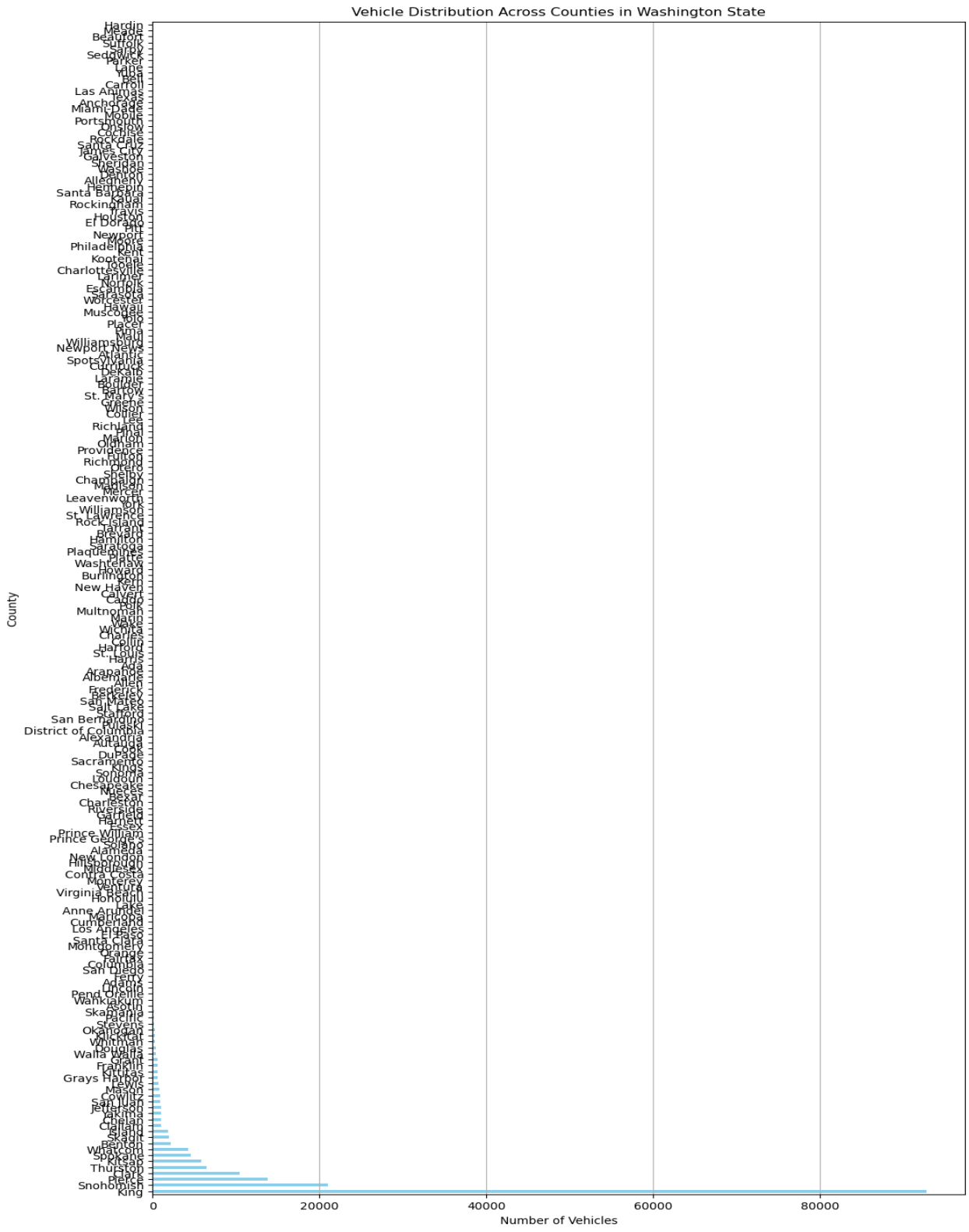
Observation

- Summary Table for vehicles of different Make and Electric Range:

	Make	Electric Range
0	ALFA ROMEO	33.000000
1	AUDI	46.454745
2	AZURE DYNAMICS	56.000000
3	BENTLEY	19.666667
4	BMW	34.711427
5	CADILLAC	8.798429
6	CHEVROLET	76.570332
7	CHRYSLER	32.212162
8	DODGE	32.000000
9	FIAT	85.645408
10	FISKER	8.755102
11	FORD	10.812914
12	GENESIS	0.000000
13	GMC	0.000000
14	HONDA	46.600240
15	HYUNDAI	15.858715
16	JAGUAR	163.254310
17	JEEP	22.365402
18	KIA	38.850175
19	LAND ROVER	25.000000
20	LEXUS	18.800000
21	LINCOLN	23.543071
22	LUCID	0.000000
23	MAZDA	25.781513
24	MERCEDES-BENZ	9.346130
25	MINI	18.016704
26	MITSUBISHI	30.646138
27	NISSAN	79.839501
28	POLESTAR	30.399660
29	PORSCHE	42.693152
30	RIVIAN	0.000000
31	ROLLS ROYCE	0.000000
32	SMART	62.325926
33	SUBARU	1.350181
34	TESLA	60.214775
35	TH!NK	100.000000
36	TOYOTA	28.095102
37	VOLKSWAGEN	22.927058
38	VOLVO	16.135737
39	WHEEGO ELECTRIC CARS	100.000000

6. County Distribution:

• How are vehicles distributed across different counties in Washington state? Represent the distribution using a barh chart.



Observation

- King has the greatest number of vehicles in the Washington state around 53%

7. Price Analysis:

• Compare the average base MSRP of vehicles eligible for the Clean Alternative Fuel Vehicle (CAFV) program versus those that are not

Observation

- Average Base MSRP for CAFV Eligible: $0.00, Not Eligible: $0.00

8. Geographical Analysis:

• How does the base MSRP vary across different cities in Washington state?

Observation

	City	Base MSRP
0	Aberdeen	0.0
1	Aberdeen Proving Ground	0.0
2	Acme	0.0
3	Adairsville	0.0
4	Addy	0.0
5	Adna	0.0
6	Airway Heights	0.0
7	Alameda	0.0
8	Alderdale	0.0
9	Alderwood Manor	0.0

9. Legislative Districts:

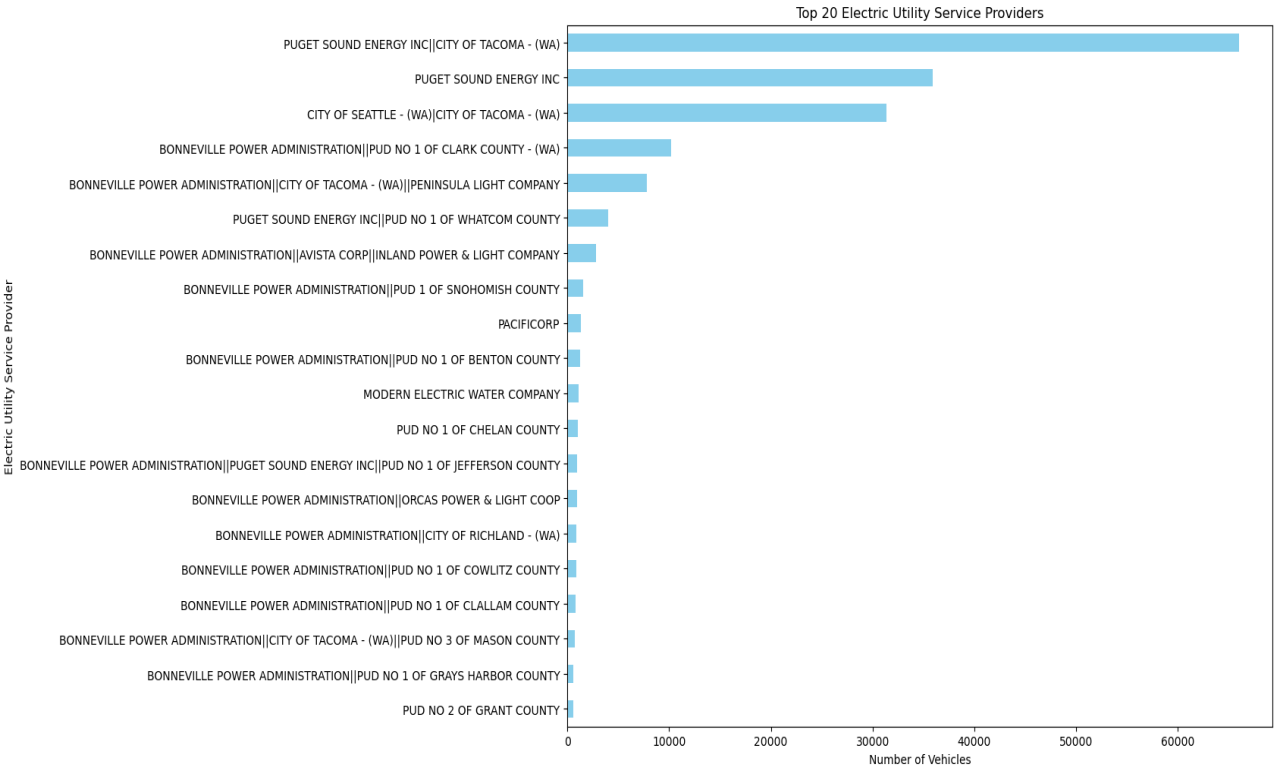
• Which legislative districts have the highest number of registered electric vehicles? Provide a ranked list

Observation

- 41 legislative districts have the highest number of registered electric vehicles
- Ranked List:
- Legislative District
  41.0 8831
  45.0 7425
  5.0 6810
  48.0 6631
  1.0 6265
  Name: count, dtype: int64
  Legislative District
  9 5
  16 4
  3 2
  40 2
  6 1
  Name: count, dtype: int64

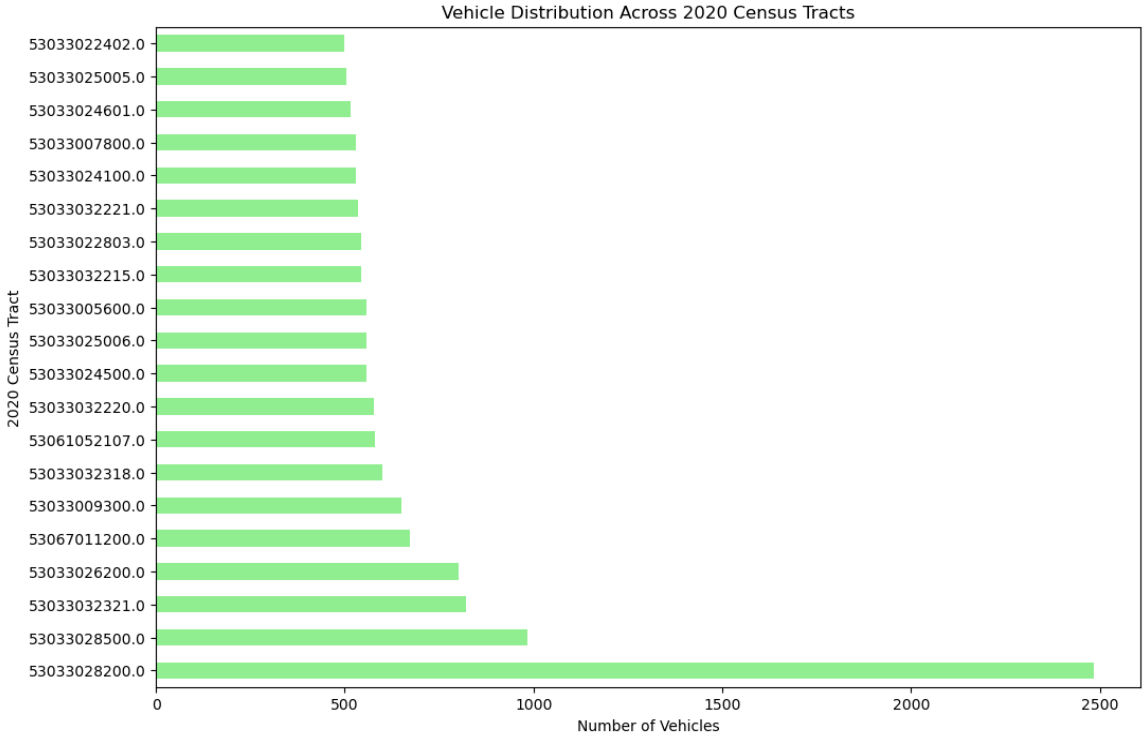
10. Electric Utility Providers:

• What is the distribution of electric utility service providers for the vehicles in the dataset?



11. Census Tract Analysis:

• How are vehicles distributed across different 2020 Census Tracts? Provide insights based on vehicle counts per tract.



12. Electric Range Correlation:

• Is there a correlation between the electric range and the base MSRP of the vehicles? Provide the correlation coefficient and interpret the result.

Observation

- Correlation Coefficient between Electric Range and Base MSRP: nan
- Correlation Coefficient (r):
  1: Perfect positive correlation.
  0.7 to 0.9: Strong positive correlation.
  0.4 to 0.6: Moderate positive correlation.
  0.1 to 0.3: Weak positive correlation.
  0: No correlation.
  -0.1 to -0.3: Weak negative correlation.
  -0.4 to -0.6: Moderate negative correlation.
  -0.7 to -0.9: Strong negative correlation.
  -1: Perfect negative correlation
- There cannot be a Correlation between Electric Range and Base MSRP

13. VIN Analysis:

• Identify any patterns or commonalities in the VIN (1-10) for the vehicles. Are there any frequent prefixes or suffixes

- Most common VIN prefixes (first 10 characters):
  VIN (1-10)
  7SAYGDEE6P 1239
  7SAYGDEE7P 1235
  7SAYGDEE8P 1197
  7SAYGDEEXP 1191
  7SAYGDEE5P 1177
  Name: count, dtype: int64

- Most common VIN suffixes (last 10 characters):
  VIN (1-10)
  7SAYGDEE6P 1239
  7SAYGDEE7P 1235
  7SAYGDEE8P 1197
  7SAYGDEEXP 1191
  7SAYGDEE5P 1177
  Name: count, dtype: int64

14. Eligibility Status:

• What percentage of vehicles are eligible for the Clean Alternative Fuel Vehicle (CAFV) program

Observation

- Percentage of vehicles eligible for CAFV: 37.29%

15. Model Popularity:

• Which vehicle models are the most popular in the dataset? Provide a frequency table of the top 10 models

Observation

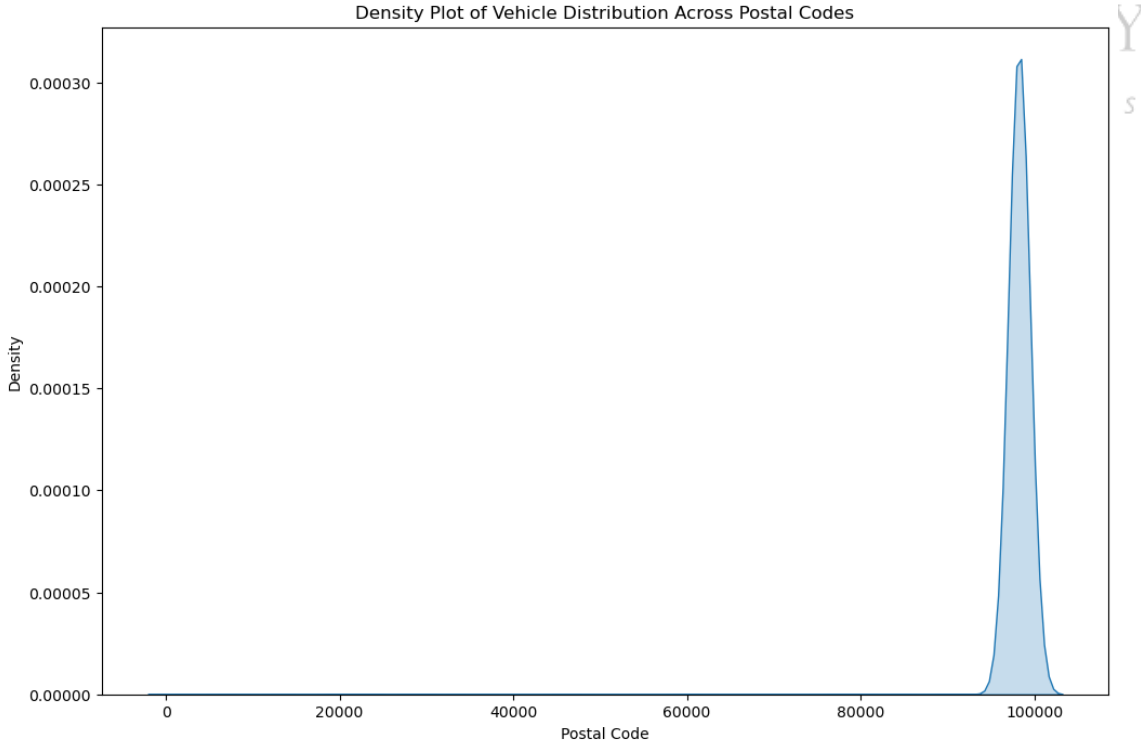
- Frequency Table of top 10 Models:

```
Model
MODEL Y          35993
MODEL 3          30091
LEAF             13365
MODEL S           7734
BOLT EV           6821
MODEL X           5796
VOLT              4796
ID.4              3937
WRANGLER          3392
MUSTANG MACH-E    3322
Name: count, dtype: int64
```

- MODEL Y is most popular in the dataset

16. Postal Code Distribution:

• How are vehicles distributed across different postal codes? Provide a heatmap or density plot



Observation

- Density Plot of Vehicle Distribution Across Postal Codes shows postal code at 100000 is maximum

17. Vehicle Location Analysis:

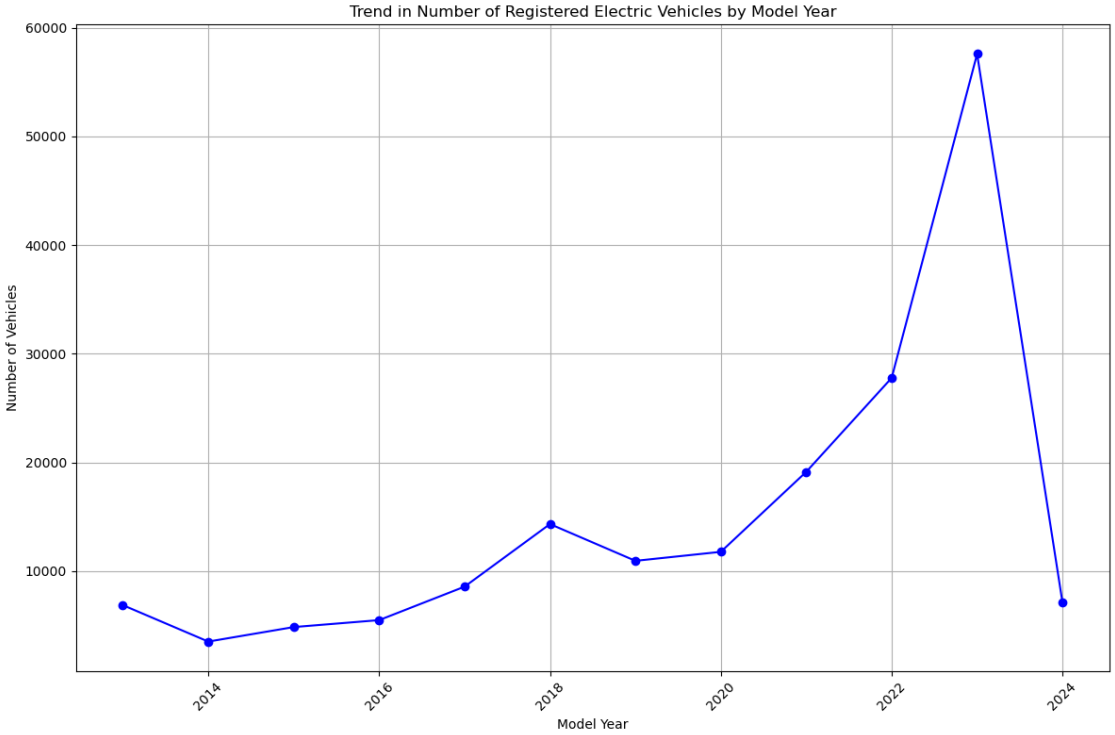
• Analyze the geographic coordinates to determine any clusters of electric vehicles in certain areas of Washington state.

Observation

- At longitude 49 and Longitude -120 the distribution is maximum

18. Model Year Trend:

• Analyze the trend in the number of registered electric vehicles by model year. Provide a line chart to show any increase or decrease over the years.

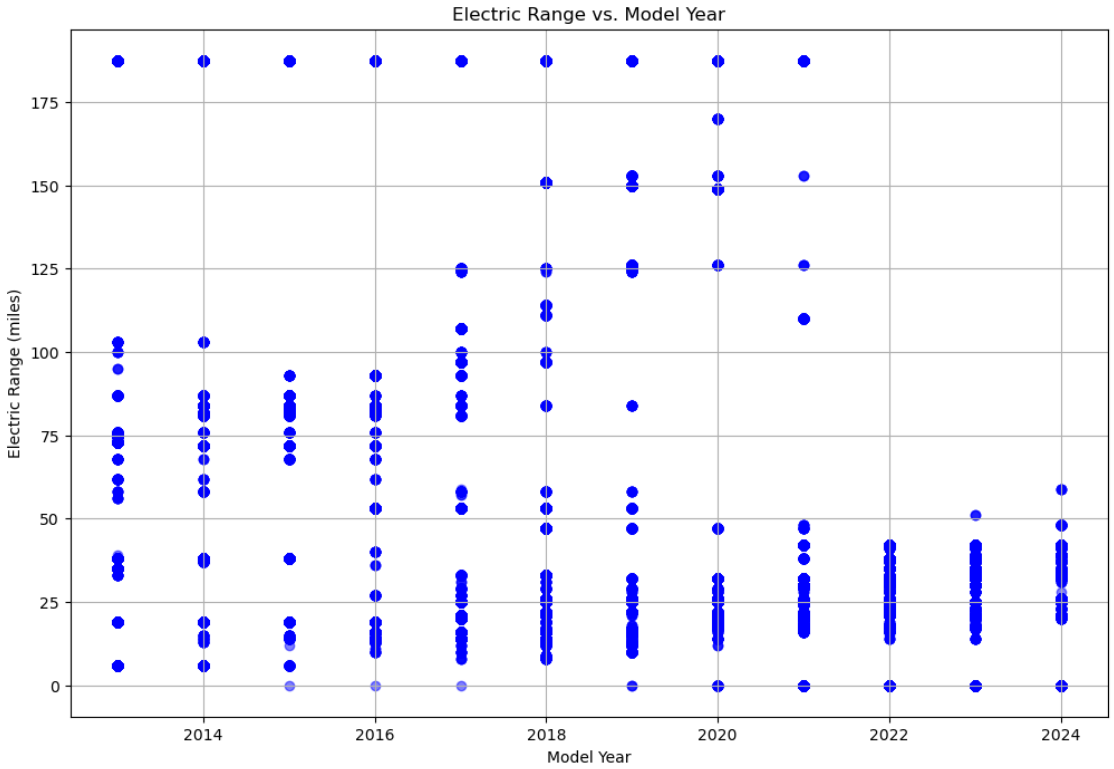


Observation

- The was a steady growth in between year 2014 and 2020
- 2020 to 2023 saw a skyroketting growth in the number of vehicle registered
- After mid of 2023 there was a drastic fall in number of registrations in 2024

19. Range vs. Year:

• Is there a trend between the model year and the electric range of the vehicles? Provide a scatter plot and analyze the trend.



Observation

- The correlation coefficient is -0.55
- This negative correlation indicates that newer model years generally have lower electric ranges compared to older model years.

20. Legislative District and MSRP:

• How does the average base MSRP vary across different legislative districts

Observation

- Legislative District
  1.0 0.0
  24 0.0
  23 0.0
  22 0.0
  21 0.0
  Name: Base MSRP, dtype: float64
- The Base MSRP remains the same for every Legislative District
- There seems to be no connection between Legislative District and Base MSRP

Conclusion

Electric Vehicle Population Report: Washington State

The Electric Vehicle Population report focuses on the EV market in the U.S., especially in Washington State. It looks at past registration data to see how EVs are catching on, predict future trends, and figure out what's driving the market.

Key Points:
- More EVs on the Road: Thanks to better technology and supportive policies, more people are driving EVs.
- Popular Models and Brands: The report highlights the most common EV models and manufacturers.
- Local Impact: Different legislative districts influence where EVs are more popular.

The report emphasizes the importance of continuing to support clean energy vehicle programs and expanding charging infrastructure to keep the market growing. This information is crucial for policymakers, manufacturers, and other stakeholders who want to promote sustainable transportation.

Uber Data Analysis Report: New York City

The Uber Data Analysis report looks at how weather affects Uber rides in New York City. It uses data on hourly pickups and weather conditions like temperature, visibility, wind speed, and precipitation.

Key Points:
- Ride Patterns: The report shows how many Uber pickups happen, tracks hourly and daily trends, and looks at how weather impacts ride demand.
- Peak Times and Areas: It identifies the busiest times for ride-sharing and how pickups vary across different boroughs and weather conditions.
- Recommendations for Uber: To improve service, the report suggests Uber should run targeted promotions during slow periods and offer incentives for drivers during bad weather.

These insights can help Uber improve its operations, ensuring better service and growth. The goal is to enhance the user experience and make sure drivers are available when needed, no matter the weather.

Summary

Both reports offer valuable insights and practical tips for boosting the EV market and improving ride-sharing services. They contribute to more sustainable transportation and better urban mobility.

Faculty Signature