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MIT WORLD PEACE UNIVERSITY | PUNE
TECHNOLOGY, RESEARCH, SOCIAL INNOVATION & PARTNERSHIPS

Tools For Data Science (TDS)

MINI PROJECT REPORT

STOCK ANALYSIS

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PROJECT DOMAIN – Finance

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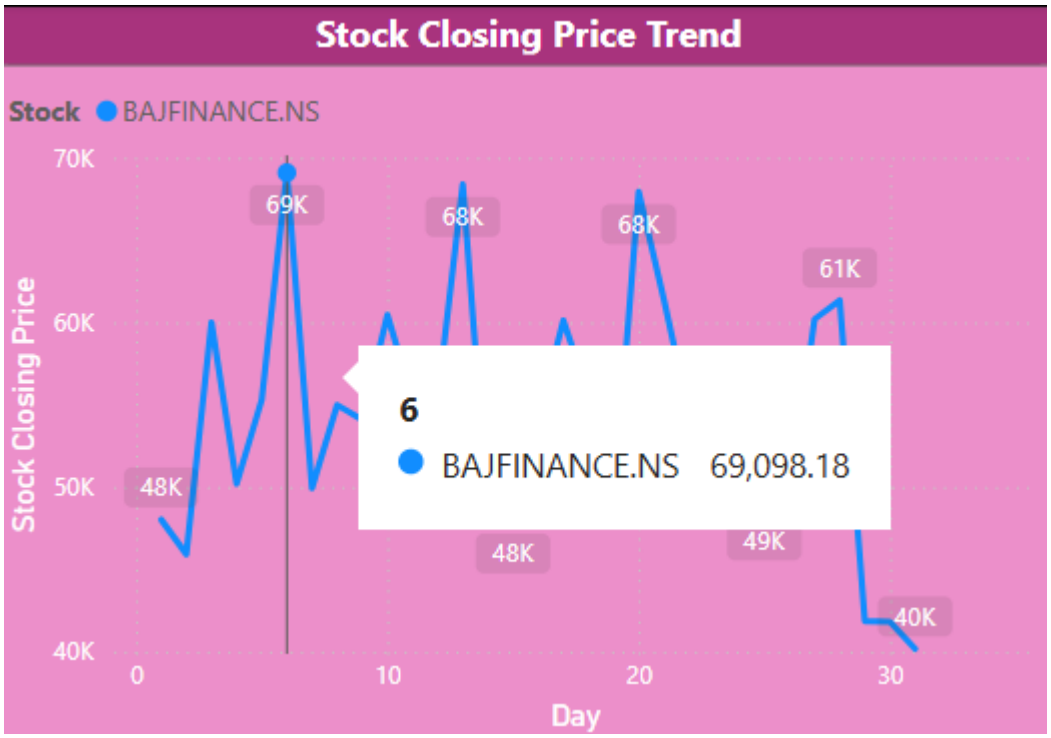
1. INTRODUCTION

1.1 Introduction

In today's fast-paced financial world, the stock market plays a crucial role in wealth creation and investment decision-making. Investors, traders, and financial analysts rely on stock market data to track trends, analyze performance, and make informed investment choices. However, interpreting vast amounts of stock data can be challenging without effective visualization and analytical tools.

This project, **"Stock Market Visualization Using Power BI,"** aims to provide an interactive and insightful analysis of stock market data using Power BI. By leveraging data visualization techniques, this project will enable users to explore stock trends, analyze price movements, track trading volumes, and compare stock performances over time. With the integration of real-time or historical stock data, users can gain a deeper understanding of market behavior and identify potential investment opportunities.

The project focuses on analyzing at least ten Indian stocks, offering an intuitive dashboard where selecting a stock will display all relevant visualizations. Users can monitor key metrics such as opening and closing prices, daily highs and lows, and moving averages, enhancing their decision-making process. The goal is to empower investors and analysts with a data-driven approach to stock market analysis, making financial insights more accessible and actionable.



1.2 Motivation

One of the key motivations for this project is the increasing complexity of stock market data and the challenges investors face in making informed decisions. With thousands of transactions occurring every second, stock prices fluctuate rapidly, making it difficult for traders and investors to track trends and analyze performance effectively. While financial platforms and brokerage firms provide raw stock data, they often lack intuitive visual insights that help users understand market trends at a glance.

This gap in accessible, data-driven stock market insights inspired the development of **"Stock Market Visualization Using Power BI."** By leveraging advanced data visualization techniques, this project aims to simplify stock market analysis and provide users with interactive dashboards that display key financial metrics.

Additionally, this project is motivated by the need to enhance financial literacy and investment awareness among individuals. Through stock market visualization, users can:

- **Track stock performance** over time, analyzing opening/closing prices, daily highs and lows, and moving averages.
- **Identify trading trends** by visualizing volume fluctuations and market movements.
- **Compare multiple stocks** side by side to recognize potential investment opportunities.
- **Gain insights into stock volatility** and price patterns, aiding in better decision-making.

This project also serves as a demonstration of Power BI's capabilities in handling real-world financial data, showcasing how complex stock market data can be transformed into meaningful and actionable insights. The ultimate goal is to empower investors, traders, and analysts with a structured, data-driven approach to stock market analysis, leading to more informed investment strategies.

2. OBJECTIVES

2.1 Objectives

The primary objective of this project is to analyze stock market data and provide actionable insights through interactive Power BI visualizations. By processing and visualizing stock performance metrics, this project aims to achieve the following goals:

- **Track Overall Stock Performance**
  This project offers a comprehensive summary of stock price movements, including opening and closing prices, highs and lows, and percentage changes over time. By visualizing these financial metrics, investors can assess stock trends and make informed trading decisions.

- **Analyze Monthly Trends**
  Stock price fluctuations vary across different periods. Monthly and historical trend analysis helps identify seasonal patterns, market cycles, and peak trading periods. Users can compare stock performance across different timeframes to refine their investment strategies.

- **Compare Multiple Stocks**
  Compare various stocks side by side to find the best-performing stocks.Detect which industries or companies are performing well in the market.

- **Stock-wise Performance Insights**
  The project enables users to analyze individual stock performance, highlighting gainers, losers, and stocks showing volatility. This helps traders focus on stocks that align with their risk appetite and investment goals.

- **Interactive Power BI Dashboard**
  Power BI provides dynamic, visually appealing dashboards with charts, filters, and reports. Users can explore stock market trends interactively, analyze data based on their preferences, and make data-driven investment decisions efficiently.
  By leveraging Power BI's powerful data visualization features, this project aims to simplify stock market analysis, making it more accessible to investors, traders, and financial analysts.

3. Dataset Description

3.1 Dataset Description

This project utilizes a stock market dataset containing **historical daily stock prices** for multiple companies. The dataset serves as the foundation for analyzing stock performance, trading volumes, and overall market trends. By exploring this data, we can extract valuable insights about stock price movements, market volatility, and investment opportunities.

3.2 Structure of the Dataset

The dataset consists of multiple stocks with daily records. Each row represents the performance of a single stock on a specific date, covering important aspects like opening price, closing price, highest and lowest prices, and trading volume.

Dataset Attributes and Their Descriptions

Column Name	Data Type	Description
Date	datetime	The trading date in YYYY-MM-DD format. It represents the **specific day** on which the stock was traded.
Stock	string	The stock ticker/symbol, which uniquely identifies each company (e.g., RELIANCE.NS, TCS.NS). This allows tracking stock performance for individual companies.
Open Price	float64	The price of the stock at the **beginning** of the trading session on that day. It indicates the first recorded transaction price.
High Price	float64	The **highest price** reached by the stock during that trading day. It helps in identifying **intraday price peaks**.
Low Price	float64	The **lowest price** recorded by the stock on that trading day. This value is useful for understanding **intraday dips**.
Close Price	float64	The price of the stock at the **end** of the trading session. The closing price is one of the most important indicators of a stock's **daily performance**.
Volume	int64	The total **number of shares traded** for the stock on that day. Higher trading volume often indicates increased investor interest and market activity.

The dataset consists of 2,448 entries and 7 columns, capturing daily stock market data for 10 major Indian companies. Each row represents a daily stock record with key financial metrics such as opening price, closing price, highest & lowest price, trading volume, etc.

Stocks Included in the Dataset:

The dataset covers 10 prominent Indian stocks listed on the NSE (National Stock Exchange):

1. **RELIANCE.NS** (Reliance Industries)
2. **TCS.NS** (Tata Consultancy Services)
3. **INFY.NS** (Infosys)
4. **HDFCBANK.NS** (HDFC Bank)
5. **ICICIBANK.NS** (ICICI Bank)
6. **WIPRO.NS** (Wipro)
7. **HINDUNILVR.NS** (Hindustan Unilever)
8. **SBIN.NS** (State Bank of India)
9. **BAJFINANCE.NS** (Bajaj Finance)
10. **LT.NS** (Larsen & Toubro)

Dataset Snippet:-

	Date	Open	High	Low	Close	Volume	Stock
2	04-01-2023	1167.784	1169.634	1148.146	1150.224	9264891	RELIANCE.NS
3	05-01-2023	1152.485	1158.376	1143.579	1148.169	13637099	RELIANCE.NS
4	06-01-2023	1153.923	1163.651	1150.11	1158.604	6349597	RELIANCE.NS
5	09-01-2023	1162.441	1188.336	1161.55	1185.961	10722753	RELIANCE.NS
6	10-01-2023	1190.162	1190.162	1162.76	1168.423	8047142	RELIANCE.NS
7	11-01-2023	1165.729	1168.241	1151.388	1153.695	11509553	RELIANCE.NS
8	12-01-2023	1153.101	1156.595	1125.767	1128.782	17688773	RELIANCE.NS
9	13-01-2023	1122.753	1129.376	1111.884	1126.955	20618583	RELIANCE.NS
10	16-01-2023	1129.284	1132.458	1108.413	1116.223	13623855	RELIANCE.NS
11	17-01-2023	1122.571	1133.988	1119.191	1132.07	10751000	RELIANCE.NS
12	18-01-2023	1129.65	1137.687	1123.644	1130.198	13448286	RELIANCE.NS
13	19-01-2023	1129.376	1133.143	1121.954	1128.987	11940054	RELIANCE.NS
14	20-01-2023	1130.334	1130.334	1113.094	1115.56	14930286	RELIANCE.NS
15	23-01-2023	1118.46	1126.316	1107.5	1109.92	10954118	RELIANCE.NS
16	24-01-2023	1114.35	1116.017	1090.305	1103.366	16488755	RELIANCE.NS
17	25-01-2023	1101.768	1102.796	1086.948	1088.113	12385018	RELIANCE.NS
18	27-01-2023	1088.958	1090.305	1055.732	1067.47	25830975	RELIANCE.NS
19	30-01-2023	1064.889	1083.249	1050.869	1077.7	21772103	RELIANCE.NS
20	31-01-2023	1087.861	1090.442	1069.137	1075.005	22691594	RELIANCE.NS
21	01-02-2023	1086.925	1086.925	1052.695	1068.634	19347800	RELIANCE.NS
22	02-02-2023	1058.632	1072.333	1055.436	1062.72	13662663	RELIANCE.NS
23	03-02-2023	1072.79	1072.79	1047.215	1063.656	24699575	RELIANCE.NS
24	06-02-2023	1057.262	1060.003	1053.061	1055.641	14837879	RELIANCE.NS
25	07-02-2023	1055.892	1062.926	1047.215	1053.106	15135435	RELIANCE.NS
26	08-02-2023	1056.349	1077.768	1053.609	1074.137	21160332	RELIANCE.NS
27	09-02-2023	1074.823	1082.769	1065.94	1076.01	13172763	RELIANCE.NS
28	10-02-2023	1075.485	1075.485	1060.14	1067.15	10790445	RELIANCE.NS

4. Data Preprocessing and Analysis Tasks Performed

4.1 Data Cleaning

Raw stock market data often contains inconsistencies such as missing values, duplicate records, and incorrect formats. To ensure data accuracy, the following preprocessing steps were applied:

Handling Missing Values

- Missing values were checked in critical columns such as Open Price, High Price, Low Price, Close Price, and Volume.
- If missing values were found in numerical fields, forward fill (previous day's value) was used for continuous data.
- Rows were dropped if a stock had multiple missing records in critical price fields.

Removing Duplicate Entries

- Duplicate rows were checked, which can occur due to data retrieval errors.
- Duplicate stock price records were removed to ensure each stock-date combination is unique.

Standardizing Date Format

- The Date column was formatted to YYYY-MM-DD to maintain consistency for time-series analysis.

4.2 Data Transformation

Converting Data Types

- The Date column was converted to datetime format for time-series analysis.
- Numerical columns such as Open, High, Low, Close, Adjusted Close, and Volume were stored as float or int data types to allow for computations.

Adding New Features for Analysis

- Daily Price Change Percentage was calculated using the formula: (Close Price - Open Price) / Open Price * 100.
- Volatility was derived using the difference between High Price and Low Price to measure intraday fluctuations.
- Moving Averages such as 5-day and 10-day moving averages were computed to identify short-term trends in stock performance.

4.3 Data Validation and Verification

Ensuring Data Completeness

- Each stock was checked to have continuous daily records without unexpected gaps.
- Stock symbols were verified to match actual stock tickers.

Validating Numerical Ranges

- Open, High, Low, and Close prices were verified to contain only positive values.
- High Price was validated to always be greater than or equal to Low Price.

Exporting Cleaned Data

- After preprocessing, the cleaned dataset was saved as corrected_stock_data.csv, ensuring it was structured, error-free, and ready for Power BI analysis.

4.4 Analysis Tasks Performed

Once the dataset was cleaned, various analytical tasks were carried out using Power BI.

Stock Price Trend Analysis

- Daily closing price trends were visualized for all stocks to observe general market movements.
- Upward and downward trends in stock performance were identified.

Volume Analysis for Market Activity

- Trading volume patterns were analyzed to detect high activity days.
- The trading activity of different stocks was compared to understand investor interest.

Monthly Performance Breakdown

- Monthly aggregated reports were created to observe seasonal stock fluctuations.
- The data was analyzed to detect whether certain months showed higher stock returns.

Comparative Stock Performance

- The returns of different stocks were compared over selected periods to understand relative performance.

Before Data Processing:-

	Price	Close	High	Low	Open	Volume	Stock	Close	High	Low	Open	Volume	Close	High	Low	Open	Volume	Close	High
2	Ticker	RELIANCE.	RELIANCE.	RELIANCE.	RELIANCE.	RELIANCE.	NS	TCS.NS	TCS.NS	TCS.NS	TCS.NS	TCS.NS	INFY.NS	INFY.NS	INFY.NS	INFY.NS	INFY.NS	HDFCBANI	HDF
3	Date																		
4	02-01-2023	1176.416	1177.832	1163.765	1164.587	5316175	RELIANCE.NS												
5	03-01-2023	1167.807	1175.091	1163.582	1171.461	7658932	RELIANCE.NS												
6	04-01-2023	1150.224	1169.634	1148.146	1167.784	9264891	RELIANCE.NS												
7	05-01-2023	1148.169	1158.376	1143.579	1152.485	13637099	RELIANCE.NS												
8	06-01-2023	1158.604	1163.651	1150.11	1153.923	6349597	RELIANCE.NS												
9	09-01-2023	1185.961	1188.336	1161.55	1162.441	10722753	RELIANCE.NS												
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11	11-01-2023	1153.695	1168.241	1151.388	1165.729	11509553	RELIANCE.NS												
12	12-01-2023	1128.782	1156.595	1125.767	1153.101	17688773	RELIANCE.NS												
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After Data Processing:-

	Date	Open	High	Low	Close	Volume	Stock
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21	01-02-2023	1086.925	1086.925	1052.695	1068.634	19347800	RELIANCE.NS

5. Application Dashboard

5.1 Overview of the Stock Market Analysis Dashboard

The Stock Market Analysis Dashboard is designed to provide investors, traders, and analysts with interactive and insightful visualizations of stock performance. Built using Power BI, the dashboard consolidates large volumes of stock data into an easy-to-understand format, allowing users to track stock trends, analyze trading volumes, compare performance across different stocks, and make informed investment decisions.

This dashboard enables users to:

- View real-time stock trends and price movements.
- Analyze historical performance to identify market trends.
- Compare multiple stocks within a single interactive interface.
- Gain insights into stock trading volumes and volatility.
- Apply filters and dynamic tools to customize their analysis.

5.2 Key Components of the Dashboard

The Stock Market Analysis Dashboard consists of multiple components that provide insights into stock performance, trends, and trading volumes. The interactive elements in Power BI enable users to explore stock data effectively. Below are the key components of the dashboard:

1. Stock Selection Filter

- A dropdown menu allows users to select a specific stock from the available dataset.
- It dynamically updates all the visualizations based on the selected stock.
- Helps users focus on individual stock analysis.

2. Stock Closing Price Trend

- A line chart displays the stock's daily closing price trend for the selected period.
- Users can observe fluctuations in stock prices over time.
- Key price points such as highs and lows are labeled for better interpretation.

3. Stock Market Candlestick Chart

- Represents the opening and closing prices of the stock over different months.

- Green and red indicators help users identify whether a stock closed higher or lower than its opening price.
- Useful for understanding stock volatility and market trends.

4. High & Low Stock Price Distribution

- A pie chart showing the distribution of high and low stock prices.
- Helps users quickly identify the proportion of stock price movements within a period.

5. Sum of Close by Month, Day, and Stock

- A bar chart representing the total sum of closing prices categorized by day and month.
- Helps track stock performance across different time intervals.
- A scroll feature allows for detailed exploration of data.

6. Line Chart (Stock Trend Over Time)

- A line chart visualizing the stock's performance over several months.
- Highlights key fluctuations and trends in stock prices.
- Enables users to analyze long-term price movements and trends.

7. Sum of Volume by Year and Month

- A bar chart displaying trading volume trends over different months.
- Helps users identify periods of high and low stock activity.
- Useful for understanding market liquidity and investor interest in the stock.

5.3 Interactive Features

To enhance the user experience, the dashboard includes multiple interactive elements:

1. Stock Selection Filter

- A dropdown menu allowing users to choose specific stocks for analysis.
- Users can compare different stocks without visual clutter.

2. Hover Tooltips

- Displays detailed information when users hover over a specific data point.
- Provides stock prices, trading volumes, and percentage changes for better insights.

3. Date Range Scroll and Time Selection

- The bar chart for closing prices by day and month includes a scroll feature, allowing users to navigate across different time periods.

4. Dynamic Line and Bar Charts

- The line chart displaying stock trends over time updates dynamically based on the selected stock and time frame.
- Users can compare different periods to identify patterns, peaks, and dips in stock performance.

5. Candlestick Chart for Market Trends

- The candlestick chart provides an intuitive representation of opening and closing prices for stocks across months.
- Users can easily identify whether the stock price increased (green) or decreased (red) over a given time frame.

5.4 Dashboard Design Approach

The dashboard was designed with a focus on clarity, usability, and efficiency:

- **User-Friendly Layout:** Key insights are displayed in a structured manner for quick analysis.
- **Minimalist Design:** The interface is free from unnecessary elements to ensure readability.
- **Consistent Color Scheme:** Different stocks are color-coded for easy differentiation.
- **Hierarchical Organization:** The most important visualizations are placed at the top, ensuring that users get critical information first.

5.5 Benefits of the Dashboard

The Stock Market Analysis Dashboard serves as an essential tool for both new and experienced investors by:

- Helping users track their preferred stocks effortlessly.
- Providing clear insights into stock trends and movements.
- Allowing comparisons between different stocks for better decision-making.
- Enabling dynamic analysis with interactive tools and filters.

6. List of Functions Used

In the development of this Power BI dashboard, several key functions and features were used to process, analyze, and visualize the stock market data effectively. These functions can be categorized into Data Processing Functions, DAX (Data Analysis Expressions) Functions and Visualization Features.

6.1 Data Processing Functions

Before the data was visualized, various transformations and processing techniques were applied to clean and structure the dataset properly. The following functions were utilized in Power BI's Power Query Editor:

1. Data Cleaning and Transformation

- **Remove Duplicates:** Eliminated any duplicate rows to ensure accurate calculations.
- **Replace Missing Values:** Filled missing values using interpolation techniques or replaced them with default values like zero or previous values.
- **Change Data Types:** Ensured that numeric fields (such as Open Price, Close Price, and Volume) were correctly formatted as decimal or integer types.
- **Date Parsing:** Converted date columns to the appropriate date format for time-series analysis.

2. Column Splitting and Merging

- **Extracted Month and Year from Date Column** to facilitate monthly and yearly analysis.
- **Merged Stock Symbol Data** to ensure consistency in naming conventions across the dataset.

3. Creating Custom Calculated Columns

- **Added columns for Monthly and Yearly Aggregation** to enable grouping of data for trend analysis.
- **Derived High-Low Difference** column to calculate the difference between high and low prices in a given period.

6.2 DAX (Data Analysis Expressions) Functions Used

Power BI's **DAX functions** were used to create calculated fields and measures for better data analysis. Below are some of the key DAX functions applied:

1. Aggregation Functions

- **SUM()** → Used to calculate total trading volume and total stock price values.
    - Example: Total Volume = SUM(StockData[Volume])
- **AVERAGE()** → Computed the average stock price over different time periods.
    - Example: Avg Closing Price = AVERAGE(StockData[Close])
- **MAX() and MIN()** → Extracted the highest and lowest prices in a given timeframe.
    - Example: Max Price = MAX(StockData[High])

6.3 Visualization Features Used

The Power BI dashboard includes multiple visual elements, each leveraging Power BI's built-in visualization features:

1. Line Charts

- Used to display **stock price trends over time** with dynamic time-series visualization.
- Applied filters to enable stock selection for customized analysis.

2. Bar Charts

- Used to compare **monthly trading volume trends** and detect fluctuations.
- Enabled sorting to visualize top-performing months.

3. Candlestick Chart

- Represented **opening, closing, high, and low prices** for each stock, making it easier to understand market trends.

4. Pie Chart

- Used to **visualize the proportion of high vs. low prices** in the selected stock.

5. Slicers and Filters

- Dropdown menus for **stock selection** allow users to explore different stocks interactively.
- Time filters allow users to analyze data across **various time periods** (daily, monthly, yearly).

7.Performance Analysis and Visualizations

The performance analysis of the stock market dashboard involves evaluating how well the dashboard represents stock trends, trading volumes, and financial insights. By leveraging interactive visualizations in Power BI, we can derive meaningful patterns from the dataset and assess the effectiveness of the dashboard in analyzing stock performance.

7.1 Performance Analysis

The dashboard provides a comprehensive analysis of stock performance by breaking down key metrics such as closing prices, trading volumes, and trends over time. Below are the main aspects of performance analysis:

Stock Price Trends: The line charts and candlestick charts enable users to analyze the fluctuations in stock prices over different time periods. By observing peaks and drops, investors can identify potential trading opportunities.

Trading Volume Insights: The bar charts provide a clear breakdown of the trading volume across months and years. This helps in identifying periods of high or low market activity, which is crucial for investment decisions.

Stock Selection for Comparative Analysis: The dropdown menu allows users to select specific stocks and analyze their performance individually. This helps in comparing multiple stocks within the dataset.

Identifying Market Trends: By analyzing the sum of closing prices over time, users can detect long-term upward or downward trends in stock values. This is useful for making strategic investment choices.

High & Low Price Comparisons: The pie chart and summary visuals provide an overview of the highest and lowest stock prices within the selected timeframe, offering a quick snapshot of market performance.

7.2 Visualizations and Their Impact

The dashboard includes a variety of Power BI visualizations to represent stock market trends effectively:

Line Chart (Stock Trend Over Time)

- Depicts the fluctuations in stock closing prices over months.
- Helps users track market cycles and seasonality in stock prices.

Candlestick Chart (Stock Market Performance)

- Provides an in-depth view of stock price movements, showing open, close, high, and low prices.
- Useful for traders analyzing market volatility and identifying bullish or bearish trends.

Bar Chart (Sum of Trading Volume by Month and Year)

- Displays trading volume trends over time, making it easier to spot high-activity periods in the stock market.

Pie Chart (High & Low Prices Distribution)

- Summarizes highest and lowest stock prices, offering a comparative view of stock valuation trends.

Stock Selection Dropdown

- Enables users to switch between stocks dynamically, ensuring a flexible and customizable experience.

7.3 Dashboard Efficiency and Usability

The dashboard is designed with efficiency and ease of use in mind:

- **Interactive Filters:** Users can focus on specific stocks or time periods for detailed analysis.
- **Clear Data Presentation:** Well-structured visualizations provide quick insights without requiring deep financial expertise.
- **Data Refreshing:** If new stock data is added, the Power BI dashboard can be updated dynamically to reflect real-time market conditions.