Data-Driven Strategies for Enhancing Petrol Bunk Performance

A Proposal Report for the BDM Capstone Project

Submitted by

Name: Rojesh

Roll number: 21f3002660

IITM Online BS Degree Program,

Indian Institute of Technology, Madras, Chennai

Tamil Nadu, India, 600036

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1 Executive Summary and Title

The Indian Oil Fuel Station, located at 105-F, Palayamkottai Road West, Millerpuram, Tuticorin, operates in the B2C segment, offering a range of fuels including petrol, diesel, Xtramile petrol, and lubricants. Since its founding in 2005, the company has been committed to maintaining its basic principles of providing high-quality products, guaranteeing customer satisfaction, and assuring safety.

The recent analysis of sales data revealed some insights into the business's performance. The fluctuations in monthly sales trends were observed which in turn suggested potential impacts on inventory management and procurement strategies, especially for fuel types. Varied sales performances across different fuel categories highlighted the need for further exploration into their successes. Visual representations, including plots and charts, provided additional insights into regional preferences, offering opportunities for targeted marketing strategies and adjustments in inventory management.

Looking ahead, the analysis proposes additional steps for a comprehensive understanding. This includes further analyses like a time series Plot for predicting future sales and a SWOT analysis to assess profits, inventory control, and growth points. The final submission aims to provide a detailed analysis covering sales volume, revenue trends, inventory management, and overall profitability.

In conclusion, the Indian Oil Fuel Station is committed to strategic refinement based on data-driven insights, positioning itself for sustained growth and competitive advantage in the dynamic fuel retail industry.

2 Detailed Explanation of Analysis Process

- **Data Collection and Cleaning:**
  - The initial phase of my project is to gather sales data for the Owner of the Fuel Station spanning 12 months.
  - Cleaning the data collected, the process includes the removal of unimportant columns, and transcribing the data to Digital format from paper to enhance accessibility and manipulation capabilities.

The Format in which the organization maintain data

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Date	Opening Stock			Purchase			Sales			Cummulative Sales		
2		MS	XP	Total	MS	XP	Total	MS	XP	Total	MS	XP	Total
3	1	13169	14197	27366			0	2364	290	2654	2364	290	2654
4	2	10774	13911	24685	8000		8000	2812	141	2953	5176	431	5607
5	3	15994	13780	29774			0	2387	142	2529	7563	573	8136
6	4	13588	13668	27256			0	2725	310	3035	10288	883	11171
7	5	10819	13382	24201			0	2503	399	2902	12791	1282	14073
8	6	8303	12987	21290			0	2542	369	2911	15333	1651	16984
9	7	5800	12644	18444	12000		12000	2157	460	2617	17490	2111	19601
10	8	15637	12200	27837			0	2266	408	2674	19756	2519	22275
11	9	13381	11809	25190			0	2497	187	2684	22253	2706	24959
12	10	10849	11640	22489			0	1768	204	1972	24021	2910	26931
13	11	9075	11454	20529			0	2396	302	2698	26417	3212	29629
14	12	6686	11171	17857	8000		8000	2721	167	2888	29138	3379	32517
15	13	12025	11029	23054			0	2899	136	3035	32037	3515	35552
16	14	9188	10993	20181			0	2318	327	2645	34355	3842	38197
17	15	6890	10685	17575	8000		8000	1945	441	2386	36300	4283	40583
18	16	13007	10259	23266			0	2784	260	3044	39084	4543	43627
19	17	10172	10017	20189			0	2395	69	2464	41479	4612	46091
20	18	7775	9966	17741	8000		8000	2403	455	2858	43882	5067	48949
21	19	13460	9532	22992			0	2419	371	2790	46301	5438	51739

The cleaned and Transcribed Data

- **Statistical Analysis:**
    - Basic Statistical methods were applied to analyze key variables such as mean, median, and standard deviation, to get insights into central tendencies and variation.

Total Fuel Sold = 1596266 liters

Total Petrol Sold = 1043642 liters

Avg Petrol Sales per Day = 2859 liters

Avg Petrol Sales per Month = 86970 liters

SD of Petrol Sales per Month = 5183 liters

Total Diesel Sold = 552624 liters

Avg Diesel Sales per Day = 1514 liters

Avg Diesel Sales per Month = 46052 liters

SD of Diesel Sales per Month = 3943 liters

- **Visualization:**
    - Visualization techniques such as line graphs, histograms, and box plots, were generated using Excel. These plots help in interpreting sales trends and identifying outliers and Distributions.
- **Time Series Analysis:**
    - The Time Series Analysis has been conducted to forecast future trends using the sales data and predict the future.
- **Insights and Recommendations:**
    - Deriving insights from the analysis which include identifying peak sales period in a month and recognizing opportunities for improvement.
    - All recommendations were formulated based on observed trends, focusing on sales we can comment on inventory optimization and deriving a strategy for increasing profits.

- **Data Trends Presentation:**
    - The data trends are presented through various graphs, tables, and plots providing a visual representation of sales patterns and fluctuations.
- **Outcome Evaluation:**
    - Mean Absolute Error (MAE) is calculated for the ARIMA model, providing a visual representation of sales patterns and fluctuation. This step helps to check the reliability of the trends and patterns identified in visual representations to ensure actionable and dependable insights.
- **Strategic Implications:**
    - The findings and insights derived from the analysis are interpreted in the context of strategic implications for the Petrol Bulk business.
    - Recommendations are formulated to guide future decisions and actions based on the identified trends and patterns.
- **Data Trends Presentation:**
    - The Analysis process is iterative, allowing for continuous improvement as new data becomes available or as business dynamics evolve.
    - The adaptative approach ensures that the analysis remains relevant and responsive to changing conditions.

3 Result and Findings

- **Time Series Analysis:**

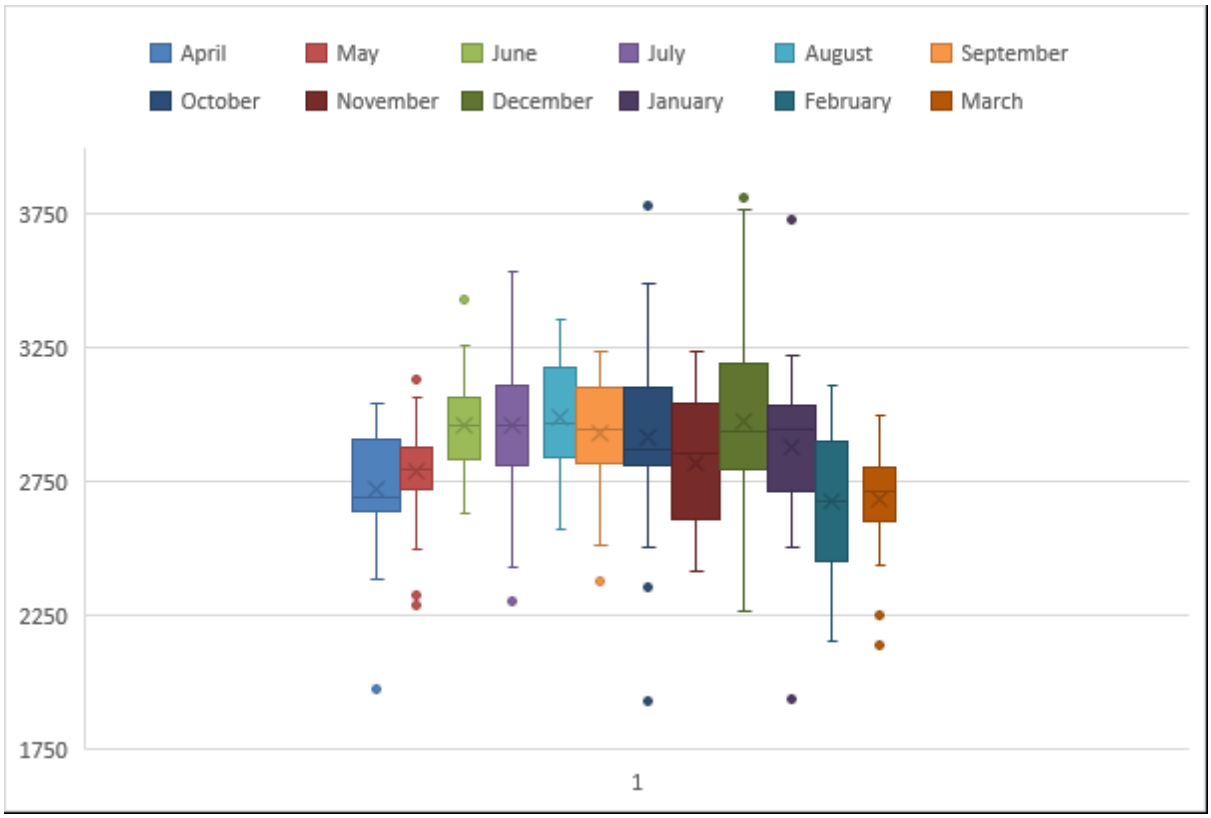
This plot was constructed using Autoregressive integrated moving average (ARIMA) models to predict future values based on past values. Here for this plot, I used 70% of the sales data as input. The other 30% data is used to validate the output. I used Gird Search to tune the parameters for the order. I didn't remove the outliers of the data to make the trend follow real-life trends.

On closely observing the trend and the actual plots we could see that both the graphs have predicted the same trend whether the graph goes up or down. This Trendline is reliable.

The Mean Absolute error while plotting this graph = 189.175

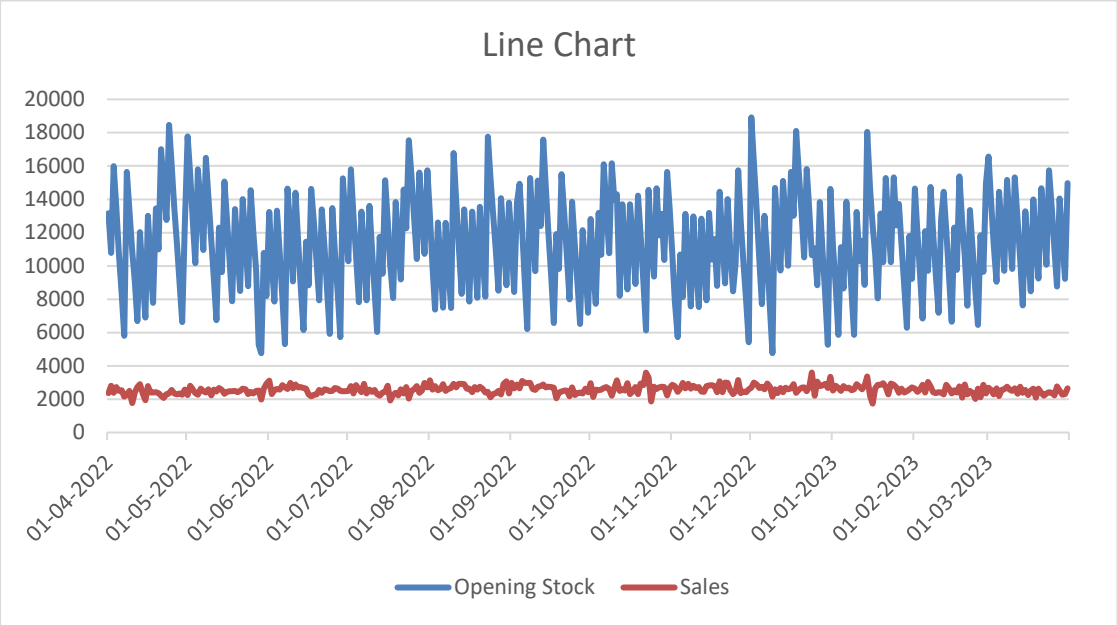
Although this graph is reliable this is not accurate as the values it predicted are not accurate. The graph provides just a trend and approximate value which is close to the original value at times. So, it's better to have an extra 300 liters of Petrol every day so it will be sufficient to satisfy the customers.

- **Visual Representations:**
    - **Box and Whisker Plots:**

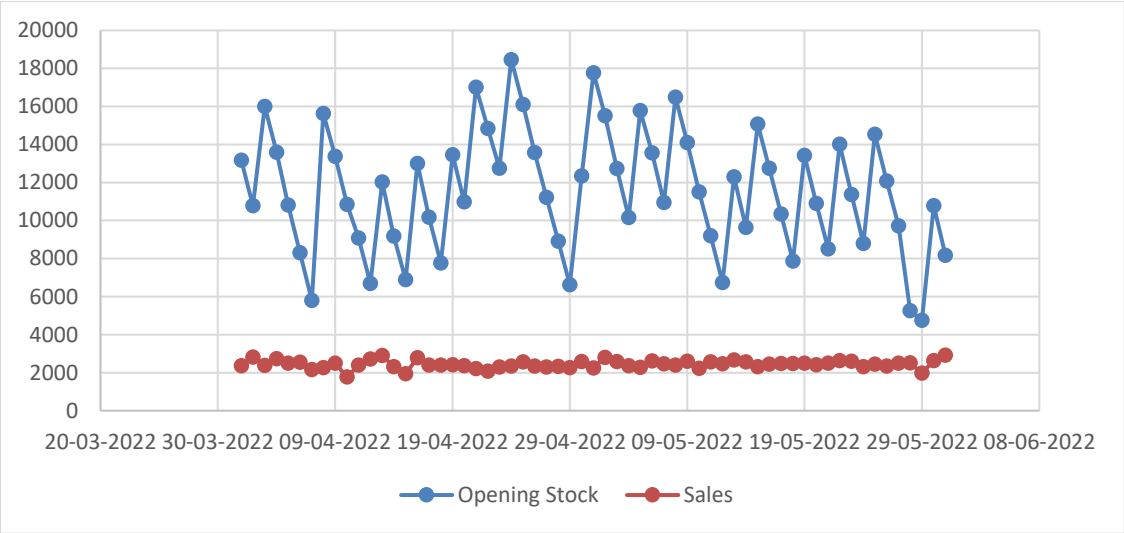


The box and whisker plots are used to deduct outliers in the given data. From the Graph, we can conclude that there are only a few outliers in the sales. The Inter Quartile of December is the highest. We here to consider the outlier in Quartile 1 as the days in Quartile 4 are not that important in the context of our analysis. In light of this, we conclude that the sales distribution demonstrates a consistent and robust performance, with occasional variations that do not significantly impact the overall trend.

- **Line Chart:**

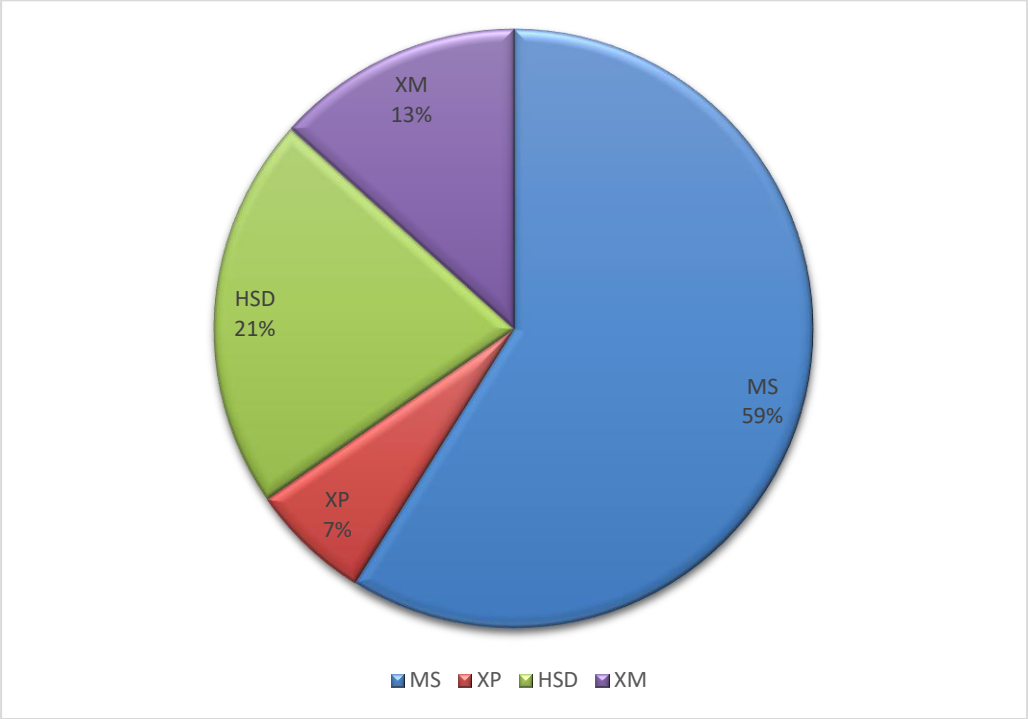


This is the line chart from the sales and inventory data for the whole year.



This is the line plot of the First two months of April and May the opening Stock and Sales data. I have plotted this small graph to show a clear picture. We can see that on some days there is a lot of difference between sales and stock. By reducing the difference between the sales and opening stock we could maintain a better inventory model. It is more efficient to maintain about 5000 liters of Petrol every day to supply oil to everyone without any struggle. The Organization mostly maintains about 6500 liters every day at least. It could be reduced to 5000 to 5500 liters every day.

- **Pie Chart:**



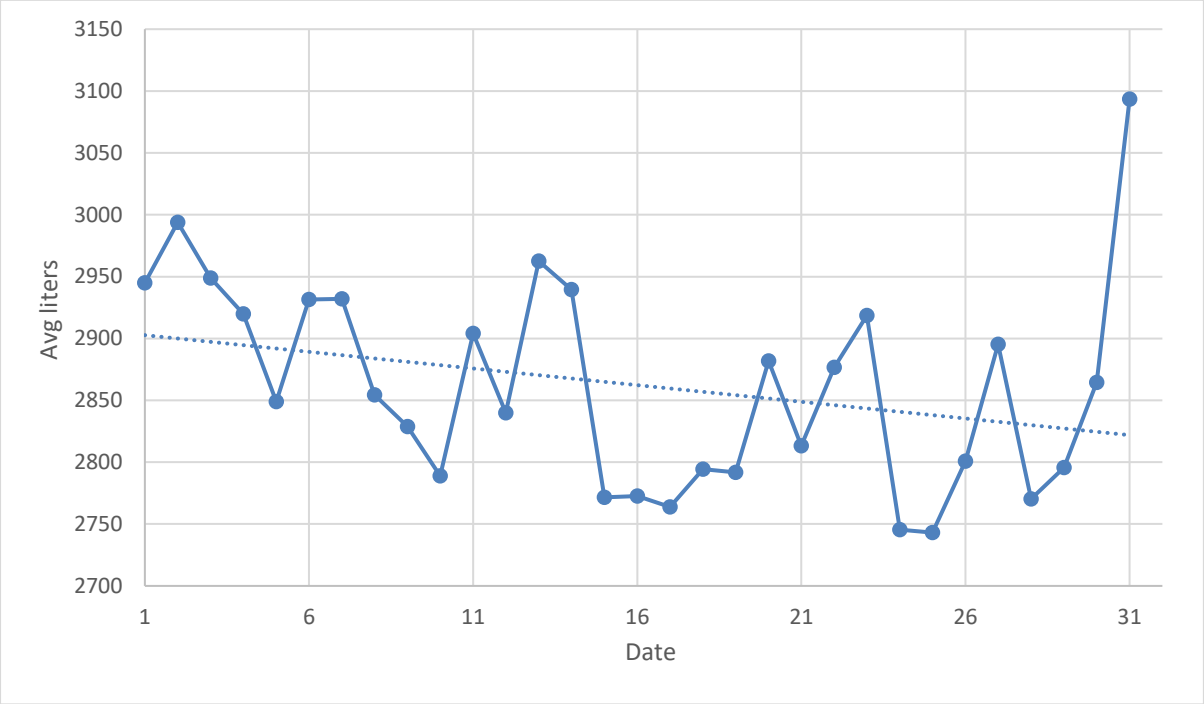
The presented plot illustrates the sale of various types of fuels at the Fuel Station. The fuel varieties include

1) MS – Motor Spirit
2) XP – Xtrapremium
3) HSD – High Speed Diesel
4) XM – Xtramile

Fuel Type	Liters Sold
MS	940085
XP	103557
HSD	339537
XM	213087
Total	1596266

The graph includes all of the days that a given nozzle is being maintained. Recent sales data shows that sales of Petrol have increased significantly, accounting for 59% of total sales.

- **Daily Sales Analysis**



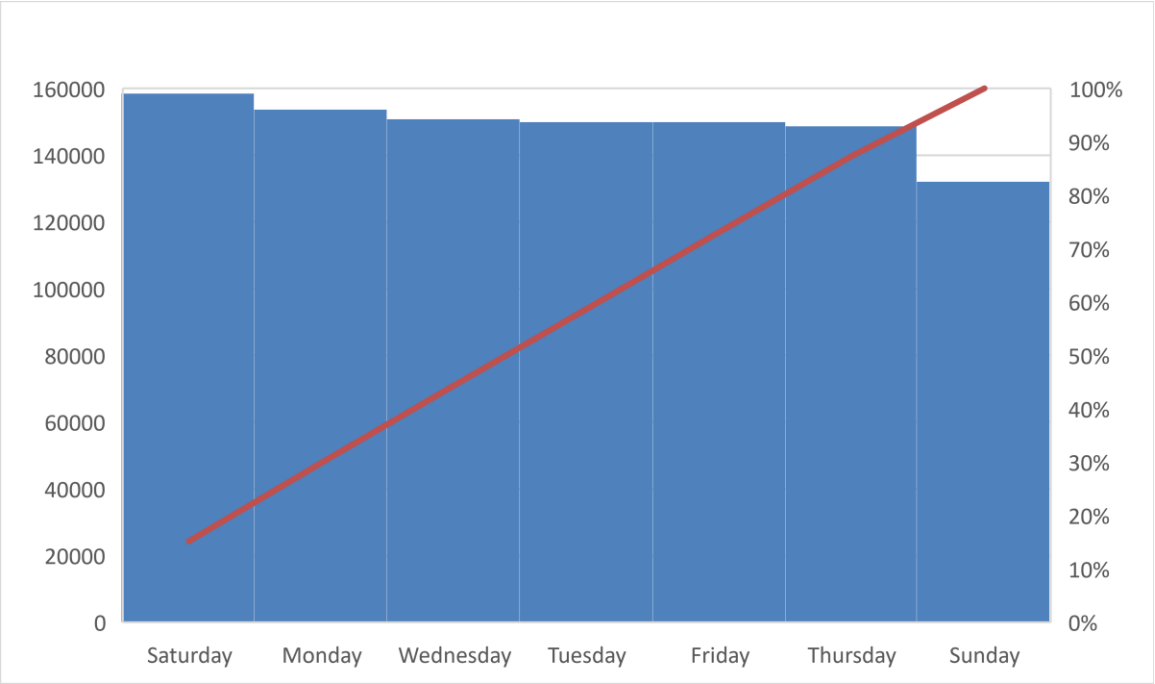
The above-mentioned plot showcases the average daily petrol sales across all days of the month. It shows the combined average sales of Petrol on the first day of every Month throughout the year from January 1st to December 1st. The graph has various minima and maxima points. We have already calculated the average sales for a day is 2859 liters.

Further exploration of the graph reveals a distinct pattern characterized by regular intervals of local maxima and minima. This recurring oscillation suggests a consistent trend, indicative of customer visits to the fuel station at predictable intervals.

This behavioral pattern implies a loyal customer base, with individuals likely returning every few days at regular intervals, underscoring the station's reliability and the establishment of routine visits. Then we could see regular intervals of local maxima and minima which indicate the presence of recurring visits by the customers to the fuel station likely to be returned every few days at a regular interval.

- **Day vs Sales:**

This is the plot between the sales and the day. On X-axis we have the day and, on the Y-axis, we have the Sales.

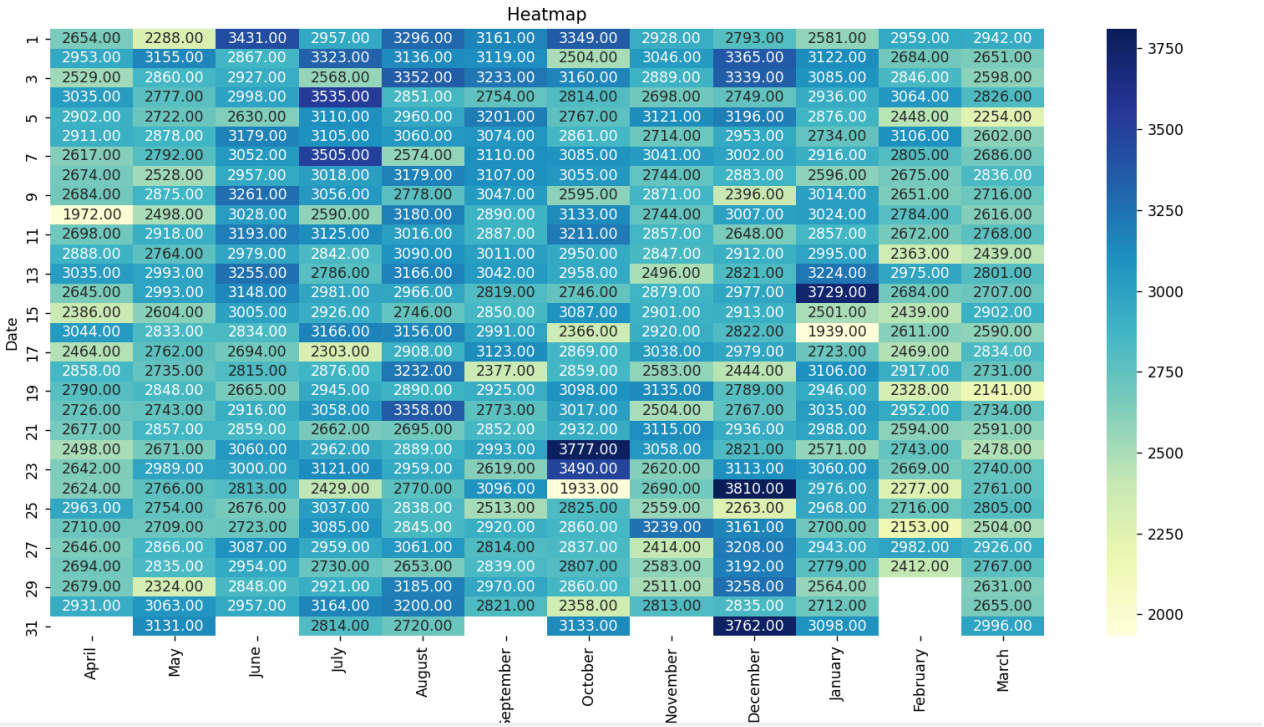


The above-mentioned plot showcases the Petrol sales across all day. It shows the combined average sales of Petrol on the first day of every Day throughout the year from combining all Mondays to Sundays.

From this Plot, we can observe that There is a peak in sales on Saturdays. This indicates that Customers prefer to refill their fuel tanks on Saturday. The Sunday shows the least sales. So, we can confirm our statement that Customers prefer to fill the fuel tanks on Saturday.

Then We can see a trend that if a day shows high sales, then the next day shows low sales. This can be with Peak sales on Saturday, followed by low sales on Sunday, then Followed by peak sales on Monday, The Sales on Monday are usually from the working people.

- **Heatmap**



From the Heat Map Analysis, we can see a pattern followed from seeing the Heat Map that there is a sales peak during the Festival Days.

The Days with peak sales were Diwali which falls in the month of October, Christmas and New Year which falls in the month of December, and the Pongal Holidays in the month of January.

Then, we can observe there is a peak of sales during the Winter Holidays in December and the month of June usually when the schools and colleges reopen for the new year/semester. The sale is also affected in the days of rain.

From closely observing the Plot I could observe that there is a peak in sales when there are government holidays on Friday or Monday. This is a key observation that could help to pre-plan the requirements for the business.

SWOT Analysis:

Strengths:

1. **Established Reputation:** With a history since 2005, Petrol Bulk has built a strong and reliable reputation in the fuel industry. Petrol Bulk has established a solid and trustworthy reputation.
2. **Diverse Service Offerings:** Providing various types of fuels, including Petrol, Xtramile, Diesel, Xtrapremium Diesel, LPG, and Nitrogen Air free of Cost and Lubricants.
3. **Owner Expertise:** With Mr. Felix as the owner since the establishment of the Fuel Station, the business benefits from his long-term dedication and experience.
4. **Customer Loyalty:** The observed recurring customer visits from my Analysis which is indicated by the sales pattern, suggest a loyal customer base, reflecting trust and satisfaction.
5. **Strategic Location:** The Fuel Sation is highly accessible so it contributes to increasing customer traffic. The Fuel Station is located on Main Road near a College and a School

Weaknesses:

1. **Dependency on Fuel Market Fluctuation:** The business is facing challenges due to the changing of fuel prices. Which sometimes affects the profit margins. This challenge can't be tackled.
2. **Technology Integration:** The Business needs to react to the increase in the sale of EVs that will be affecting the sales drastically in the future.
3. **Insufficient Digital Presence:** A lack of online visibility and digital marketing strategies may limit outreach to a broader audience.

4. **Limited Environmental Initiatives:** As consumer awareness of environmental issues rises, a lack of strong environmental sustainability practices could become a vulnerability.

Opportunities:

1. **Glowing Fuel Demand:** With the increase in automobiles, the demand for the fuels is likely to grow, presenting a significant business, requiring compliance measures that could be costly.
2. **Diversification of Services:** Exploring new services or expanding the product line, such as offering electric charging stations, can make the fuel station tap into evolving market needs.
3. **Partnerships:** Tuticorin is one of the major ports in India, Most of the Ships usually use Diesel as Fuel. The business could have a tie-up with a few major companies to increase the sales in turn increasing profits.
4. **Technology Adoption:** Embracing modern technologies for operations and customer engagement can enhance efficiency and competitiveness.

Threats

1. **Competition from alternating Fuels:** The side of EV and alternating fuel station stations posed a threat to traditional fuel business.
2. **Economic Downturns:** Economic recession can impact consumer spending on fuel, potentially affecting the business revenue.
3. **Environmental Regulations:** Compliance with ever-tougher environmental standards and laws could be difficult, involving large expenditures to ensure compliance and possibly affecting running expenses.

4 Interpretation of Result and Findings

The analysis of the data spanning 12 months has yielded significant insights offering valuable implications for strategic decision making. We are going to see the detailed interpretation of the key results and findings:

1) **From the Time Series Analysis (ARIMA Model):**

   The Implementation of the ARIMA Model for time series analysis proved Effective as the Trend line is reliable. The close alignment between the Actual Trend and the Predicted Trend confirms the reliability. While Reliable the ARIMA Model's predictions are not pinpoint accurate. Thus, the recommendation is to maintain an additional 350 liters daily acts as a buffer to accommodate potential inaccuracy in predictions.

2) **From the Box and Whiskers Plot:**

   The box and whisker plots have been used to identify the outliers highlighting occasional variations. The Highest Interquartile Range (IQR) is in December indicating a diverse sales pattern but no impact on overall consistency. From this, we can conclude that Sales Distribution exhibits stability with occasional fluctuations.

3) **From the Line Plot:**

   The line plot has been used to showcase the differences between sales and stock and reveal opportunities for improved inventory management. The optimization recommendation would be proposing a reduction in daily petrol maintenance of 5000 liters to 5500 liters aiming at optimizing supply and reducing excess.

4) **From Daily Sales Analysis:**

The daily sales analysis has been used to showcase the recurring pattern of the local maxima and minima suggesting a loyal customer base with predictable visit intervals. The routine visits at regular intervals indicate the reliability of the fuel station and their reliability of the fuel station and customer loyalty. From the above inference, we can conclude that there are chances for individualized services and targeted marketing to increase client engagement.

5) **From the Pie Chart:**

The pie chart reflects a varied product offering, with a significant emphasis on traditional petrol (MS) sales. The MS represents almost 59% of the total share in the sales. This is mainly due to an increase in production of Petrol Cars using BS6 engines. Followed by the HSD (High-Speed Diesel) with almost 21% of the total sales. The presence of a considerable diesel market suggests a diverse customer base, catering to both petrol and diesel vehicle owners.

Recommendations:

1) Maintaining 5000 liters to 5500 liters every day for daily requirements. The purchase needs to be done on alternating days or once every three days to have fuel to supply customers.
2) For operational effectiveness and customer satisfaction, fuel inventory management strategy that helps the organization optimize purchasing frequency while matching daily frequency.
3) A robust and adaptable supply chain will benefit from routine monitoring and modification based on the performance indicators.
4) Fuel stations must adapt to the future by building a few fast-charging stations for electric vehicles (EVs). Starting this transition from now onward will pave the way for a sustainable future for the fuel station.

In conclusion, the analysis of the results highlights the need for a balanced approach, combining the strengths of the ARIMA model with the strategic measures to optimize and enhance engagement. The Findings will pave the way for strategies aimed at improving operational efficiencies, customer satisfaction, and overall business success.