

MarketPulse: A Real-Time Financial Analysis Platform Using Data Science and Web Technologies

Prajeeth L¹, V Punya Lakshmi², Mr. Nagaraj A³, Ms. Sridevi Nagaraja⁴

^{1,2}Students, Computer Science and Engineering, Jyothy Institute of Technology, Bengaluru, India

³Professor of Practice, Computer Science and Engineering, Jyothy Institute of Technology, Bengaluru, India

⁴Founder and CEO, NiyantTEK Private Limited, Bengaluru, India

Abstract - MarketPulse is a dynamic, real-time financial analytics platform designed to streamline the process of stock market analysis and decision-making. Combining the power of data science, machine learning, and web scraping technologies, the platform delivers real-time stock prices, predictive analytics, sentiment analysis, and interactive chart visualizations. Built using Django and React.js, it leverages third-party financial news APIs services to provide updated market trends and data. Users can compare stocks, track market indices, explore news sentiment, and visualize data using tools like Chart.js and D3.js. The integration of real-time data with smart analysis tools ensures accurate risk assessment, making MarketPulse a complete decision-support system for investors, traders, and financial enthusiasts.

Key Words: Financial Analysis, Stock Forecasting, Django, React.js, Real-time Data, Financial Dashboard, Data Science

1. INTRODUCTION

In the rapidly evolving financial landscape of today, having immediate access to precise market data and analytics is essential for making prompt and well-informed investment choices. MarketPulse is a comprehensive online financial analysis platform designed to meet this demand by combining data science, web scraping, and modern visualization technologies. This system utilizes both real-time and historical stock data, financial news, and sentiment analysis to provide actionable insights through a user-friendly interface. Developed with Django for backend processing and React.js for the frontend, the platform includes features such as interactive stock charts, stock comparisons, a Market Mood Indicator, and a customizable watchlist. Data is gathered from reliable APIs. By offering a centralized, enhanced dashboard for examining market trends, MarketPulse enables traders, investors, and financial enthusiasts to make more intelligent, data-driven decisions.

1.1 Motivation

The financial market is known for its significant volatility and intricate nature, presenting difficulties for

investors and traders who depend on conventional techniques to effectively assess market dynamics. To tackle this challenge, MarketPulse was developed as a data-focused platform aimed at streamlining stock market analysis by utilizing visual tools and integrating real-time data. The main goal of this initiative is to enable users to understand market trends, assess risks, and make well-informed decisions, all through an intuitive interface backed by strong data analytics.

1.2 Objective

MarketPulse's primary goal is to make financial analysis more accessible by converting intricate stock market data into easy-to-understand visual representations. This approach helps users grasp market trends and dynamics more effectively. Additionally, the platform is designed to offer real-time stock monitoring features, allowing users to observe changes and movements as they occur. Finally, it guarantees the provision of interactive charts and secure data access, which enhances both user experience and data security.

1.3 Scope

The purpose of MarketPulse is to provide a real-time financial dashboard with in-depth knowledge about the world stock market. The platform has AI-powered components including the Market Mood Indicator, which assesses investor emotion and risk ratings based on current data. Additionally, users may access sectoral and worldwide indexes, which gives them a comprehensive picture of the financial environment and aids in improved decision-making. A responsive experience across devices is guaranteed by the system, which is fundamentally scalable and user-friendly. It also facilitates future improvements and integration with new features and data sources.

2. UNDERSTANDING THE STOCK MARKET

The stock market is a dynamic and complex system where shares of publicly traded companies are continuously bought and sold, with their values influenced by factors such as supply and demand, investor sentiment, and macroeconomic indicators. Beyond facilitating trades, it reflects the financial health of companies, sectors, and

entire economies. Effective stock market analysis requires interpreting a wide range of data—price fluctuations, trading volumes, and news sentiment—to predict trends and guide investment decisions.

MarketPulse was developed to simplify this complex analysis process for users of all experience levels. It provides real-time stock prices, historical data, and sentiment-based insights, all presented through interactive, customizable charts. Unlike traditional static graphs or manual data analysis, MarketPulse enables users to monitor live market trends, compare stock performance, and assess market sentiment—all within a single, user-friendly platform. By converting raw data into actionable insights, MarketPulse empowers investors to make confident, informed decisions.

2.1 Data Science in Stock Market

Data science is at the heart of modern stock market analysis, enabling users to derive actionable insights from vast and complex datasets. In MarketPulse, data science techniques are employed to analyze historical stock prices, track market trends, and visualize key metrics that influence stock performance. By processing large volumes of financial data, the platform helps users identify patterns, correlations, and price movements with greater clarity and efficiency. Rather than simply displaying raw numbers, MarketPulse transforms financial data into interactive charts and comparative visualizations using libraries like Chart.js and React Charts. It incorporates statistical techniques such as moving averages, percentage change calculations, and price-volume correlation to generate meaningful insights.

The platform also leverages web scraping tools like BeautifulSoup to collect real-time financial news and stock-related updates from trusted sources such as Moneycontrol and Economic Times. This curated information helps users understand the broader market environment alongside technical trends. By combining data science and web scraping, MarketPulse offers a smarter, more informative experience than traditional stock tracking platforms. It empowers users to make informed decisions by presenting timely, processed, and visually rich data that captures both market performance and sentiment-driven developments in a user-friendly interface.

2.2 Data Visualization for Stock Market

Data visualization plays a critical role in MarketPulse by transforming raw stock market data into meaningful visual insights that enhance user understanding and decision-making. The platform utilizes advanced libraries like Chart.js, React Charts, and Google Charts to render real-time and historical data through interactive and dynamic visual elements. Users can explore candlestick charts, line graphs, and bar charts to analyze stock performance over

different intervals and compare multiple stocks or indices on a unified timeline. Custom chart controls allow users to adjust parameters like time range, chart type, and data intervals, offering granular control over the analysis. Additional tools such as zoom, drag, and tooltip features enable deeper inspection of price movements and trading patterns.

The visualization layer also incorporates market mood indicators, sectoral trends, and index comparisons, making it easier for investors to assess bullish or bearish sentiments and recognize key market signals. By presenting complex financial data in an intuitive and responsive format, the platform empowers users to make informed trading and investment decisions with confidence.



Figure 1: Candlestick chart using Google chart



Figure 2: Comparison Line Chart using Google chart

3. RELATED WORK

3.1 Literature Survey

Numerous studies have explored the application of machine learning and data science techniques for stock market forecasting and analysis. Amisha Kirti et al. [1]

employed models like LSTM, GRU, and SVR to predict stock indices, concluding that LSTM and SVR yielded better accuracy, supported by metrics such as RMSE and R^2 . Their work also proposed an interactive ML dashboard for visualizing market trends. Similarly, Shrawani Pagar et al. [2] implemented data science tools like Python and YFinance for technical analysis, combining data preprocessing and feature engineering with trading pattern recognition to enhance investment strategies. Jai Jagwani et al. [3] took a time series approach, integrating ARIMA and Holt-Winters models to forecast Apple Inc.'s prices using Yahoo Finance data, noting that combining seasonal and non-seasonal models improved prediction accuracy. Meanwhile, Kamaladdin Fataliyev et al. [4] emphasized the importance of text-based data—news, social media, and financial reports—in stock forecasting, applying NLP and sentiment analysis to extract insights and identify challenges in predictive modeling.

Other works reinforce the role of visualization and statistical tools in financial forecasting. Sameer Yadav [5] examined Indian market volatility, linking macroeconomic factors and speculative trading to price fluctuations while reviewing control mechanisms like circuit breakers. Bharat Gupta et al. [6] utilized Monte Carlo simulations and Bootstrap methods for risk assessment, demonstrating that visualizing stock trends enhances decision-making. A. Leelavathi et al. [7] proposed a Python-based SVM model paired with candlestick and correlation charts, which improved user analysis and stock classification. Dr. Kanahaiya Lal Ambashtha et al. [8] analyzed Nifty-50 with technical indicators like SMA, EMA, and Dow Theory, validating buy/sell signals with statistical tests. Florina Covaci et al. [9] created a financial dashboard integrating real-time data and key financial ratios, enabling informed trading. Finally, Sneha Patil et al. [10] presented a holistic approach using technical and fundamental indicators along with algorithmic trading models, showcasing the advantages of data-driven forecasting in minimizing human bias and enhancing investment strategies.

4. PROPOSED MODEL

4.1 Workflow

The proposed operational framework of MarketPulse adheres to a systematic, real-time financial analytical methodology that aids investors and traders in executing data-informed decisions through the utilization of sophisticated visualization and sentiment analysis instruments. The platform amalgamates both historical and real-time stock information, presenting insights via interactive, customizable charts that facilitate users in monitoring stock trends, sectoral performance, global indices, currencies, and commodities. A salient feature is the Market Mood Indicator, which quantifies sentiment

through the integration of market volatility and performance metrics, further augmented by the sentiment analysis of financial news. The operational process commences at the User Interaction layer, where users undertake actions such as searches, clicks, and submissions via a web interface.

These inputs are subsequently processed by the Client Layer, which transmits HTTP requests to the API Services (Presentation Layer). The API layer is responsible for validating and routing the requests to the Business/Application Layer, where the core logic is executed—encompassing data retrieval, analysis, machine learning predictions, and sentiment scoring. The Database Layer oversees the management of the storage and retrieval of processed stock data, user preferences, and sentiment-classified news articles. Ultimately, the system transmits the response back through the API to the client, where the UI is dynamically refreshed with visual and analytical feedback. This cohesive flow guarantees that users obtain timely, precise, and actionable financial insights, thereby facilitating efficient and informed investment strategies.

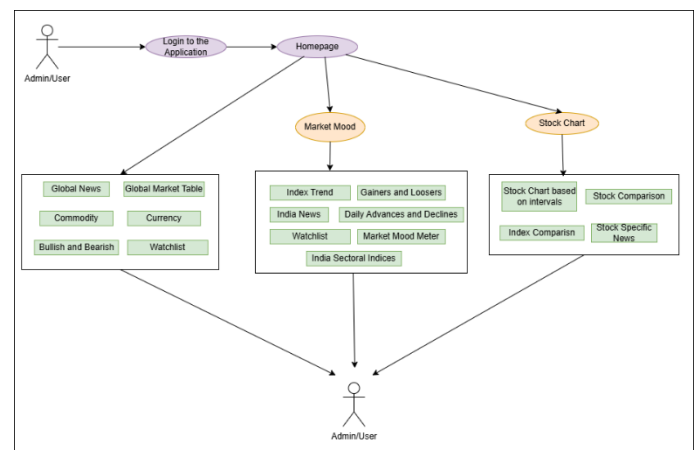


Figure 3: Workflow

4.2 Techniques Used

The innovative evolution of the MarketPulse platform meticulously intertwines a variety of fundamental data science methodologies along with advanced web scraping techniques, ultimately aiming to furnish users with an all-encompassing and deeply insightful stock market analysis experience that is both engaging and informative. To achieve this ambitious goal, the platform strategically employs powerful libraries such as Pandas and NumPy, which are essential tools for the intricate manipulation and rigorous analysis of vital stock market indicators, including but not limited to stock prices, trading volume fluctuations, and significant historical trends over time. Through the application of sophisticated statistical methods, including moving averages, percentage changes,

and the intricate correlation between price and volume, MarketPulse adeptly identifies and elucidates patterns and valuable insights that are embedded within complex financial data, thus empowering users to make informed decisions.

Furthermore, in addition to these advanced analytical techniques, MarketPulse harnesses the capabilities of web scraping tools, notably BeautifulSoup and Requests, to meticulously aggregate and extract relevant financial news articles from reputable sources such as Moneycontrol and Economic Times, thereby ensuring a steady stream of up-to-date information. This scraped content undergoes a rigorous filtering and processing procedure to maintain high relevance and quality, resulting in a meticulously curated news feed that is directly linked to the specific stocks of interest for each user, enhancing their engagement and understanding. For the purpose of effective data visualization, the platform incorporates a diverse array of libraries including Chart.js, React Charts, and Google Charts, which collectively facilitate the creation of interactive stock charts, dynamic trend graphs, and comparative analysis tools that are visually appealing and informative. The integration of these multifaceted techniques guarantees that users receive not only accurate and real-time data but also the opportunity to engage with this information in an interactive manner that significantly promotes a deeper understanding of financial markets, ultimately leading to more astute investment decisions. By synthesizing data science with web scraping and visualization techniques, MarketPulse positions itself as a pivotal resource for investors seeking to navigate the complexities of the stock market landscape with greater confidence and clarity. Such a comprehensive approach not only enriches the user experience but also enhances the overall effectiveness of investment strategies in an ever-changing economic environment.

4.3 Implementation Details

MarketPulse has been meticulously designed with a highly modular and inherently scalable framework, which is crucial for facilitating a performance that is not only robust but also aligned with the principles of user-centric design. The backend infrastructure is fundamentally powered by the Django web framework, complemented by the Django REST Framework, which plays a pivotal role in managing API endpoints, overseeing user authentication processes, and orchestrating interactions with the database through the comprehensive capabilities provided by the Django admin interface.

The frontend component of the application has been adeptly developed utilizing React.js, which endows the user interface with a dynamic, responsive, and visually engaging experience that significantly enhances user interaction. For the visualization of financial data, advanced charting components are employed that

leverage the capabilities of Chart.js and D3.js, thus enabling the presentation of real-time financial information through customizable and visually appealing representations.

Real-time stock market data is efficiently retrieved via the API, while the aggregation of financial news is adeptly conducted through web scraping techniques as well as external APIs, which provide a comprehensive overview of relevant financial information. Furthermore, an advanced machine learning layer has been ingeniously constructed using Scikit-learn, which facilitates the generation of stock price predictions alongside sentiment analysis scores that are subsequently displayed within the user-friendly dashboard interface.

Among the plethora of additional features, the platform guarantees secure user authentication through the implementation of JWT (JSON Web Tokens) and OAuth2 protocols, while also ensuring precise timezone synchronization through the utilization of Python's pytz library in conjunction with JavaScript's Date() objects, thereby accommodating users from diverse geographical locations. Currently, the local deployment of the entire platform is operational on a localhost server, providing a controlled environment for testing and development.

Moreover, the architecture of the system incorporates Continuous Integration and Continuous Deployment (CI/CD) pipelines in conjunction with Docker technology, which collectively facilitate streamlined processes for automated deployment and rigorous integration of new features and fixes. The platform also supports a robust role-based access control mechanism, thereby ensuring that user permissions are meticulously managed according to predefined roles. Additionally, it includes sophisticated real-time logging and error handling functionalities that are indispensable for maintaining system stability and long-term maintainability of the application. Particular emphasis has been placed on enhancing the Market Mood Indicator and Index Trend modules to provide users with deep insights into market sentiment and stock-index correlation.

4.3.1 Market Mood Indicator

The Market Mood Meter is a unique and insightful feature designed to reflect the emotional sentiment and overall risk environment of the stock market on any given day. It evaluates the ratio of advancing to declining stocks and translates this data into five emotional states: Panic, Fear, Neutral, Greedy, and Extreme Greedy. When the number of declining stocks far exceeds the advancing ones, the market is considered to be in a state of Panic or Fear, indicating high uncertainty and potential selling pressure. A balanced ratio typically points to a Neutral sentiment, where neither bullish nor bearish forces dominate. On the other hand, when advances significantly outnumber

declines, the mood shifts toward Greedy or Extreme Greedy, signaling heightened investor confidence and a strong buying trend. By encapsulating complex market behavior into easily understandable emotional cues, the Market Mood Meter empowers users to gauge market sentiment at a glance and make more informed, risk-aware trading decisions.

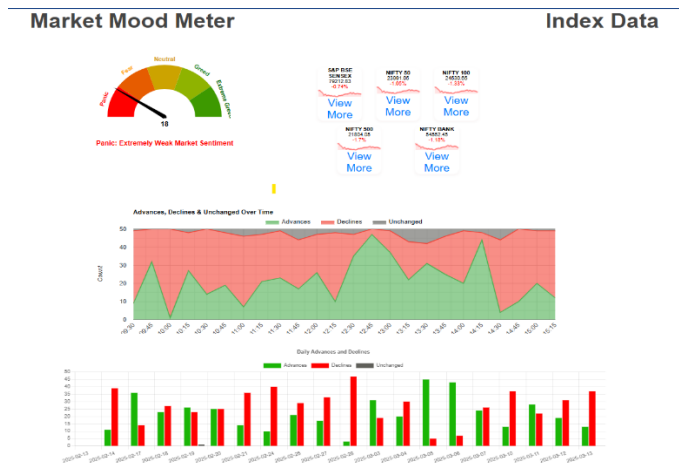


Figure 4: Market mood summary

4.3.2 Index Trend

The Index Trend module is a powerful analytical tool that helps users understand how individual stocks are performing in relation to their benchmark indices. It evaluates whether a stock's movement is in alignment with or diverging from the overall trend of its corresponding index.

This alignment provides key insights into sector strength, investor sentiment and potential momentum trading opportunities. A stock moving in sync with a rising index suggests strong sector-wide momentum, while divergence may signal unique stock-specific factors or early signs of reversal. What makes this feature especially dynamic is that users can customize the correlation threshold according to their preference—enabling them to adjust the sensitivity of the trend analysis. This flexibility allows for personalized insights, letting users visualize how closely a stock tracks its index based on the defined correlation, and adapt their trading strategies accordingly. Whether tracking consistency or seeking anomalies, the Index Trend module serves as a strategic edge for both trend-followers and tactical traders.

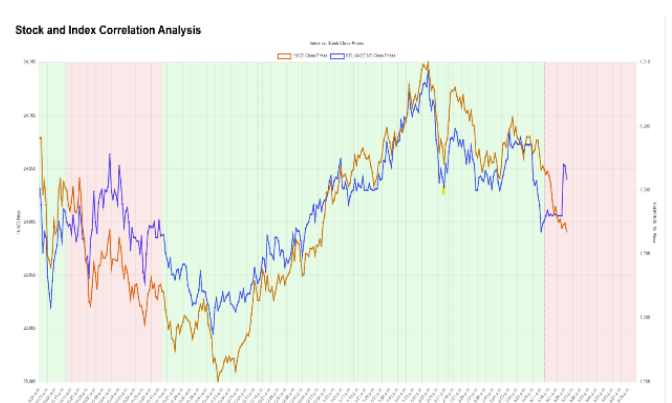


Figure 5: Index Trend Analysis describing Nifty 50 index versus Reliance stock

5. CONCLUSION

MarketPulse illustrates how combining data science, web technologies, and financial analytics can transform the interaction between investors and stock market data. By utilizing real-time data retrieval, machine learning algorithms, sentiment analysis, and interactive visualizations, the platform provides a thorough and user-friendly decision-support system. Its modular architecture allows for scalability and easy maintenance, while secure authentication safeguards user information. With the help of advanced tools such as Django, React.js, Chart.js, and NLP libraries, **MarketPulse** delivers precise predictions, indicators of market sentiment, and informative visual displays to support financial decision-making. The platform effectively connects raw financial data with accessible insights and lays the groundwork for future developments like automated trading, tailored recommendations, and portfolio optimization. In summary, **MarketPulse** stands out as a powerful, scalable, and intelligent solution for contemporary financial analysis.

REFERENCES

- [1]. Kirti, S. Chandra, R. C. Barik and B. Biswal, "Forecasting and Visualizing Stock Market Indices: A Machine Learning Dashboard," 2023 7th International Conference Trends in Electronics and Informatics (ICOEI), Tirunelveli, India, 2023, pp. 1272-1279.
- [2]. S. Pagar, A. Jaiswal, A. Auti, V. Purohit and V. Mishra, "Technical Analysis of Stock Market using Data Science and its tools," 2023 7th International Conference On Computing, Communication, Control And Automation (ICCUBEA), Pune, India, 2023, pp. 1-5.

- [3]. J. Jagwani, M. Gupta, H. Sachdeva and A. Singhal, "Stock Price Forecasting Using Data from Yahoo Finance and Analysing Seasonal and Nonseasonal Trend," 2018 Second International Conference on Intelligent Computing and Control Systems (ICICCS), Madurai, India, 2018, pp. 462-467.
- [4]. Fataliyev, Kamaladdin & Aneesh, Sreevallabh & Prasad, Mukesh & Liu, Wei. (2021). Stock Market Analysis with Text Data. 10.48550/arXiv.2106.12985.
- [5]. Yadav, Sameer. (2017). STOCK MARKET VOLATILITY - A STUDY OF INDIAN STOCK MARKET. Global Journal for Research Analysis. 6. 629-632.
- [6]. Gupta, Bharat & Bhardwaj, Shefali & Govinda, K. & Rajkumar, Rajasekaran. (2020). Stock Market Analysis using Data Visualization. International Journal of Recent Technology and Engineering. 8. 10.35940/ijrte.C4193.038620.
- [7]. A. Leelavathi, G. Sri Jaya Sairam, G. Rishitha, V. Venkat, SH. Thahira, D. Harika Poorna, "Visualization and Forecasting Stocks," International Research Journal of Engineering and Technology (IRJET), April 2024.
- [8]. Ambashtha, Dr-Kanahaiya & Singh, Manoranjan. (2020). Comparative Technical Analysis and Prediction of Nifty-50 Performance. 9.
- [9]. Covaci, Florina & Boscan, Dragoş. (2023). Financial Analysis Dashboard Application for Stock Exchange Listed Companies. Journal of Computer Science and Technology Studies. 5. 10-21. 10.32996/jcsts.2023.5.4.2.
- [10]. Sneha Patil, Yash Bharat Jadhav, Neel Gude, Anish Shivram Gawde, Mohammed Naif, Aditi Bombe, "Data Science Approach to Stock Market Analysis," International Research Journal of Engineering and Technology (IRJET), August 2023.