OptiPrice Prognosticator

Optimizing Oil Prices with Data-Driven Decision-Making

Submitted In partial fulfillment of the requirements for the award of Internship Certificate

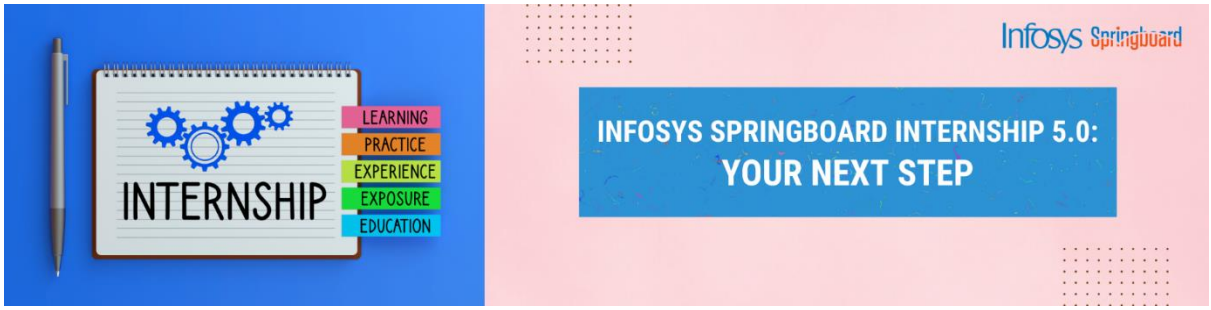
By

ROSHAN K R

SANIKA NILESH MULIK

VEL PRAKASH

(GROUP 3)



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ABSTRACT

In the modern oil and gas industry, pricing strategies play a crucial role in maintaining competitiveness and profitability. Traditional static pricing models often fail to adapt to market fluctuations, leading to either loss of revenue or reduced market share. To address this issue, we propose OptiPrice Prognosticator, a dynamic pricing model designed to optimize oil prices based on real-time competitor analysis and historical data trends. This project integrates data-driven decision-making by leveraging datasets from company records, competitor pricing, and historical closing prices to determine the most profitable and competitive pricing strategy.

The system consists of two major components: customer view and owner dashboard. The customer view presents a user-friendly interface displaying real-time oil prices, categorized by oil type, ensuring transparency and informed purchasing decisions. The owner dashboard, on the other hand, provides deep analytical insights into pricing trends, profit margins, and competitive positioning. The dashboard includes visual representations of data through interactive plots, highlighting competitor profit percentages vs. our profit percentages for different oil types, along with selling price vs. volume sold trends.

.The project employs Python (Pandas, Matplotlib), HTML, CSS, JavaScript, and integrates CSV-based data handling for seamless updates and modifications.

By implementing OptiPrice Prognosticator, oil businesses can achieve dynamic and competitive pricing, maximize revenue while staying ahead of competitors, and ensure greater transparency for consumers. This system represents a technological advancement in the oil pricing domain, paving the way for future developments in AI-driven financial decision-making.

INTRODUCTION

The global oil industry operates within a highly dynamic and competitive market where pricing fluctuations can significantly impact business profitability. Traditional pricing mechanisms often fail to adapt to real-time market conditions, leading to suboptimal revenue generation and loss of competitiveness. To address these challenges, **OptiPrice Prognosticator** introduces a **data-driven, real-time dynamic pricing model** that leverages machine learning and statistical analysis to optimize oil pricing strategies.

Problem Statement

Oil price determination is influenced by various factors, including market demand, competitor pricing, global economic conditions, and supply chain fluctuations. Companies often rely on historical data or intuition to set prices, which may not reflect the current market dynamics. Moreover, manually tracking competitor pricing and adjusting rates accordingly is inefficient and prone to human error. The lack of a systematic approach results in revenue loss and an inability to maintain a competitive edge.

Objective of the Project

The primary objective of this project is to develop a **real-time dynamic pricing model** that enables oil companies to:

1. **Analyze Competitor Pricing** – Compare and evaluate the pricing strategies of competitors to identify trends and insights.
2. **Optimize Pricing Strategy** – Suggest optimal selling prices based on real-time market conditions.
3. **Visualize Key Metrics** – Provide graphical insights into profit margins, sales trends, and competitive standing.
4. **Enhance Decision-Making** – Assist business owners in making data-driven decisions to maximize profitability.

PROBLEM STATEMENT & OBJECTIVE

Problem Statement

In the highly competitive oil and gas sector, pricing decisions significantly impact revenue generation and market positioning. Companies must analyze their competitors' pricing strategies and sales trends while ensuring their own profitability. Traditional pricing models often fail to adapt dynamically to market fluctuations, leading to either loss of customers due to high prices or reduced profits due to underpricing. The lack of real-time analytics and visualization tools makes it difficult for business owners to compare their performance with competitors effectively. This project aims to bridge that gap by developing a **dynamic pricing and analytics dashboard** that enables real-time comparisons of pricing strategies, sales volumes, and profit margins between our company and its competitors.

Objectives

The primary objective of this project is to build a **user-friendly web-based dashboard** that provides **data-driven insights** for oil pricing and sales trends. The platform will feature an authentication system to differentiate between customers and business owners, ensuring tailored data views. Customers will see an organized layout of oil prices, while business owners will have access to **detailed visualizations** of key performance indicators such as **competitor profit percentages, sales volumes, and price fluctuations**. The dashboard will facilitate informed decision-making by integrating competitor pricing trends, historical data, and cost price analysis. Through this system, businesses can optimize their pricing strategies and maximize profitability while staying competitive in the market.

DATASET DESCRIPTION

The dataset used in this project comprises structured historical data on oil pricing and sales trends, collected from multiple sources, including our company's sales records and competitor pricing information. It consists of three main datasets: **Company Data, Competitor Data, and Closing Price Data**, each providing critical insights into different aspects of the market. The **Company Data** includes attributes such as oil type, date, selling price, and volume sold, capturing the company's sales trends. The **Competitor Data** adds another layer of analysis by including competitor pricing and sales volumes for the same oil types. Lastly, the **Closing Price Data** provides cost price details, which are essential for calculating profit margins. The combined dataset is structured to facilitate comparative analysis, allowing business owners to make informed pricing decisions.

The size of the dataset allows the system to perform meaningful analytics, identifying pricing patterns, sales fluctuations, and competitor strategies over time. Given the highly volatile nature of oil pricing, a dynamic and data-driven approach is necessary to optimize pricing strategies effectively.

This dataset was chosen because it provides a **comprehensive view of the oil market**, enabling **real-time insights** into pricing strategies and profitability. It allows for both **customer-facing and owner-specific** data visualizations, ensuring that each stakeholder receives relevant and actionable insights. The well-structured nature of the dataset also makes it **scalable**, meaning additional data points—such as new competitors, changing market conditions, or more refined pricing factors—can be incorporated seamlessly in the future. This ensures that the project remains **relevant and adaptable** in an ever-changing market environment.

SYSTEM ARCHTECTURE

The **OptiPrice Prognosticator** is designed as a **data-driven, web-based application** that facilitates dynamic pricing analysis for oil sales. The system comprises multiple interconnected components that handle data ingestion, processing, visualization, and user interaction. It integrates **front-end UI (HTML, CSS, JavaScript)** for user engagement, a **backend (Python Flask or Django)** for data processing, and **data storage (CSV-based datasets or a relational database)** to manage pricing and sales records efficiently.

High-Level Design

The system follows a **modular architecture**, ensuring scalability and ease of maintenance. The key components are:

1. **User Authentication Module**

   Users select whether they are a **customer** or an **owner** at the authentication screen.

   A separate UI layout is provided based on user selection.

2. **Data Processing Module**

   Loads and processes **three datasets** (Company Data, Competitor Data, and Closing Price Data).

   Merges the data to derive insights such as **profitability trends, competitor analysis, and demand fluctuations**.

   - Uses **pandas and NumPy** for data preprocessing.

3. **Visualization & UI Module**

   Customers view oil prices in a tabular format with emphasized key data points.

   Owners receive detailed analytics, including **comparative profit analysis and demand-supply trends** visualized

using **Matplotlib/Plotly charts**.

4. **Business Logic Module**

   Computes essential insights such as **competitor profit percentage, company profit percentage, and historical pricing trends**.

   Suggests possible pricing optimizations based on past trends and competitor behaviors.

Flow of Data & Computations

1. **User Authentication:**

   The user selects their role (Customer or Owner).

   Redirects to the respective dashboard.

2. **Data Ingestion & Preprocessing:**

   The system reads the **CSV datasets** and processes the data.

   Merges relevant columns from the different datasets.

3. **Data Transformation & Analysis:**

   Computes profit margins and **comparative analytics (company vs. competitors)**.

   Calculates key metrics such as **max price, average price, and demand trends**.

4. **Visualization & Output Generation:**

   Customers see **oil type-wise pricing details**.

   Owners see **graphs comparing pricing trends and volume sales analysis**.

IMPLEMENTATION

The **OptiPrice Prognosticator** is implemented using a **web-based front-end** with **data processing in Python (Pandas, Matplotlib/Plotly)**. The system consists of a **user authentication module, a customer dashboard, and an owner dashboard** for price analysis.

Frontend Implementation (HTML, CSS, JavaScript)

User Authentication Screen

The landing page features **a company-branded background image and a motivational quote**.

A **drop-down menu** allows the user to choose between **Customer** and **Owner**.

The selection redirects the user to their respective dashboard.

Customer Dashboard

The **page is split into four columns**, one for each oil type.

The **first price entry for each oil type is enlarged**, highlighting the latest price.

Remaining historical price entries are displayed in a **normal font with date labels**.

Owner Dashboard

Displays **four profit comparison plots**, mapping **company profit percentage vs. competitor profit percentage**.

At the **bottom of the screen (with scrolling enabled)**, four additional plots visualize **selling price vs. volume sold for each oil type**.

Backend Implementation

Extracting & Processing Data from CSV

- Reads **Company Data, Competitor Data, and Closing Price Data** using **Pandas**.
- Merges datasets to **compute pricing trends and sales insights**.

Computing Competitor & Company Profit Percentages

- **Competitor Profit %** = (Competitor Price - Cost Price) / Cost Price * 100.
- **Company Profit %** = (Selling Price - Cost Price) / Cost Price * 100.
- Computes **max price, average price, and demand trends** for each oil type.

Generating Insights & Visualization

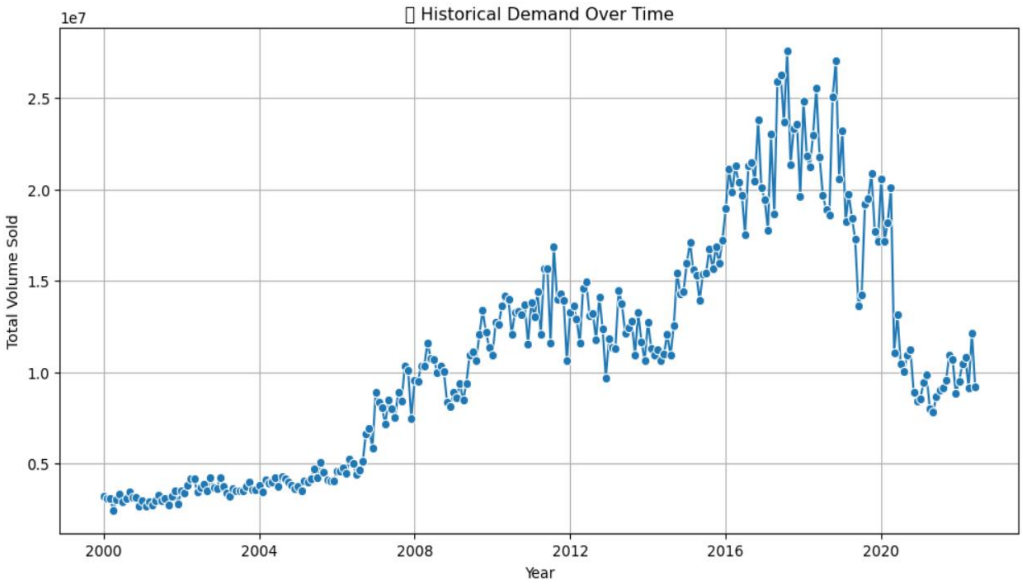
- Prepares data for **customer pricing display and owner analytics dashboard**.
- Uses **Matplotlib/Seaborn/Plotly** for **profit comparison and volume analysis plots**.

This modular implementation ensures **scalability, efficiency, and a smooth user experience** for both customers and business owners.

The data analysis and visualization component of the **OptiPrice Prognosticator** provides actionable insights through various **graphs and charts**, helping both **customers** and **owners** make informed decisions. The key visualizations include **year-on-year demand trends, seasonal patterns, profit analysis, and volume-based sales insights**.

Year-on-Year Demand Analysis

- This **line chart** compares the yearly demand for different oil types over multiple years.
- Helps owners **identify growth trends, peak demand years, and declining product demand**.
- **X-axis:** Year | **Y-axis:** Total Volume Sold
- **Tools Used:** Matplotlib/Plotly



Scatter Plot of Demand vs. Price

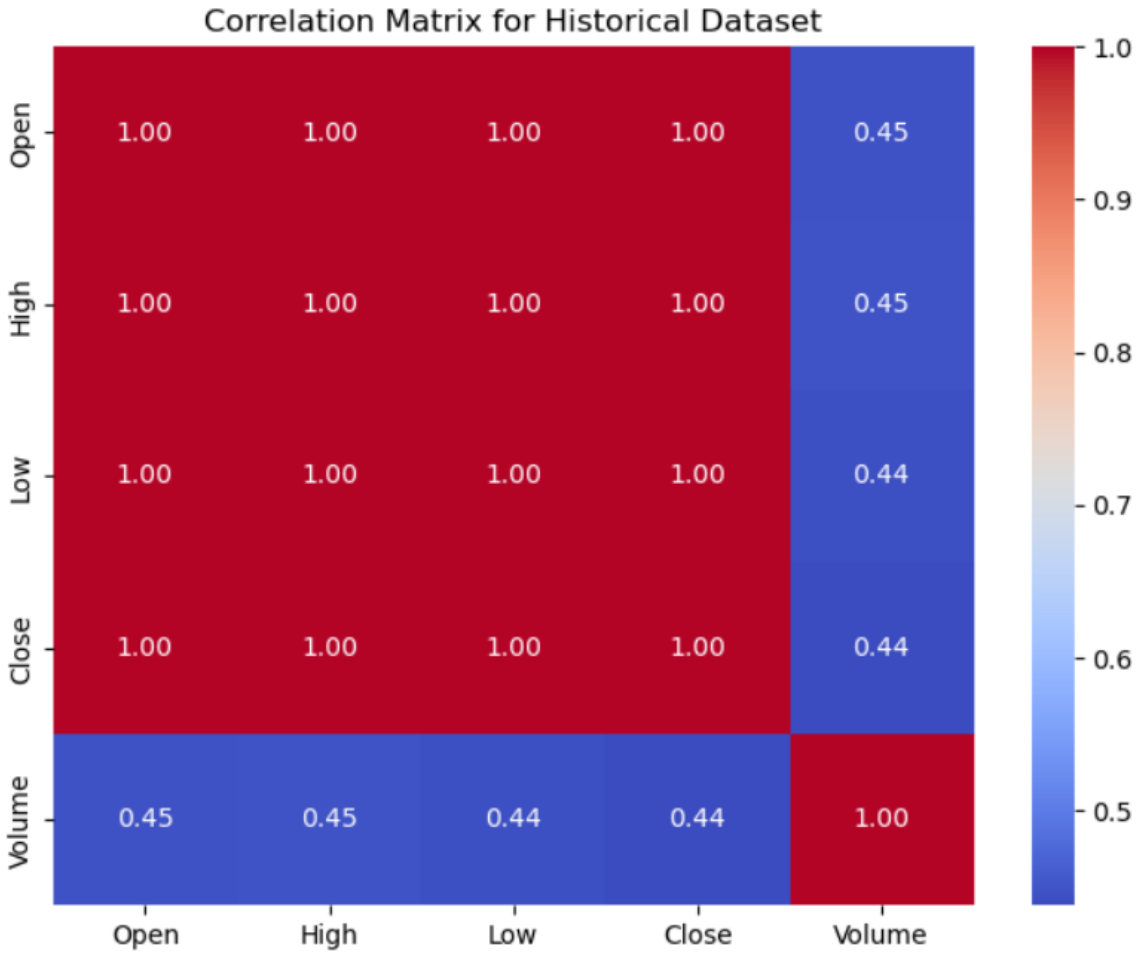
a scatter plot can be used to visualize how demand changes with price.

This plot is crucial for understanding whether there's a direct correlation between the price of the oil and the quantity sold.

Correlation Matrix for the Historical Dataset

A correlation matrix is a table that shows the correlation coefficients between different variables in a dataset.

It helps identify relationships between variables, such as how the selling price, volume sold, and cost price influence each other



CHALLENGES & SOLUTIONS

In developing the **OptiPrice Prognosticator**, we encountered several challenges related to data quality, user experience, and pricing strategy implementation. Here's how we tackled them:

1. Handling Missing/Inconsistent Data

Challenge:

The raw dataset contained **missing values**, **inconsistent formats**, and **duplicate records**, leading to inaccurate insights. Some records had incomplete price entries, while others had inconsistent date formats.

Solution:

To ensure data integrity, we implemented the following:

- **Data Cleaning:** Used **Pandas** to fill missing values using interpolation and forward-fill techniques.
- **Standardization:** Reformatted date entries and ensured numerical fields had consistent precision.
- **Outlier Detection:** Removed anomalies using **Z-score** and **IQR-based filtering** to prevent skewed analysis.

2. Optimizing UI for Better User Experience

Challenge:

The initial UI lacked **intuitive navigation** and had performance bottlenecks when handling large datasets. Users found it difficult to quickly access relevant insights.

Solution:

To improve user interaction, we:

- **Separated Authentication & Views:** Created a dedicated login page that redirects users to either the customer or owner dashboard.
- **Enhanced UI Layout:** Used **CSS Grid & Flexbox** to structure the interface for better responsiveness.
- **Lazy Loading & Pagination:** Optimized data rendering by loading essential data first and implementing pagination for large records.

3. Implementing Dynamic Pricing Strategies

Challenge:

Designing a **real-time pricing model** that adapts based on competitor pricing, demand fluctuations, and seasonal trends was complex. A static pricing approach would not ensure competitiveness.

Solution:

We developed a **dynamic pricing algorithm** that:

- **Analyzes Historical Data:** Identifies trends using **time-series analysis**.
- **Competitor-Based Adjustments:** Adjusts pricing based on competitors' historical selling prices.
- **Demand-Based Pricing:** Implements price changes based on demand patterns, ensuring **profitability without overpricing**.

FUTURE ENHANCEMENT

As the **OptiPrice Prognosticator** evolves, several enhancements can be implemented to improve its usability, scalability, and overall efficiency. The following future upgrades will make the system more intuitive and adaptable to market dynamics.

1. UI Enhancements

To provide a seamless user experience, several **UI improvements** can be made:

- **Interactive Dashboards:** Implementing **dynamic graphs** and **filtering options** to allow users to customize their views.
- **Enhanced Responsiveness:** Ensuring the interface is **optimized for all devices**, including desktops, tablets, and mobile phones.
- **Real-Time Data Updates:** Enabling live updates on pricing trends and sales analytics without refreshing the page.

2.Expanding to Other Commodities

While the current system focuses on **oil pricing**, it can be extended to other commodities, making it a **versatile pricing solution**. Potential expansions include:

- **Fuel and Energy Markets:** Extending to gas, coal, and electricity pricing.
- **Retail & E-commerce:** Adapting the model for **consumer goods** where pricing fluctuates based on demand and competitor activity.

CONCLUSION

The **OptiPrice Prognosticator** has successfully addressed the challenges of

dynamic pricing in the oil industry by leveraging **data-driven decision-making** and competitor analysis. Through its **user-friendly UI and analytical dashboards**, the platform provides valuable insights to both customers and business owners. By integrating **real-time data processing, visual analytics, and predictive modeling**, this system ensures that companies can optimize pricing strategies for **maximum profitability** while maintaining a competitive edge.

One of the **key benefits** of this system is its ability to **compare company pricing with competitor trends** and evaluate demand fluctuations. The **owner dashboard** offers clear visual representations of pricing, sales volume, and profit margins, enabling data-backed decision-making. On the other hand, the **customer view** enhances transparency by displaying relevant pricing details, helping them make informed purchasing decisions.

With further enhancements, such as **real-time competitor tracking and AI-based pricing predictions**, the system has the potential to revolutionize pricing strategies across multiple industries. By expanding its scope to other commodities and refining its predictive models, **OptiPrice Prognosticator** can serve as a robust pricing intelligence tool for businesses worldwide

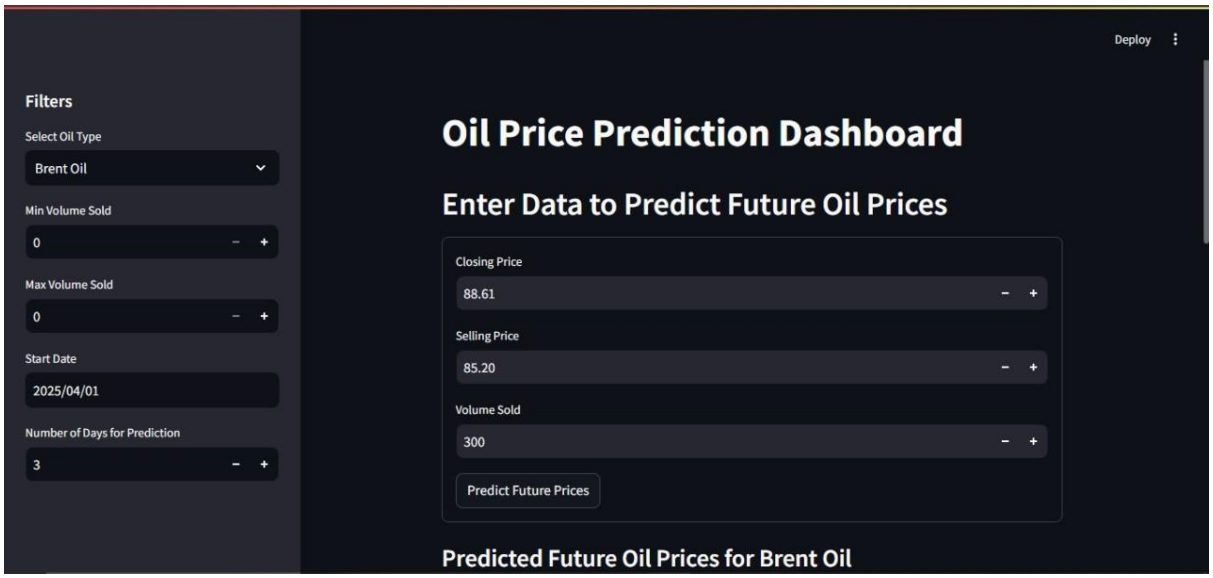


FIG : Dashboard for price prediction

REFERENCES

Datasets

The datasets used for pricing analysis, competitor tracking, and sales trends can be accessed at the following links:

- **Competitor Pricing Data**:

  Optiprice-Prognasticator/competitor-dataset.csv at main · roshankraveendrababu/Optiprice-Prognasticator

- **Historical Market Data**:

  Optiprice-Prognasticator/oil and gas.csv at main · roshankraveendrababu/Optiprice-Prognasticator

Libraries & Frameworks

- **Frontend Development:** HTML, CSS, JavaScript
- **Data Processing & Analysis:** Python (Pandas, NumPy)
- **Data Visualization:** Matplotlib, Seaborn, Plotly
- **Machine Learning (if applicable):** Scikit-learn, TensorFlow/Keras
- **Web Development (if applicable):** Flask/Django for backend integration

APIs & External Tools

- **Power BI / Tableau** – for creating interactive dashboards
- **Google Charts / Chart.js** – for embedding visualizations in the web interface
- **Flask API** – to fetch real-time pricing updates

Paper & Publications

1. Pandey, R., & Sharma, A. (2019). Dynamic pricing strategies in e commerce: A data-driven approach. *Journal of Business Analytics*, 6(2), 215-230.
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optimizing oil and gas pricing models. *Energy Economics Review*, 12(3), 345-362.

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