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REAL-TIME STOCK PRICE PREDICTION SYSTEM USING AI TECHNIQUES

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ABSTRACT

The stock market plays a crucial role in a country's financial growth, but it is also highly dynamic and unpredictable. It can be influenced rapidly by various factors such as political developments, investor sentiment, media reports, company restructuring, and growth strategies. Every trading day, thousands of investors participate in the stock market—some gain profits, while others incur losses. However, predicting these gains or losses on any given day remains a significant challenge. This research presents a web-based application developed for predicting stock market trends through the implementation of machine learning techniques. The system integrates both historical stock data and real-time data obtained from APIs, and employs three robust predictive models—ARIMA (Auto Regressive Integrated Moving Average), LSTM (Long Short-Term Memory), and Linear Regression. These models are utilized to forecast the closing price for the next trading day, as well as to provide projections for the subsequent seven days. By analyzing historical patterns and trends in the data, the models aim to extrapolate future price movements with improved precision. The integration of numerical data analysis significantly enhances the overall accuracy and reliability of the stock price predictions generated by the system.

Key Words: Stock Market, ARIMA, LSTM, Linear Regression, Web Interface.

INTRODUCTION

Real-time stock market analysis focuses on tracking live market movements, allowing investors to respond quickly to price fluctuations. Stock prices change rapidly due to a variety of reasons, including financial reports, interest rate decisions, and global events. Investors who monitor the market closely can make timely decisions to buy, sell, or hold their investments, depending on market trends. Understanding market patterns and price movements helps traders maximize gains and minimize losses. The rise of algorithmic trading and artificial intelligence (AI) in financial markets has further enhanced the ability to analyse market trends and execute trades efficiently.

One of the key aspects of stock market analysis is understanding the factors that drive price changes. Economic indicators such as GDP growth, unemployment rates, and inflation affect investor confidence and influence market trends. Additionally, company-specific factors like quarterly earnings reports, mergers, and leadership changes impact stock performance. Political stability and international trade policies also play a role in shaping market movements, as global economic conditions directly affect businesses and industries.

PROBLEM STATEMENT

Financial markets are highly volatile and influenced by numerous factors such as economic indicators, news sentiment, and investor behaviour. Accurately predicting stock prices in real time is a challenging task due to the non-linearity and complex dependencies in financial data. Traditional statistical models often struggle to capture these patterns effectively.

This project aims to develop a real-time stock price prediction system using AI techniques such as ARIMA, LSTM, and Linear Regression to forecast stock closing prices. The objective is to analyse historical and real-time stock data, apply advanced machine learning and deep learning algorithms, and compare their predictive performance. The model will help traders, investors, and financial analysts make more informed decisions by providing accurate short-term stock price predictions.

MOTIVATION

In today's highly volatile financial markets, investors and analysts require more than conventional tools—they need intelligent systems capable of delivering timely insights, adaptive forecasting, and data-driven decision support. A Real-Time Stock Price Prediction System powered by AI addresses these needs by integrating advanced predictive models into a unified platform.

Key Features:

- **Accurate Price Forecasting:** Utilizes ARIMA, LSTM, and Linear Regression models to deliver precise short-term stock closing price predictions based on historical and real-time data.
- **Real-Time Data Integration:** Continuously collects and processes real-time stock market data through API integration, enabling up-to-date and responsive forecasting.
- **Comparative Model Analysis:** Provides performance evaluation of multiple AI techniques, allowing users to compare model accuracy and reliability for better investment strategies.
- **Decision Support Tools:** Assists traders and investors with actionable insights, visual analytics, and trend analysis to guide investment decisions and risk management.
- **Learning and Adaptation:** Enhances model accuracy over time through continuous learning, data updates, and feedback mechanisms, supporting more reliable financial forecasting.

LITERATURE REVIEW

1. Avita Katal, Naman Adlakha, Ridhima (2021). Real Time Stock Market Analysis. [1]

The paper by Avita Katal, Naman Adlakha, Ridhima (2021) explore the intricacies of real-time stock market prediction and highlight the challenges posed by the volatile and non-linear nature of financial data. The authors emphasize how traditional statistical models often fall short in accurately forecasting stock prices due to these complexities. To address this, the study proposes a machine learning-based system that leverages multiple algorithms—including LSTM (Long Short-Term Memory), Linear Regression, Random Forest, and K-Nearest Neighbors—to enhance prediction accuracy. The proposed framework integrates real-time data with historical trends, applies technical indicators, and incorporates sentiment analysis to improve model reliability. The findings suggest that the Random Forest algorithm outperformed others in terms of Mean Squared Error, making it a more robust choice for stock price forecasting. This research provides significant insights into the evolving field of algorithmic trading and the role of AI in real-time financial decision-making.

2. Aadhitya A, Rajapriya R, Vineetha R S, Anurag M Bagde (2023). Predicting Stock Market Time-Series Data Using CNN-LSTM Neural Network Model. [2]

The paper by Aadhitya A, Rajapriya R, Vineetha R S, Anurag M Bagde (2023) present a comprehensive study on stock market time-series prediction using a hybrid CNN-LSTM Neural Network model. The research explores the limitations of traditional forecasting models, particularly in handling the non-stationary and highly dynamic nature of financial data. The authors propose a custom deep learning architecture that integrates Convolutional Neural Networks (CNN) for feature extraction and Long Short-Term Memory (LSTM) networks for capturing temporal dependencies in stock price data. The model is

trained and tested on both historical and real-time data sourced from APIs such as Alpha Vantage, and demonstrates strong predictive performance across multiple stock exchanges including NYSE, NASDAQ, and NIFTY. The study provides a detailed account of model development, data preprocessing, training methodology, and evaluation metrics. With an average Mean Squared Error (MSE) as low as 0.035 and high variance scores, the proposed model proves to be both robust and adaptable. This research offers valuable insights into the application of deep learning in financial forecasting, highlighting both the strengths of CNN-LSTM models and considerations for real-time deployment and scalability.

3. Sagar A. Dhanake, Rushikesh Fade, Anushka Alhat, Dhananjay Gadhe, Sakshi Gaikwad (2024). Real-Time Stock Price Prediction. [3]

Sagar A. Dhanake, Rushikesh Fade, Anushka Alhat, Dhananjay Gadhe, Sakshi Gaikwad (2024) introduced a comprehensive real-time stock price prediction framework that leverages advanced machine learning techniques to enhance the accuracy of financial forecasting. The study emphasizes the integration of deep learning models—particularly LSTM and CNN—for capturing complex temporal and spatial patterns in stock data. By employing a hybrid CNN-LSTM approach, the authors successfully demonstrate how combining feature extraction with sequential learning improves model generalization and predictive performance. Additionally, the study incorporates sentiment analysis to evaluate public opinion from social media and financial news, further refining prediction outcomes. This research significantly contributes to the fields of financial technology and algorithmic trading by offering a user-accessible, adaptable system for real-time market analysis—thereby aiding informed investment decisions and fostering career advancement for professionals in data-driven finance and analytics.

4. Sanmoy Paul, Shashank Vishnoi (2023). Real-Time Stock Trend Prediction via Sentiment Analysis of News Articles. [4]

Sanmoy Paul, Shashank Vishnoi (2023) introduced a real-time stock trend prediction model that leverages sentiment analysis of financial news articles to forecast market movements. Their research is based on the hypothesis that news sentiment significantly influences investor behavior, with negative news having a more sustained impact on stock returns. Using a semi-supervised learning approach, they trained their model with both manually labeled and historical stock data. Among various machine learning algorithms tested, the linear SVM with TF-IDF feature extraction achieved the highest accuracy—over 90%—and demonstrated a 52% correlation with actual return directions. This study highlights the effectiveness of integrating sentiment analysis into financial forecasting and offers valuable insights for traders and market analysts.

5. **Jagruti Hota, Sujata Chakravarty, Bijay K. Paikaray, Harshvardhan Bhoyar (2022). Stock Market Prediction Using Machine Learning Techniques. [5]**

Jagruti Hota, Sujata Chakravarty, Bijay K. Paikaray, Harshvardhan Bhoyar (2022) developed a machine learning-based framework for predicting stock prices using a user-friendly platform that simplifies complex data interpretation. The study evaluates various ML algorithms—including Random Forest, Decision Tree, Support Vector Regression, and Artificial Neural Networks—applied to American Airlines stock data. Their system provides a practical and accessible interface for financial analysts and researchers, enabling effective stock trend analysis. The Random Forest model emerged as the most accurate, demonstrating its suitability for real-time forecasting. This work contributes to the growing field of algorithmic trading and financial analytics, offering valuable tools for career development in finance and data science.

6. Sidra Mehtab, Jaydip Sen, Abhishek Dutta (2023). Stock Price Prediction Using Machine Learning and LSTM-Based Deep Learning Models. [6]

Sidra Mehtab, Jaydip Sen, Abhishek Dutta (2023) developed a robust predictive framework for stock price forecasting using a combination of traditional machine learning models and LSTM-based deep learning architectures. The study focuses on predicting the NIFTY 50 index using historical data and evaluates the performance of multiple regression techniques alongside four LSTM models with different input configurations and network architectures. Among the models tested, the univariate LSTM model using one week of prior data exhibited the highest accuracy and efficiency, demonstrating its suitability for real-time

financial forecasting. This research contributes significantly to the field of financial data science, offering an adaptable and scalable solution for investors and analysts seeking to enhance their decision-making in dynamic markets.

7. Mehar Vijh, Deeksha Chandola, Vinay Anand Tikkiwal, Arun Kumar (2020). Stock Closing Price Prediction using Machine Learning Techniques. [7]

Mehar Vijh, Deeksha Chandola, Vinay Anand Tikkiwal, Arun Kumar (2020) developed a machine learning-based system aimed at accurately predicting stock closing prices using models such as Artificial Neural Networks (ANN) and Random Forest (RF). The framework provides a user-friendly approach for analyzing complex financial data by generating new predictive variables from basic stock features like open, high, low, and close prices. Through comparative analysis using metrics like RMSE and MAPE, the study demonstrates that ANN offers superior accuracy for most companies analyzed. This work contributes meaningfully to financial analytics by offering an accessible and effective tool for stock price forecasting, supporting enhanced decision-making in the domain of data-driven investment and trading strategies.

8. Pratheeth S and Vishnu Prasad R (2021). Stock Price Prediction using Machine Learning and Deep Learning. [8]

Pratheeth S and Vishnu Prasad R (2021) developed a web-based stock price prediction system integrating machine learning and deep learning algorithms to enhance the accuracy and accessibility of financial forecasting. The platform utilizes ARIMA, Random Forest, and LSTM models to analyze stock data and generate next-day and long-term price predictions. Designed with a user-friendly interface, the system displays results clearly through interactive web pages built using HTML, CSS, and Bootstrap, supported by a Flask backend. By making complex predictive models more interpretable and accessible to users, this work contributes significantly to financial analytics and provides a practical tool for both professionals and learners seeking to advance their careers in data science and investment domains.

9. Abin Shakya, Anuj Pokhrel, Ashuta Bhattarai, Pinky Sitikhu, Subarna Shakya (2018). Real-Time Stock Prediction Using Neural Network. [9]

Abin Shakya, Anuj Pokhrel, Ashuta Bhattarai, Pinky Sitikhu, Subarna Shakya (2018) developed a real-time stock prediction system utilizing a feed-forward neural network to estimate short-term stock price movements in the Nepal Stock Exchange. The model incorporates real-time market indicators such as transaction volume, number of trades, and price volatility to capture public sentiment and supply-demand dynamics. Designed with user accessibility in mind, the system offers a structured approach to short-interval forecasting, providing insights into stock price fluctuations every two minutes. The implementation contributes to the growing field of computational finance by making predictive analytics more interpretable and actionable, thus supporting both academic research and practical investment strategies.

10. Tran Phuoc, Pham Thi Kim Anh, Phan Huy Tam & Chien V. Nguyen (2024). Applying Machine Learning Algorithms to Predict the Stock Price Trend in the Stock Market – The Case of Vietnam. [10]

Tran Phuoc, Pham Thi Kim Anh, Phan Huy Tam & Chien V. Nguyen (2024) developed a stock price trend prediction model using the Long Short-Term Memory (LSTM) algorithm combined with technical analysis indicators such as SMA, MACD, and RSI. The study focused on Vietnam's emerging stock market, utilizing historical data from VN-Index and VN30-listed companies. By training the LSTM model on past price movements and evaluating its performance on unseen data, the model achieved an accuracy exceeding 93% for most stocks tested. This research highlights the effectiveness of LSTM in capturing short-term stock volatility and provides a practical framework for investors and financial analysts seeking data-driven insights in volatile markets.

EXISTING SYSTEM:

The current stock prediction ecosystem is fragmented, with separate platforms for data collection, predictive modeling, real-time analysis, and trading. Platforms like Yahoo Finance and Google Finance provide stock data, but they lack integration with advanced AI-based forecasting tools and actionable insights for future price trends. Machine learning platforms such as TensorFlow and PyTorch offer frameworks for building predictive models but do not directly link these models with real-time stock data or market conditions. Trading platforms like Robinhood or E*TRADE enable stock transactions but fall short on providing real-time predictive analytics, actionable insights, or AI-driven decision support for stock trading. AI-based prediction tools offer stock price forecasts based on historical data but often fail to integrate real-time stock prices, market sentiment, or technical indicators for continuous and adaptable predictions. This lack of cohesion forces users to juggle multiple services, leading to inefficiencies and a fragmented experience. Most platforms do not offer a dynamic, AI-powered stock prediction system that evolves with market conditions. To address these limitations, a unified, intelligent interface is needed—one that seamlessly integrates real-time stock data, predictive models, technical indicators, and actionable insights into a cohesive, user-centric platform for smarter trading decisions.

PROPOSED SYSTEM:

The proposed system for real-time stock price prediction employs a robust hybrid framework that integrates statistical and deep learning models—specifically ARIMA, LSTM, and Linear Regression—to capture both linear and non-linear trends in stock market behavior. The process begins with the continuous acquisition of real-time stock data through APIs, ensuring that the system always operates on the most current market information. This raw data is then subjected to a rigorous preprocessing pipeline that includes cleaning, normalization, and transformation into structured time-series formats suitable for model training. Each model in the framework serves a distinct purpose: the ARIMA model is used for analyzing and forecasting linear, stationary components of time-series data, providing reliable short-term trend analysis; Linear Regression establishes direct linear relationships between historical prices and future values, offering a straightforward baseline prediction; and the LSTM model, known for its ability to capture long-term dependencies and temporal dynamics, is employed to model complex, fluctuating patterns in sequential data. These models are trained individually using historical data, and their performance is evaluated using Root Mean Square Error (RMSE), which serves as a key metric for measuring prediction accuracy and guiding iterative optimization. Once the models demonstrate optimal performance, they are serialized and deployed into a real-time environment where they are integrated with live dashboards or financial platforms to provide continuous, up-to-date stock price forecasts. The system's architecture is designed to be modular and scalable, allowing for seamless updates and the potential integration of ensemble learning techniques to enhance prediction accuracy by leveraging the strengths of each individual model. Additionally, future improvements may include incorporating external data sources such as financial news sentiment, macroeconomic indicators, and global stock indices to further refine the model's ability to predict price movements in dynamic and volatile market conditions.

METHADOLOGY: Stock Price Prediction System has 8 modules:

1. Requirement Analysis

- Identify target users (investors, traders, analysts) and their needs through surveys or interviews.
- Analyze existing prediction tools and platforms to understand limitations.
  Define functional requirements (real-time prediction, model comparison, data visualization).
- Define non-functional requirements (high availability, low latency, scalability).
  Establish KPIs such as prediction accuracy (e.g., RMSE), response time, and system uptime.

2. System Design

- Design a modular architecture consisting of data ingestion, preprocessing, model training, prediction engine, and visualization modules.

- Develop a scalable database schema to store historical prices, prediction outputs, and model performance metrics.
- Build API layers for real-time data fetching and prediction delivery.
- Design an intuitive front-end dashboard for visualization and user interaction.

3. Data Collection and Preprocessing

- Collect real-time and historical stock data via APIs (e.g., Alpha Vantage, Yahoo Finance).
- Perform data cleaning (handling missing values, noise) and normalization.
- Convert raw stock prices into structured time-series datasets suitable for modeling.
  Engineer additional features like moving averages, RSI, and volume indicators to enrich the dataset.

4. AI-Based Prediction Models

- **ARIMA**: Use for modeling linear, stationary trends in historical data.
- **Linear Regression**: Apply as a baseline model to predict future prices from key indicators.
- **LSTM**: Leverage for modeling long-term dependencies and capturing complex temporal patterns.
- Split data into training and testing sets, and optimize each model for best performance.
- Evaluate models using metrics like RMSE, MAE, and MAPE.

5. Real-Time Prediction Pipeline

- Set up a data stream that continuously feeds real-time stock data to the system.
- Deploy trained models to make live predictions on incoming data.
- Visualize predictions alongside actual prices in the dashboard.
- Provide comparison across models to assist users in evaluating reliability.

6. Visualization and User Interface

- Build an interactive front-end using **React** or **Angular**.
- Display historical trends, predicted prices, model comparisons, and performance metrics.
- Add tools for filtering stocks, selecting models, and viewing prediction history.
- Ensure responsive design and accessibility across devices.

7. System Implementation

- Use **Python (Flask/Django)** for backend API and model integration.
- Choose **TensorFlow/Keras** or **PyTorch** for LSTM model development.

8. Deployment and Maintenance

- Host the application on a cloud platform with continuous integration and delivery setup.
- Monitor system performance and model accuracy using analytics dashboards.
- Regularly retrain models with updated data to improve forecasting precision.
- Collect user feedback and add features like portfolio tracking, sentiment analysis, or additional indicators.

RESULTS & ANALYSIS

Figure1: Home page for Stock Price Prediction Interface

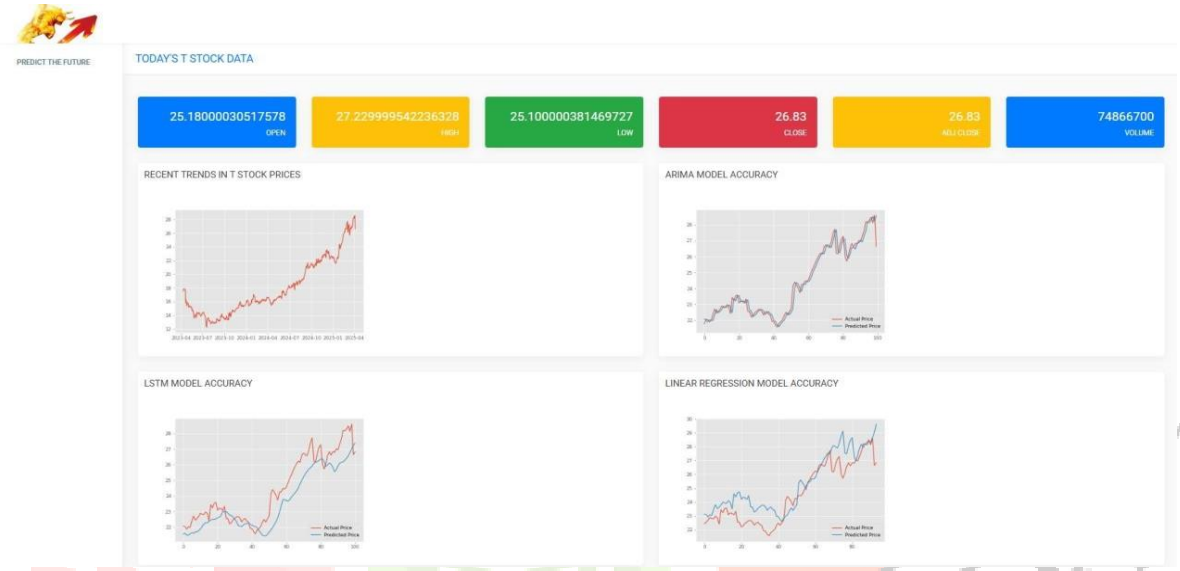

Figure2: Today Stock Price Details and Visualization

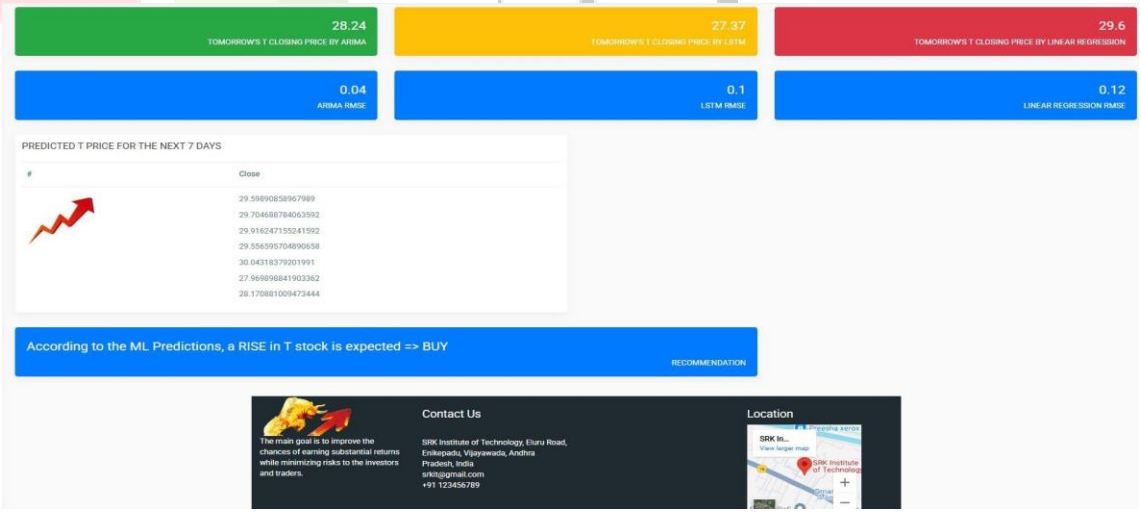

Figure3: Closing Price Prediction, Forecast for next 7 days and Recommendation

CONCLUSION:

Our website presents an advanced stock prediction platform that empowers investors, traders, and financial enthusiasts with accurate, real-time market insights using cutting-edge machine learning and deep learning techniques. At its core, the system integrates ARIMA for short-term trend analysis, LSTM for capturing complex, long-term patterns, and Linear Regression for modeling direct relationships between historical prices and influencing factors. This combination ensures comprehensive forecasting by analyzing data from multiple perspectives. The platform continuously pulls in real-time stock feeds and historical data, allowing it to adapt to shifting market dynamics and provide up-to-date predictions. With this intelligent tool, users can confidently navigate market volatility, make proactive investment decisions, and pursue long-term financial growth. Designed for ease of use and consistent performance, the system showcases the transformative potential of AI in finance and serves as a strategic ally for both casual investors and seasoned professionals aiming to stay ahead in a fast-moving market.

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[5] Jagruti Hota, Sujata Chakravarty, Bijay K. Paikaray, Harshvardhan Bhoyar (2022). Stock Market Prediction Using Machine Learning Techniques.

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