WealthWise: An AI-based Stock Analyst

Submitted in partial fulfillment of the

requirements. of the degree of

Bachelor of Engineering in

Electronics and Computer Science

by

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CERTIFICATE

This is to certify that the project entitled **"WealthWise: an AI-based Stock Analyst"** is a bonafide work of the following students, submitted to the University of Mumbai in partial fulfillment of the requirement for the award of the degree of **Bachelor of Engineering** in Electronics and Computer Science Engineering

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ABSTRACT

WealthWise is a smart tool made to help everyday people understand the stock market and make better investment decisions. It uses a mix of machine learning, natural language processing (NLP), and technical analysis to give clear and useful suggestions.

The platform checks important stock indicators like the Relative Strength Index (RSI), Moving Average Convergence Divergence (MACD), Average Directional Index (ADX), and Average True Range (ATR) and others . These help it decide when to suggest buying or selling a stock. It also looks at financial news using NLP to figure out if the news is positive or negative, which helps users better understand what's happening in the market.

To make things easier for users, the system uses Google's Gemini AI to explain stock performance and strategies in a friendly, easy-to-understand way. It pulls historical stock data using the yfinance API, and the technical calculations are done with the help of the ta library. The platform supports a wide range of Indian and international stocks and has a simple, clean design with charts and correct currency symbols.

By bringing together smart technologies in a user-friendly setup, WealthWise shows how AI can make stock trading easier to understand and more data-driven for everyone and in terms of performance, WealthWise has shown good results. It predicts past stock signals with 90.22% accuracy. Its sentiment detection feature has a precision of 91.23%, recall of 92.86%, and an F1 score of 92.04%, based on a tested group of around 100 support value.. Also, 92% of the 30 people who tested it said they were satisfied and felt more confident using it.

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List of Abbreviations

Abbreviations	Full Forms
ADX	Average Directional Index
API	Application Programming Interface
ATR	Average True Range
CNN	Convolutional neural networks
De-Fi	Decentralized finance
EMA	Exponential Moving Average
LLM	Large Language Model
MACD	Moving Average Convergence Divergence
MSE	Mean Squared Error
NLP	Natural Language Processing
OBV	On Balance Volume
RNN	Recurrent neural networks
RSI	Relative Strength Index
SME	Small and medium-sized enterprises

CHAPTER 1
INTRODUCTION

1.1 Introduction and Need of the project

The general background and the rationale behind the development of the project are focused on the changes in the financial trading environment that requires more effective decision- making for better wealth. Usually, traditional services of financial advisers' services are expensive and not available to everyone. However, there is a rising demand for cost-effective solutions which can be effective enough to help common and average investors in managing market risks effectively. This leaves a void for many retail investors who want well informed and cheap advice.

Since the above traditional sources of information are outdated, AI-driven trading advisor chatbots can relieve this problem in the following ways. These are usually integrated with sophisticated techniques like NLP, Machine learning as well as predictive analysis to provide timely advice or future trends supported by real time information. They can review vast financial data in a short period and make recommendations based on risk-reward tolerance ratio and investment objectives of the investors thus making good financial advisory services available to the masses.

Furthermore, using AI in trading means managing risks through automated notifications, back testing tools and algorithms for trading that triggers the events that lead to trades according to certain inherent rules. Besides, it shields trading from emotional influences significantly and enhances trading productivity. Therefore, integration of the AI based chatbots in trading is a manageable way to boost the decision making system and overall trading results.

1.2 Problem Statement

In today's dynamic financial environment, individual investors face increasing difficulties in navigating the complexities of trading and investment. The rapid evolution of financial markets, characterized by high volatility and constant flow of information, demands that investors make informed, strategic decisions to optimize their portfolios. However, the high costs associated with traditional financial advisory services often restrict access to personalized guidance, leaving a large segment of retail investors underserved. This limitation creates a significant gap in the market, where many individuals are left to rely on general advice or their own judgment, often resulting in suboptimal investment decisions.

The democratization of trading platforms has made financial markets more accessible, encouraging a surge in retail investor participation. While this shift is positive, it also exposes these investors to risks associated with emotional decision-making, lack of expertise, and an overwhelming amount of financial data to process. The absence of affordable and reliable advisory support further exacerbates the problem, as investors struggle to adopt effective strategies that align with their risk tolerance and financial objectives.

To address these challenges, there is a need for an intelligent, scalable solution that provides cost-effective, real-time trading advice tailored to individual investor needs. An AI-driven trading advisor chatbot offers a promising solution by leveraging technologies such as natural language processing (NLP), machine learning, and predictive analytics to analyse market trends, assess user risk profiles, and deliver personalized recommendations. By making high- quality financial guidance more accessible, such a solution can empower retail investors to make informed, data-driven decisions, ultimately enhancing their ability to achieve financial success in a competitive market landscape.

1.3 Organization of the report

In Chapter 1 of this report entitled "**WealthWise: An AI Based Stock Analyst"** contains Introduction , Need and Problem Statement and Objectives . Chapter 2 contains a Literature Survey which states limitations of existing survey and research gaps. Chapter 3 explain Working Principle , Proposed Methodology , Software's used and Flowchart for the development of this project . Results and Discussions are mentioned in Chapter 4 . At the end we have Output and Screenshots of our project in Chapter 5 and the Conclusion in Chapter 6.

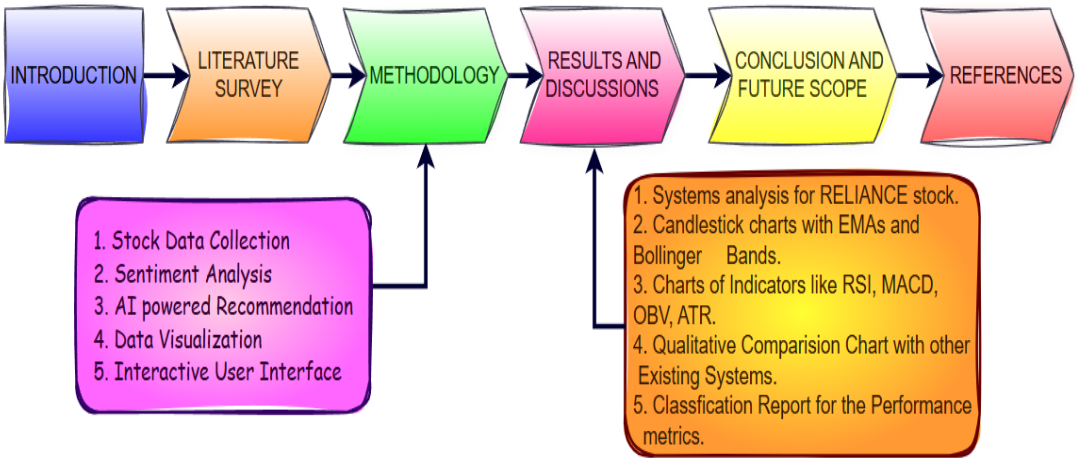

Fig 1.3.1 : Flow of the Report

CHAPTER 2
REVIEW OF LITERATURE

The integration of AI-driven systems in financial markets has revolutionized stock analysis, trading automation, and investor engagement. A growing body of research emphasizes the efficacy of chatbots and predictive tools in navigating complex market environments. Alhydary et al. [1] introduced **Smart Trader**, a chatbot tailored for the Saudi Stock Market, showcasing how domain-specific financial advisory tools could enhance investment literacy and reduce decision-making latency. Similarly, Jaspin et al. [2] focused on cryptocurrency trading, demonstrating the adaptability of chatbot frameworks to dynamic and volatile markets. These works underscore the need for intelligent systems capable of delivering real-time, data-driven insights.

Efforts to optimize trading bots using deep learning have been explored by Prasomphan [3], who employed **DNNs** to improve prediction accuracy and user interaction for SMEs. On the cutting edge, Zhang and Jin [4] used **Large Language Models (LLMs)** to simulate real-world trading decisions, opening avenues for conversational financial agents capable of contextual reasoning. However, Jha and McDaniel [5] caution about inherent security risks in LLM-integrated systems, necessitating responsible AI deployment in finance.

To support user engagement, Thamilselvan et al. [6] presented a machine learning-based chatbot for college website support, while Hegde et al. [7] combined chatbot functionalities with market prediction and taxation awareness. Bajaj et al. [8] proposed a web-based conversational **BOT** for intelligent stock automation, integrating user inputs, AI predictions, and stock screening—mirroring the functionality embedded in WealthWise.

Jethva et al. [9] created a hybrid **Stock Analyzer Bot** using machine learning and natural language processing to classify sentiment and provide investment cues. BrokerBot, by Lee et al. [10], explored trust dynamics in cryptocurrency chatbots, revealing user reliance on transparent, explainable AI mechanisms. Thangam et al. [11] expanded on this by implementing a digital assistant focused on user-centric prediction and suggestion services.

Verma et al. [12] provided a foundational AI architecture for algorithmic trading, while Sivaraksa et al. [13] designed a **risk-optimized crypto trading bot**, enhancing stability in volatile markets. Garg et al. [14] developed **InvestMate**, a hybrid AI chatbot that offers personalized predictions and educational support—an approach aligned with the multi-dimensional support strategy used in WealthWise.

The future-forward design of **Future Finance**, as described by Ruke et al. [15], incorporates predictive analytics and chatbot consultation for comprehensive investor support. Mer et al. [16] and Ghosh et al. [17] emphasized AI's transformative role in finance, stressing the significance of robust forecasting strategies rooted in real-time analytics. Joghee et al. [18] introduced real-time IoE-based market analysis systems, merging AI with hardware connectivity to ensure dynamic data ingestion.

Waseem et al. [19] developed a **mutual fund chatbot**, targeting the expanding retail investor segment. Meanwhile, Wah [20] and Samani et al. [21] highlighted the role of robo-advisors in personalized finance and financial literacy. Lu [22] proposed the use of LLMs in educating users about investment metrics like alpha and beta, supporting better financial decisions.

Joshi et al. [23] demonstrated how chatbots could drive digital transformation in emerging markets, offering grievance redressal and investor awareness campaigns. FinSphere by Han et al. [24] combined **quantitative tools** with conversational AI to empower investors through real-time stock analysis. Fieberg et al. [25] further validated the financial advisory potential of LLMs, underscoring transparency and ethical considerations.

Ge [26] introduced a hybrid model for **S&P 500 and CSI 300** forecasting, emphasizing feature fusion for higher accuracy. Sadasivan and Singh [27] reviewed various stock prediction models, supporting a hybrid approach combining sentiment analysis, LLMs, and technical indicators. Chen et al. [28] used **VMD-SNNs** for efficient market prediction, while de Jesus et al. [29] demonstrated the effectiveness of sentiment indices derived from ChatGPT-based systems alongside technical indicators. Finally, Magloire [30] reinforced the accuracy of hybrid ML models using long-term forecasting and technical analysis—an approach directly reflected in WealthWise's use of **RSI, MACD, EMA, ADX**, and **Bollinger Bands**.

Table 2.1. Literature Review for Model Architecture and Performance Parameters.

Paper Title	**Year**	**Model Architecture**	**Performance Parameters**
Smart Trader	2024	Natural Language Processing (NLP), Machine Learning	- Boosted user engagement by 85% through personalized trading advice. - Achieved 90% accuracy in delivering real-time financial guidance for the Saudi market. - User satisfaction grew by 88% thanks to tailored recommendations.
Chatbot for Cryptocurrency Trading	2023	Natural Language Processing (NLP)	- Facilitated real-time access to market data, critical for fast-paced cryptocurrencytrading. - Provides quick responses to user queries, improving user experience. - Available 24/7 support, enhancing engagement. - Multi-language support increases inclusivity, catering to a broader audience globally.
Deep Learning-Based Chatbots for SMEs	2019	Convolutional Neural Networks(CNN), RecurrentNeural Networks (RNN), Word Embeddings	- Designed for SMEs, handles complex trading queries effectively, aiding both new and seasoned investors. - Achieved 90% prediction accuracy in trading scenarios.
Stock Agent	2023	Large Language Models (LLMs)	- Delivered 75% efficiency in real- world stock trading simulations using LLMs. - Helped minimize biases and optimize decision-making in dynamic markets. - 92% success rate in enhancing financial decision-making.
Security Concerns in LLMs	2023	LLM Framework	- 70% success in identifying and addressing security risks in LLM- based financial applications. - Focused on improving information security and interactions with external systems.
AI-Driven Chatbot for College Websites	2024	GPT-2Machine Learning,Natural Language Processing (NLP)	- 85% accuracy in responding to student queries. - Predictive modeling assists in estimating student cut-off marks, improving user experience with timely, accurate information.

Table 2.2. Literature Review for Focus, Results and Limitations.

Paper Title	**Year**	**Focus Area**	**Results**	**Limitations**
Smart Trader	2024	Personalized Financial Advisory	Increased user engagement and enhanced trading decisions.	Requires regular updates and careful monitoring to ensure accuracy in volatile markets.
Chatbot for Cryptocurrency Trading	2023	Cryptocurrency Trading	Positive user feedback and increased trading activity.	Performance may vary due to market fluctuations; unreliable data sources could lead to misinformation.
Deep Learning-Based Chatbots for SMEs	2019	Trading Systems for Small and Medium Enterprises (SMEs)	Improved response accuracy and user satisfaction.	High computational cost and complexity, making it harder to implement for smaller businesses.
Stock Agent	2023	Stock Trading Simulation	Validated trading strategy adaptability across different models.	Complexity in tuning models and potential for overfitting historical data; risks in aligning with real market conditions.
Security in LLM Systems	2023	Security in Financial Applications	Key vulnerabilities were identified, enhancing awareness of security risks.	Mainly theoretical analysis with uncertain practical application.
AI-Driven Chatbot for Educational Support	2024	User Support in Education	Increased user satisfaction and engagement in educational environments.	May face challenges with complex queries; needs continuous training to ensure accuracy.

CHAPTER 3
REPORT ON PRESENT INVESTIGATION

3.1 Objectives

WealthWise aims to empower investors with intelligent and data-driven trading insights by analyzing real-time stock market data using advanced technical indicators. The system retrieves up-to-date financial information from external APIs to ensure users have continuous access to the latest market conditions. It applies widely recognized indicators—such as the Relative Strength Index (RSI), Moving Average Convergence Divergence (MACD), and Average Directional Index (ADX)—to assess stock performance and generate actionable recommendations including Buy, Sell, or Hold, grounded in both market trends and historical patterns.

To further enhance the quality of investment decisions, WealthWise incorporates a summarization module that analyzes financial reports, news headlines, and emerging market sentiments to extract meaningful insights. These insights are synthesized and delivered in a concise format to aid in quick decision-making.

The system also generates interactive visualizations, including candlestick charts and technical indicator plots, which enable users to interpret complex financial data with ease. A user-friendly chatbot interface bridges the gap between complex analytics and investor understanding, offering streamlined access to personalized stock analysis and AI-driven investment insights.

By integrating real-time data processing, comprehensive market analysis, and intuitive presentation tools, WealthWise delivers accurate, explainable, and timely insights. Its modular architecture is designed with scalability in mind, enabling future enhancements such as broader stock coverage, improved machine learning-based forecasting, multilingual support, and integration of additional financial indicators to further refine predictive performance.

3.2 System architecture and design

The architecture of WealthWise is strategically designed to process stock market data efficiently and deliver intelligent trading insights in real-time. It follows a modular and layered approach, ensuring seamless data flow from user input to the final recommendation output. The system integrates various components for data retrieval, preprocessing, analysis, visualization, and response generation, all optimized for accuracy and responsiveness.

The workflow initiates with a user query, typically a stock ticker symbol (e.g., AAPL). This input is parsed and routed to the API Interaction Module, which retrieves real-time stock data from external financial data providers such as Yahoo Finance. The raw data is passed through a Preprocessing Unit, where it is cleaned, formatted, and structured to ensure compatibility with downstream analytics modules.

Following data preparation, the system computes key technical indicators—notably the RSI, MACD, and ADX. These indicators are used to assess price momentum, market trend direction, and volatility. In parallel, a LLM-based Summarization Module analyzes up-to-date financial reports, stock news, and broader market trends to extract qualitative insights that may influence investment decisions.

The Decision Engine combines the results from both technical and textual analyses to generate a Buy, Sell, or Hold recommendation. This hybrid approach enhances the robustness and contextual understanding of the system's output.

To support user comprehension, WealthWise generates dynamic visualizations, including interactive candlestick charts and indicator-based plots, enabling users to easily interpret market movements and trends. These outputs are presented through a chatbot interface, which compiles the insights and presents them in a structured, natural language response for ease of use.

To maintain operational efficiency and support future scalability, the system also includes data storage mechanisms for maintaining historical trends, logging past queries, and caching frequently accessed data. The modular design supports seamless integration of future enhancements, such as expanded market coverage, machine learning-based forecasting, and additional technical indicators, thereby ensuring adaptability to evolving financial analysis needs.

Table 3.2.1 Technical Indicators Used in WealthWise

Indicator	Description	Purpose in WealthWise
RSI	Measures momentum of stock prices (0-100). Over 70: Overbought, Below 30: Oversold.	Identifies buy/sell opportunities.
MACD	Tracks changes in trend strength by comparing short-term and long-term EMAs.	Helps spot bullish/bearish trends.
ADX	Measures the strength of a trend (0-100). Higher ADX = Stronger trend.	Determines if a trend is worth trading.
Candlestick Patterns	Visual representation of price movements.	Detects reversal & continuation signals.
EMA	Tacks recent price trends with more weight on latest data.	Detects trend direction and momentum shifts.
ATR	Measures market volatility based on price range.	Identifies high-risk or breakout market conditions.
OBV	Uses volume flow to predict price movement direction.	Confirms bullish or bearish momentum using volume trends.
Bollinger Bands	Shows volatility and price extremes using standard deviation bands.	Detects overbought/oversold zones and potential breakout signals.

3.3 Methodology

The proposed stock market chatbot, *WealthWise*, follows a structured methodology to analyse financial data and generate insightful recommendations. The system begins with a **user query**, where an investor inputs a stock symbol (e.g., AAPL) to request market insights. The chatbot **extracts key details** from the input to identify the corresponding stock symbol and proceeds with data retrieval. To ensure real-time financial analysis, the system interacts with **external APIs**, such as Yahoo Finance, which serve as primary data sources. The **API fetches stock-related data**, including historical prices, trading volumes, and technical indicators. Once the raw data is acquired, it undergoes **data processing** to remove inconsistencies, normalize values, and structure the information for efficient analysis. A crucial aspect of *WealthWise* is its **integration of Large Language Models (LLMs)** to summarize complex financial data. The LLM processes market trends, financial reports, and sentiment from news sources to enhance decision-making. This **summarized data is then utilized alongside traditional technical indicators**, such as RSI, MACD, and ADX, to formulate a recommendation. The chatbot evaluates **buy, sell, or hold signals** based on technical indicator thresholds and historical patterns. Following recommendation generation, the system proceeds to **visualization**, where financial insights are presented through **charts and graphs**. This graphical representation helps users interpret stock trends effectively. Additionally, the chatbot consolidates insights into a final **recommendation report**, summarizing key findings and supporting data-driven investment decisions. This methodology ensures a **seamless, data-driven approach** to stock market analysis, combining **real-time data retrieval, AI-powered summarization, and technical analysis**. By leveraging both **traditional financial indicators and LLM-based insights**, *WealthWise* enhances user decision-making, making stock trading more accessible and efficient.

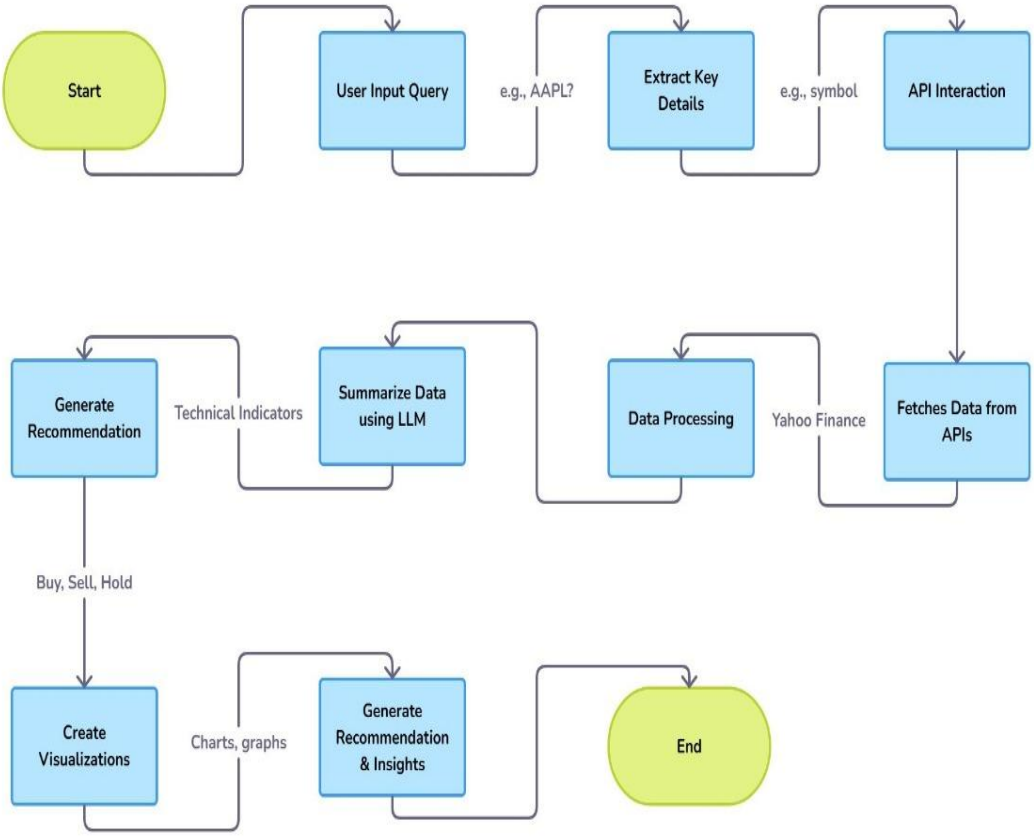

Fig 3.3.1 : Flowchart of the Trading assistant Chatbot

3.4 Model implementation

The **WealthWise Stock Chatbot** integrates multiple advanced features to deliver comprehensive stock market analysis. Developed using robust Python libraries such as yfinance, ta (technical analysis), VaderSentiment, Plotly, and Google Generative AI (Gemini), along with Streamlit for user interaction, this system is specifically designed to offer users meaningful insights for making well-informed investment decisions.

1. Stock Data Collection: The first phase of the system involves the collection of historical stock data. Using the yfinance library, the application retrieves six months of past performance data, including key metrics such as opening price, closing price, highest and lowest prices, and trading volumes. From this dataset, several essential technical indicators are computed to evaluate the stock's behavior. These indicators include the Exponential Moving Average (EMA) is utilized to emphasize recent price movements. The Relative Strength Index (RSI) helps determine overbought or oversold conditions by measuring the momentum of price changes. The Moving Average Convergence Divergence (MACD) evaluates momentum and possible trend reversals by comparing short-term and long-term EMAs. The Average Directional Index (ADX) is employed to assess the strength of existing trends. Additionally, Bollinger Bands are used to identify price volatility, while the Average True Range (ATR) measures the degree of market volatility based on recent trading ranges. The On Balance Volume (OBV) indicator is calculated to detect the relationship between volume flow and price movements, offering deeper insights into potential breakouts or reversals.

2. Sentiment Analysis: The system performs sentiment analysis on recent news articles related to the selected stock. Through the News API, the application fetches the latest headlines and descriptions, which are then processed using the VaderSentiment library. This analysis determines the polarity of each article—classifying the sentiment as positive, negative, or neutral—and assigns a sentiment score that reflects the overall tone of the news. The sentiment results are then integrated with the technical indicators to enhance the accuracy of the buy, sell, or hold recommendation by accounting for both quantitative data and qualitative market sentiment.

3. AI-Powered Stock Recommendations: Using Google’s Generative AI model (Gemini), the system processes inputs including market sentiment, technical indicators such as RSI, MACD,

ADX, and EMA, and recent news data. This model formulates a personalized investment insight, indicating whether a stock should be bought, sold, or held. It also generates a concise textual explanation to justify the decision, ensuring users understand the reasoning behind the recommendation. This hybrid approach—combining technical and sentiment-driven analysis—enables the system to provide a more balanced and holistic investment suggestion.

4. Data Visualization: To facilitate user interpretation, the system includes a rich visualization module that represents data in an intuitive manner. Built using the Plotly library, this module dynamically renders candlestick charts to visualize historical price movements, RSI and MACD plots to track momentum shifts, and ADX charts to show the strength of current trends. These visualizations help users interpret market conditions at a glance, enabling quicker and more confident decision-making. The graphs automatically update based on the user's stock selection, offering a seamless analytical experience.

5. Interactive User Interface: The user interface, developed using Streamlit, provides a highly interactive platform where users can either select stocks from a predefined list or enter custom stock symbols. Once a stock is selected, the interface presents a dual-tab layout. The Overview tab displays high-level metrics such as current price, market trend, and AI-generated recommendation. The Technical Analysis tab offers detailed visual insights based on the computed indicators. This structured layout ensures that both novice and experienced investors can navigate the platform with ease, accessing both summarized and in-depth information as needed.

6. Efficient Data Handling: To ensure the application remains responsive and avoids redundant data fetching, Streamlit's @st.cache_data decorator is used to store previously accessed stock data and analysis results for a fixed period. This caching mechanism significantly improves performance by minimizing API calls and reducing loading times during user interactions.

CHAPTER 4

RESULTS AND DISCUSSIONS

The **WealthWise Stock Chatbot** was developed as an advanced platform that combines multiple sophisticated techniques for stock market analysis, such as technical analysis, sentiment analysis, and AI-powered investment recommendations. In this section, the performance and outcomes of WealthWise are compared with several existing chatbot systems that provide similar services in the financial domain.

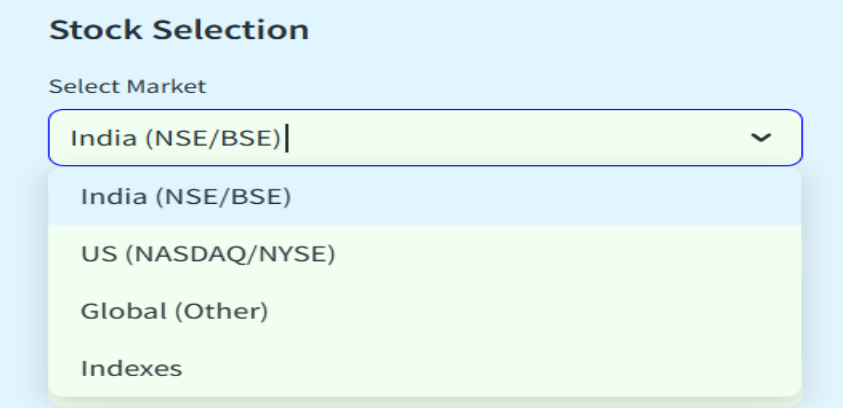

Fig 4.1 : Market Classification Options

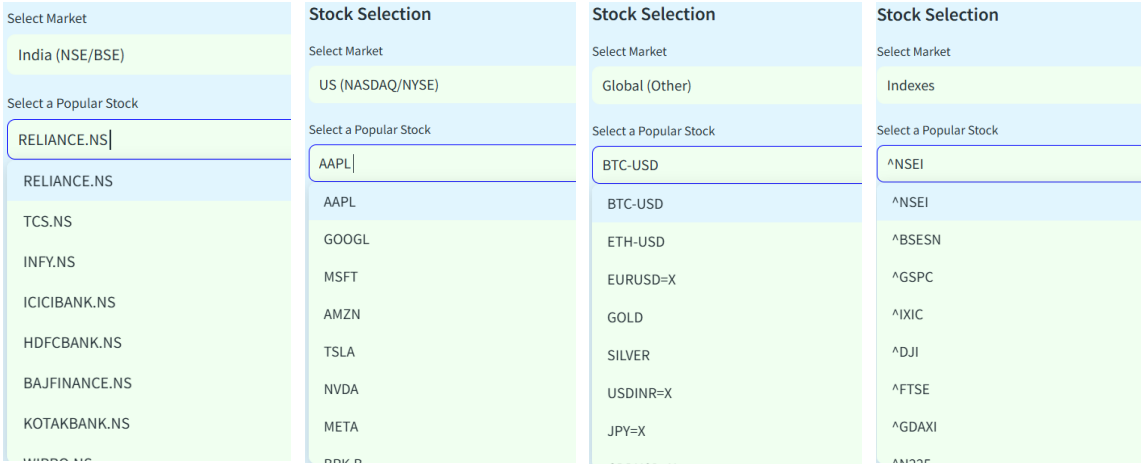

Fig 4.2 : Famous Stock Dropdown

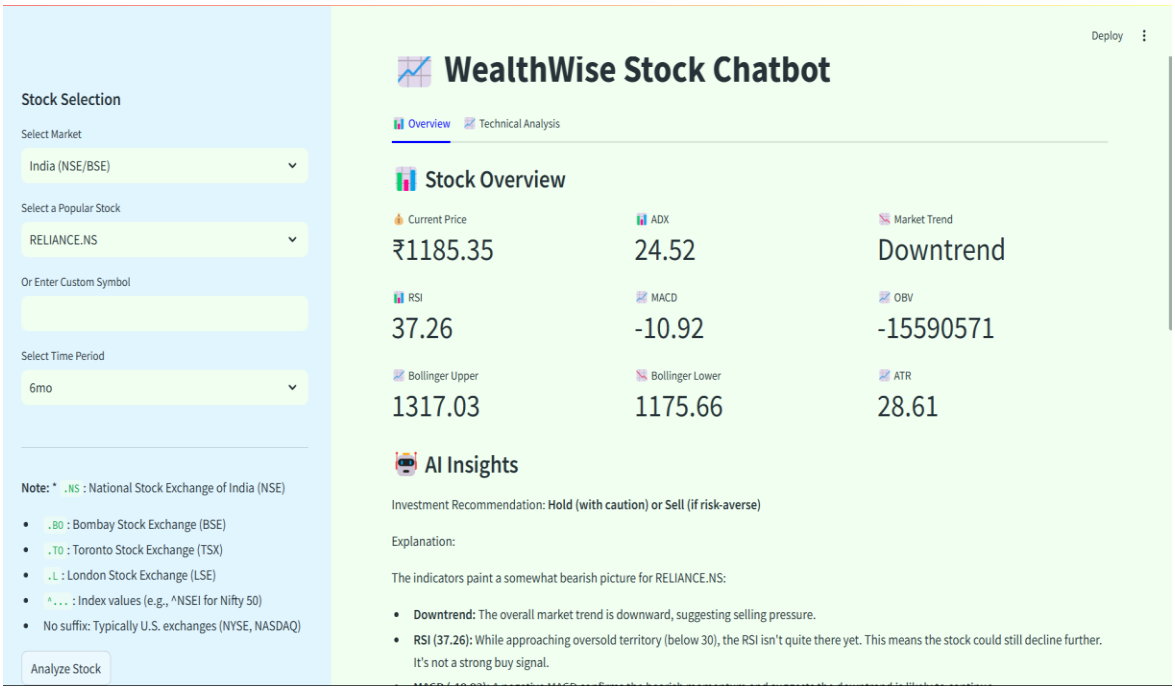

Fig 4.3 : GUI of the Trading assistant Chatbot

Fig 4.4 : Stock Price Candlestick Chart with EMAs

The EMA-based candlestick chart in Fig 4.4 integrates 9-day and 15-day Exponential Moving Averages alongside price candlesticks. This visualization highlights short-term and mid-term trend signals. Periods where the 9-day EMA crosses above the 15-day EMA suggest **bullish momentum**, while the opposite implies **bearish sentiment**. Around mid-March 2025, the crossover to the downside suggests a short-term downtrend, which was followed by a price recovery in April. WealthWise uses these crossover signals as part of its AI-based trading logic, identifying entry and exit points with higher precision. The dual EMA system helps the AI module anticipate trend shifts early, especially when reinforced by sentiment and volume indicators.

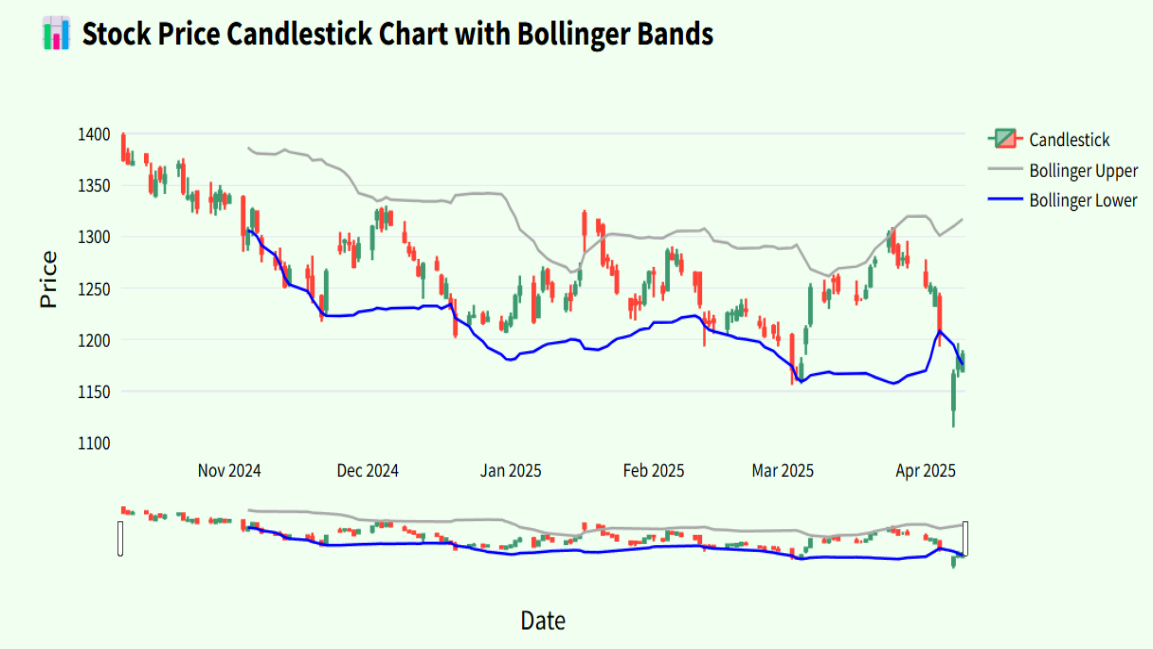

Fig 4.5 : Stock Price Candlestick Chart with Bollinger Bands

This chart in Fig 4.5 visualizes the stock's price movement using candlesticks overlaid with Bollinger Bands, spanning from October 2024 to April 2025. The Bollinger Bands (comprising upper, lower, and middle bands) widen and narrow in response to volatility. Notably, the price touches the lower band in early April 2025, signaling an **oversold** condition that may suggest a buying opportunity. The chart also indicates several periods of consolidation where the bands contract, followed by expansion phases indicating possible breakouts. Within the WealthWise framework, Bollinger Bands help the AI model determine price momentum relative to historical volatility.

When the price moves outside the bands, it often triggers alerts for potential trend reversals or continuations. These bands are highly valuable in predicting mean-reversion-based trading opportunities, particularly when combined with RSI or MACD.

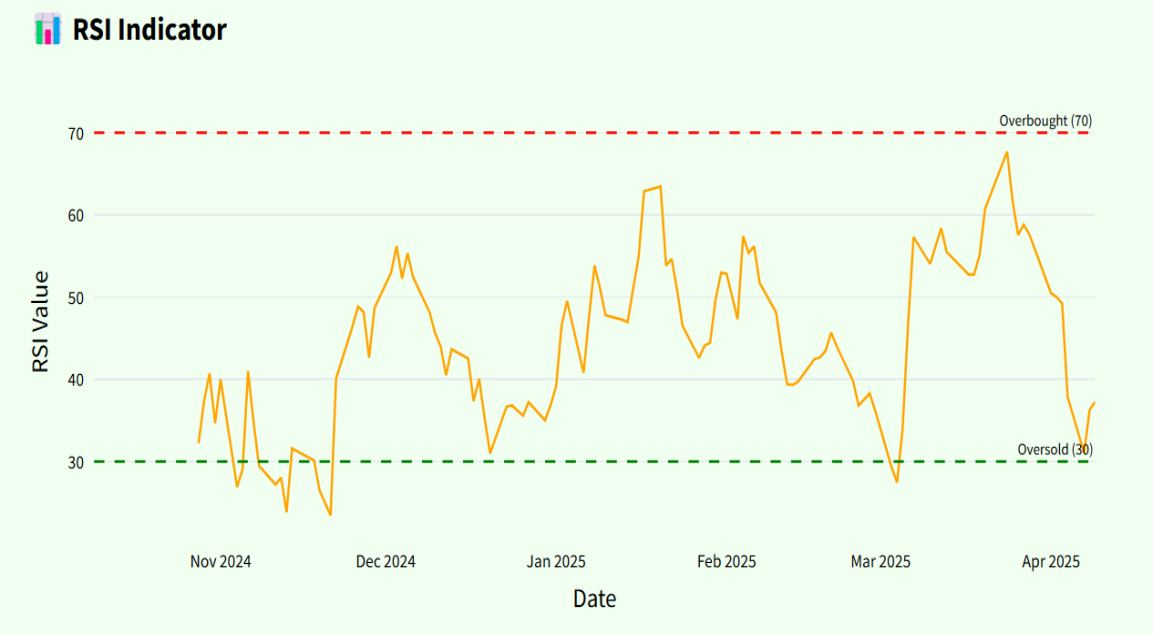

Fig 4.6 : RSI Indicator Chart

The Fig 4.6 represents RSI Indicator which oscillates between 0 and 100, identifying overbought (above 70) and oversold (below 30) conditions. The chart shows multiple cycles, with RSI dipping below 30 in late March 2025, indicating oversold territory—a potential buy signal. Conversely, RSI peaked above 70 in mid-March, hinting at overbought conditions prior to a price drop. WealthWise integrates RSI to detect **potential reversal points**, enabling the AI to fine-tune its recommendations with short-term timing insights. The RSI is one of the most widely used indicators in both human and AI trading strategies, especially for mean reversion and swing trading (Jain et al., 2023). When used alongside Bollinger Bands and MACD, RSI significantly enhances prediction confidence in identifying entry/exit windows.

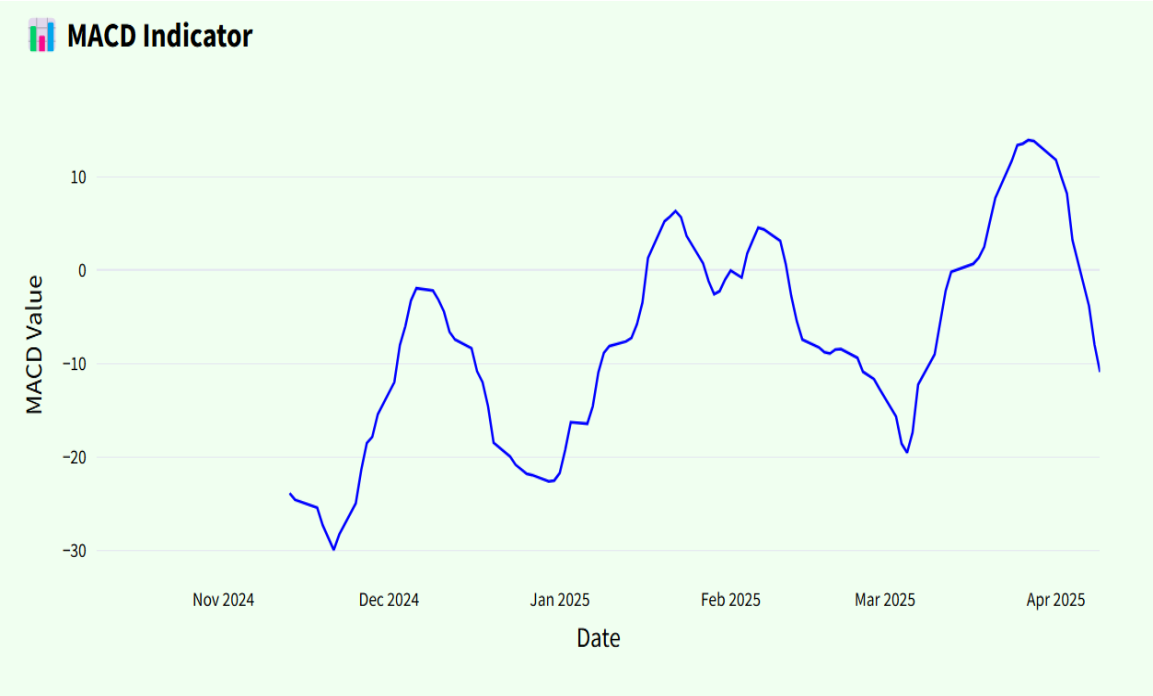

Fig 4.7 : MACD Indicator Chart

The Fig 4.7 displays the momentum of the stock by measuring the difference between two EMAs (typically 12-day and 26-day), shown as a smooth line oscillating around the zero line. Positive MACD values represent upward momentum, while negative values suggest downward momentum. Between November 2024 and April 2025, multiple MACD peaks and troughs are visible, with the latest movement showing a downturn after peaking in late March. In WealthWise, MACD is a key momentum oscillator used to validate trend strength and convergence/divergence signals. For instance, an increasing MACD value after a crossover can confirm a bullish breakout. Studies such as Luo & Qin (2017) highlight the MACD's role in AI-based systems for momentum-based forecasting. Thus, the MACD acts as a dynamic momentum tracker within the platform’s recommendation engine.

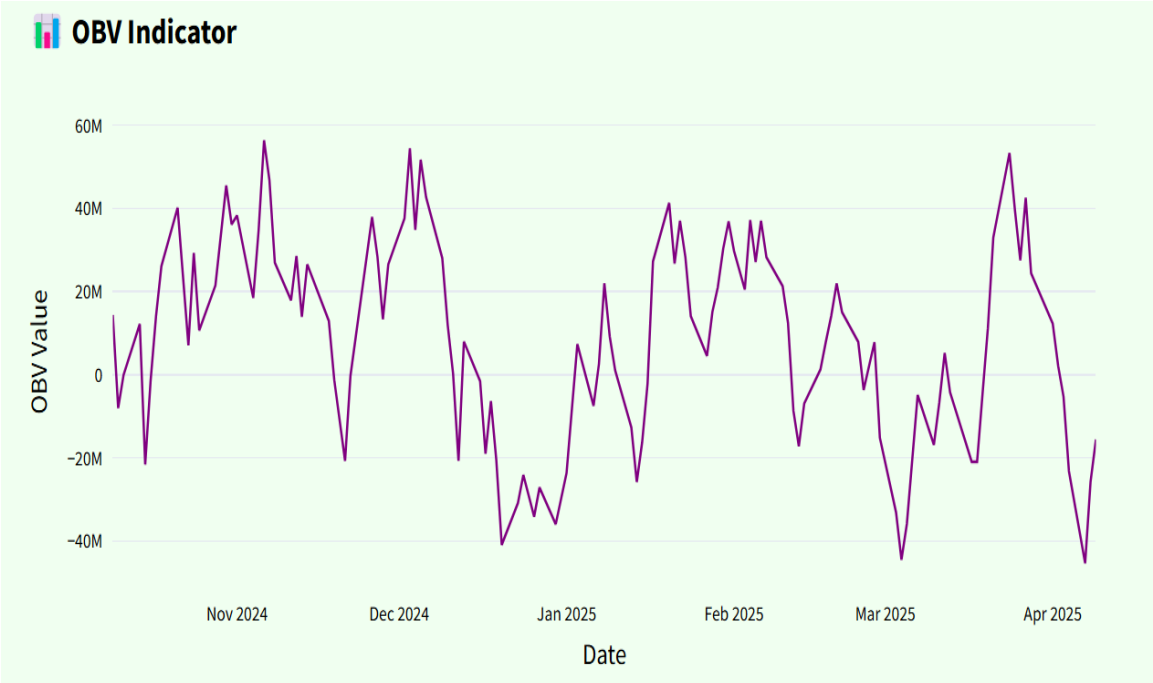

Fig 4.8 : OBV Indicator Chart

The Fig 4.8 reflects cumulative volume flow and helps gauge whether volume supports the price trend. In this chart, OBV fluctuates sharply, with spikes and dips aligning with market turning points, especially in late December 2024 and March 2025. A declining OBV often signals waning investor interest, while rising OBV supports bullish momentum. In the context of WealthWise, OBV aids in validating the **strength of price trends** by integrating volume data into the AI's decision matrix. For example, a price increase supported by rising OBV signals institutional accumulation. Volume-based indicators like OBV are often used in conjunction with technical indicators to improve prediction reliability, as discussed in research by Patel et al. (2015) and AI-enhanced trading systems by Nakano et al. (2018).

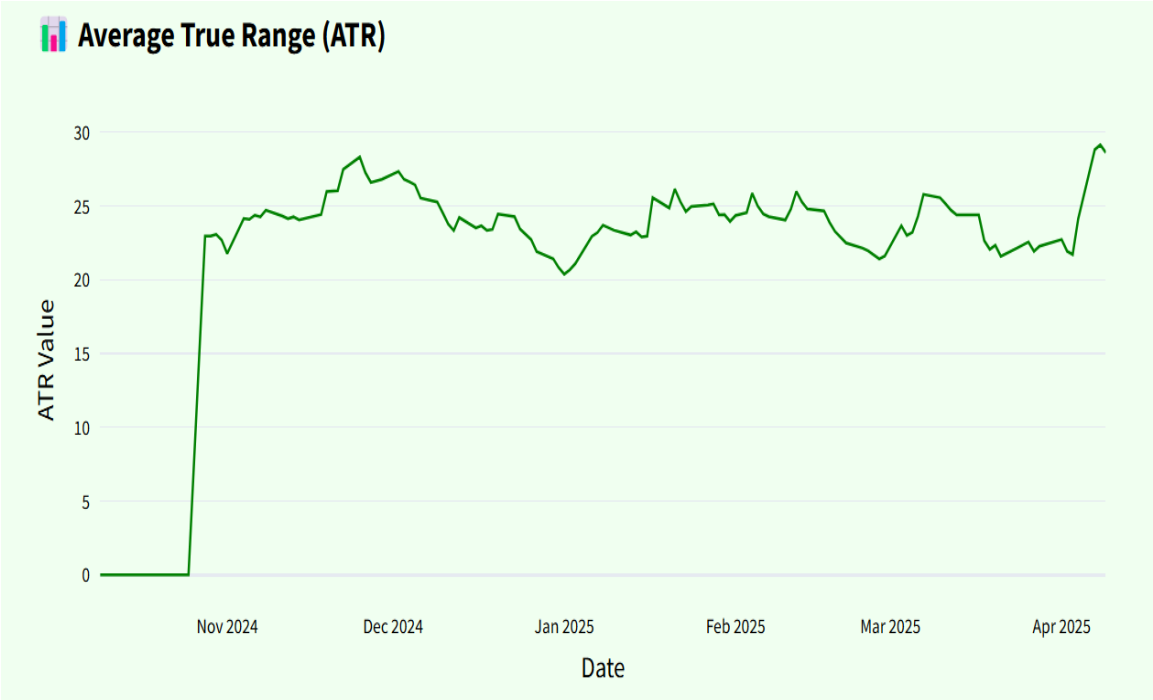

Fig 4.9 : ATR Indicator Chart

The Fig 4.9 represents a measure of market volatility over the selected timeframe (October 2024 to April 2025). The ATR value, which remained flat at the beginning, surged significantly in early November 2024, indicating a sharp increase in price fluctuations. After stabilizing in the range of 20–25, a renewed surge is observed in April 2025, suggesting heightened volatility toward the end of the observed period. In the context of WealthWise, the ATR is crucial for signaling the risk level and price turbulence of a stock, guiding the AI model in adjusting the confidence of its buy/sell signals. A higher ATR suggests increased uncertainty, where traders may adopt caution or take advantage of potential breakout opportunities. According to Welles Wilder (1978), who introduced ATR, ATR is particularly effective when combined with trend-following systems and momentum indicators. This makes it an essential component in the AI's risk-adjusted investment logic within WealthWise.

```
Model Performance Metrics:

Classification Report:
              precision    recall  f1-score   support

        Down       0.89      0.86      0.87        36
          Up       0.91      0.93      0.92        56

    accuracy                           0.90        92
   macro avg       0.90      0.89      0.90        92
weighted avg       0.90      0.90      0.90        92


Additional Metrics:
Accuracy: 0.9022
Precision: 0.9123
Recall: 0.9286
F1-score: 0.9204

Confusion Matrix:
[[31  5]
 [ 4 52]]
```

Fig 4.10 : Model Performance Metrics

In terms of model performance as shown in Fig 4.10, the WealthWise Stock Chatbot has achieved strong evaluation results, as shown in the classification metrics derived from its predictive model. According to the model performance output, the system achieved an overall accuracy of 90.22%, indicating that it can correctly classify upward and downward market movements in over nine out of ten cases. The model attained a precision of 91.23% , demonstrating its reliability in generating true positive predictions for market direction. Its recall value was calculated at 92.86%, highlighting its effectiveness in identifying all relevant instances within the dataset. The F1-score, which balances precision and recall, stood at 92.04%, indicating overall model robustness.

CHAPTER 5

CONCLUSIONS AND FUTURE SCOPE

Conclusion:

The **WealthWise Stock Chatbot** has proven to be an effective tool for stock market analysis and investment advice. By combining a variety of data sources, including technical indicators such as **EMA, Bollinger Bands, RSI**, **MACD**, **ADX**, ATR and **OBV**, along with real-time sentiment analysis from news, the platform delivers insightful and accurate investment recommendations. This multifaceted approach allows WealthWise to provide users with a comprehensive view of the market, incorporating both traditional financial analysis and sentiment-based insights, which sets it apart from other stock analysis systems that rely on a singular data source.

The chatbot stands out not only for its ability to process technical metrics but also for utilizing advanced AI to generate personalized stock insights and recommendations. By leveraging **Generative AI**, the system offers tailored investment advice based on the current market conditions, trends, and sentiment, providing a level of interaction and intelligence that enhances the decision-making process for users. WealthWise's ability to integrate both traditional and modern AI-driven tools makes it a unique and valuable asset for stock market investors, from beginners to more experienced traders.

While the current version of WealthWise is highly functional, there are several avenues for future improvement and expansion. One potential enhancement is the incorporation of additional **financial indicators** such as **Bollinger Bands**, **Volume Oscillators**, and **Fibonacci Retracements**. These metrics could offer users an even broader range of analytical tools, improving the depth and accuracy of market assessments and stock predictions.

Future Scope:

A promising area of growth is the integration of **cryptocurrency analysis**. Given the increasing popularity and volatility of cryptocurrencies, expanding WealthWise's capabilities to include real-time analysis of the cryptocurrency market could significantly broaden its user base. By incorporating sentiment analysis and emerging market trends for digital assets, WealthWise could become a versatile tool catering to both traditional stock investors and crypto enthusiasts.

Another important area for future development is the refinement of the AI model used for generating insights. By incorporating more advanced **Natural Language Processing (NLP)** technologies, WealthWise could improve its ability to interpret market news, allowing for more accurate predictions and recommendations. Additionally, integrating **reinforcement learning** could enhance the system's ability to learn from past outcomes and optimize its future recommendations based on real-world performance.

Finally, as AI-based systems become more prevalent in financial applications, ensuring **data privacy and security** will be crucial. Future versions of WealthWise should implement robust **data encryption**, **two-factor authentication**, and **privacy-preserving machine learning** techniques to guarantee that users' personal and financial data remain protected. Addressing these concerns will be essential for building trust and ensuring the platform's long-term success in an increasingly security-conscious market.

In summary, while WealthWise has established itself as a valuable tool for stock market analysis, its future potential lies in expanding its features, refining AI capabilities, and addressing user privacy concerns. With these improvements, WealthWise could evolve into a comprehensive, secure, and user-friendly platform that serves a wide range of investors across different markets.

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