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TradeSense: Predictive Analytics for Stocks

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Abstract: *The stock market is a complex and rapidly changing environment where accurate predictions can greatly enhance investment decisions. Traditional forecasting methods often struggle to adapt to fluctuating market conditions and diverse economic influences. This study presents a stock prediction and analysis system that uses machine learning and predictive analytics to identify trends and forecast stock movements more effectively. The system processes historical data through techniques such as data cleaning, feature extraction, and model training using algorithms like Linear Regression and Long Short-Term Memory (LSTM) networks. Built with Python for predictive modeling and PHP for backend integration, the platform offers real-time data visualization and performance tracking through an intuitive web interface. By merging AI-powered insights with user-friendly design, the proposed system aims to empower investors and analysts with more reliable, data-driven tools for making informed financial decisions.*

Keywords: *Stock Market, Machine Learning, Predictive Analytics, LSTM, Python, Financial Forecasting*

I. INTRODUCTION

Imagine being able to look at a stock and have a smart system tell you where it might go next not based on guesswork or endless chart analysis, but through real data and machine learning. That's what this project is all about.

Most investors today still rely on traditional methods like reading patterns, checking indicators, or following market sentiment. While these techniques can help, they often miss the deeper patterns hidden within years of stock data. With markets moving faster than ever, making the right decision at the right time has become increasingly difficult.

This project introduces a Stock Prediction Web Application that uses deep learning to bring clarity to the chaos of the stock market. It learns from historical data analysing trends, prices, and movements to predict a stock's next closing price. Behind the scenes, it combines two powerful AI models: Long Short-Term Memory (LSTM) for understanding longterm patterns and Convolutional Neural Networks (CNN) for identifying shortterm changes. Together, they make predictions that are smarter, faster, and more reliable than traditional analysis.

Even though it's powered by advanced AI, the platform itself is simple and intuitive. Users can search for any stock and instantly see its past performance, real-time charts, and the predicted future price all in one place. The idea is to make intelligent forecasting accessible to everyone, from beginners to seasoned investors.

At its core, this project bridges the gap between data science and finance, showing how technology can empower people to make more confident, informed investment decisions. It's a step toward a future where anyone can trade smarter not harder.

II. LITERATURE REVIEW

Traditional stock forecasting methods, such as the Box-Jenkins ARIMA model, have been widely used to analyze time series data and predict trends [1]. While these models work well for simple, linear patterns, they often fail to capture the complex and unpredictable movements seen in today's financial markets. To address these challenges, researchers began exploring Artificial Neural Networks (ANNs), which can identify hidden relationships and nonlinear dependencies in market data [6].

A major step forward came with the introduction of Long Short-Term Memory (LSTM) networks by Hochreiter and Schmidhuber [3]. LSTMs are specifically designed to remember long-term dependencies, making them highly effective for time series forecasting. Fischer and Krauss [4] applied LSTMs to stock prediction and achieved significantly better accuracy compared to traditional models. Similarly, Nelson et al. [7] demonstrated that LSTM-based models could capture temporal relationships and provide more reliable market predictions.

As deep learning evolved, researchers began combining different neural network architectures to enhance forecasting performance. Brownlee [5] suggested that integrating Convolutional Neural Networks (CNNs) with LSTMs helps extract meaningful features from large datasets before making predictions. Later studies by Zhang et al. [8] and Chen et al. [10] confirmed that hybrid CNN-LSTM models, supported by big data analytics, deliver higher accuracy and adaptability in dynamic market environments.

Building on these insights, this project applies hybrid deep learning techniques to create a web-based stock prediction system that combines data-driven accuracy with user-friendly accessibility.

III. RESEARCH GAP

Existing stock prediction systems show a clear trade-off between accuracy, adaptability, and interpretability. Traditional forecasting techniques such as the ARIMA model proposed by Box and Jenkins [1] remain useful for analyzing linear and stationary time series, but they struggle to capture the nonlinear, volatile nature of financial markets. Similarly, classical statistical and regression-based models often fail to adapt to rapid market shifts influenced by external economic and social factors.

With the rise of machine learning, neural network-based models have significantly improved predictive accuracy. Early works by Zhang et al. [6] demonstrated that Artificial Neural Networks (ANNs) outperform traditional statistical methods by learning complex data patterns. The introduction of Long Short-Term Memory (LSTM) networks by Hochreiter and Schmidhuber [3] further enhanced time series forecasting by effectively handling long-term dependencies in sequential data. Fischer and Krauss [4] and Nelson et al. [7] successfully applied LSTMs to financial data, achieving superior predictive results compared to earlier models.

However, existing approaches still face key limitations. Many deep learning models act as “black boxes,” offering limited interpretability for end users. Furthermore, they often require high computational resources and lack user-friendly interfaces that make predictions accessible to non-technical investors. Recent studies [8], [10] emphasize the importance of integrating hybrid CNN-LSTM architectures with real-time visualization tools to improve both accuracy and usability.

This gap highlights the need for an accessible, data-driven platform that combines predictive precision, simplicity, and interactive visualization—an area this project aims to advance.

IV. RESEARCH OBJECTIVE

The primary objective of this research is to design and evaluate an intelligent stock prediction web application that combines deep learning algorithms with an interactive visualization interface to enhance investment decision-making. The system aims to provide reliable and real-time forecasts of stock prices by leveraging historical data and advanced neural network models, specifically Long Short-Term Memory (LSTM) and Convolutional Neural Networks (CNN). Unlike traditional statistical forecasting models that struggle to capture nonlinear trends and market volatility, this project aspires to deliver a more adaptive, data-driven, and user-friendly solution.

A key goal of this research is to implement predictive algorithms capable of learning temporal dependencies in financial time series data. Using LSTM and CNN architectures, the system analyzes stock price patterns, trends, and volatility to generate accurate future predictions. The backend will be developed using Python, integrating libraries such as TensorFlow and Keras for model training, while MySQL will be used for structured data storage and retrieval.

To ensure accessibility, a simple yet dynamic web interface will be developed using HTML, CSS and JavaScript. The frontend will allow users to input stock symbols, view historical performance charts, and visualize future predictions through interactive graphs. The design emphasizes usability, enabling both experienced investors and beginners to interact with AI-driven insights without requiring technical expertise.

The evaluation phase of this project will involve testing model accuracy using metrics such as Mean Squared Error (MSE), Root Mean Squared Error (RMSE), and Mean Absolute Percentage Error (MAPE). These results will be compared against traditional statistical and regression-based models, offering quantitative proof of the system’s effectiveness.

Ultimately, the overarching aim is to bridge the gap between complex AI forecasting systems and accessible, user-oriented financial tools. By combining predictive analytics, intuitive design, and transparent data visualization, this project seeks to empower users to make more informed, confident, and data-driven investment decisions in an increasingly unpredictable financial market.

V. PROPOSED SYSTEM

The system is built using a layered architecture to ensure modularity, scalability, and clear separation of responsibilities across components. At the core lies the Prediction Engine, powered by deep learning models such as LSTM and CNN. This module is responsible for analyzing historical stock data, identifying trends, and generating accurate predictions for future stock prices. Each stage of data handling from collection to prediction is fully automated to ensure consistency and reliability.

To make the application efficient and user-centric, a backend server manages all computations and communication between the database, the machine learning model, and the frontend interface. Developed using Python and PHP, it handles tasks such as fetching real-time stock data through APIs, pre-processing input data, and invoking trained prediction models.

The backend ensures that results are generated quickly while maintaining data integrity and security. On the user side, a modern frontend interface connects all system components seamlessly. Built using HTML, CSS, JavaScript, and React.js, it allows users to enter stock symbols, view predictive charts, and analyze real-time market data. The system updates dynamically using AJAX or WebSocket connections, ensuring users always receive the latest results.

In summary, the architecture combines the intelligence of AI-based forecasting, the efficiency of an optimized backend, and the simplicity of a clean, interactive frontend. It is designed to deliver a smooth, informative, and reliable stock prediction experience for users of all backgrounds.

A. Data Collection Module

This module gathers historical and real-time stock data from trusted APIs such as Alpha Vantage or Yahoo Finance. It collects details like opening price, closing price, trading volume, and market indicators. The collected data is then cleaned, normalized, and stored in the database for use by the prediction engine.

B. Database Module

The MySQL database serves as the backbone for structured data storage. It stores historical data, model predictions, user preferences, and interaction logs. Indexed tables and efficient query handling ensure fast data retrieval, supporting both analytical and visualization components.

C. Prediction Engine Module

This is the brain of the system. Implemented in Python using TensorFlow and Keras, it integrates LSTM and CNN architectures to learn temporal dependencies and spatial features in stock price movements. Once trained, the model predicts future closing prices and sends the results to the backend for visualization.

D. Visualization Module

The Visualization Module transforms raw prediction data into interactive graphical outputs. Users can view stock trends, historical charts, and predicted values through dynamic line and candlestick charts built using Chart.js or Plotly. This visual approach helps users interpret AI predictions with ease.

E. User Interface Module

The frontend provides an accessible and intuitive environment for user interaction. It allows users to input stock tickers, select timeframes, and view results instantly. Designed using React.js and styled with Tailwind CSS, the interface supports responsive layouts, real-time data refresh, and a user-friendly dashboard

F. Evaluation & Performance Module

To ensure reliability, the system includes a Model Evaluation Module that continuously measures prediction performance. Metrics such as MSE, RMSE, and MAPE are computed and stored for analysis. This module also enables retraining of models with updated data to maintain long-term prediction accuracy.

G. System Design

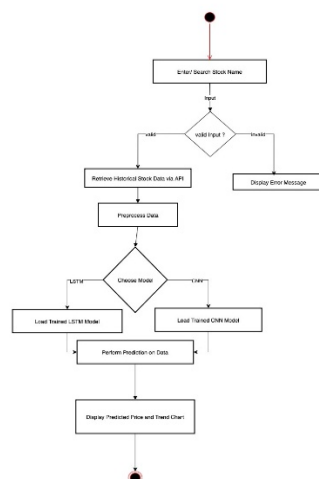


Fig. 1 Flow Diagram

VI. RESULTS

The Stock Prediction Web Application demonstrates the potential of machine learning in financial decision-making by combining real-time market data with CNN- LSTM models to forecast stock prices. With features like data visualization, trend analysis, and an intuitive interface, the platform enhances user experience and supports informed investment strategies. While improvements are needed in handling volatile data and refining predictive accuracy, the system lays a strong foundation for future enhancements such as sentiment analysis, mobile accessibility, and portfolio management. Overall, the project highlights the transformative role of predictive analytics in modern finance, making stock analysis more accessible, engaging, and effective.

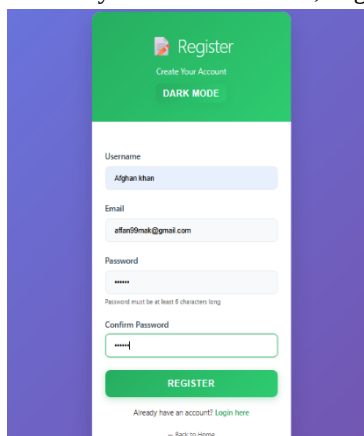


Fig. 2 Trading Page

VII.CONCLUSION AND FUTURE WORK

This Stock Prediction Web Application offers a glimpse into the future of financial decision-making by demonstrating the power of machine learning, specifically using advanced CNN-LSTM models, to forecast stock prices based on live market data. The platform significantly enhances the user experience by providing data visualization and trend analysis within an intuitive interface, allowing users to craft better-informed investment strategies. While we recognize the current need to better manage highly volatile market data and continuously refine predictive accuracy, this system establishes a strong foundation for exciting future enhancements, including the integration of sentiment analysis, the development of mobile accessibility, and the addition of comprehensive portfolio management tools, ultimately highlighting the transformative potential of predictive analytics to make stock analysis more accessible and effective in modern finance.

As the Stock Prediction Web Application evolves, it is crucial to address existing limitations and expand functionality to better support investors and market enthusiasts. The following initiatives are planned to enhance predictive accuracy, scalability, and user engagement. By integrating advanced algorithms and user- centric features, the platform aims to provide a more reliable and comprehensive financial forecasting tool.

Improve accuracy by fine-tuning CNN- LSTM models and exploring hybrid approaches that combine deep learning with traditional financial indicators.

Incorporate news and social media sentiment data to capture market psychology and improve forecasting reliability.

Allow users to track multiple stocks, manage virtual portfolios, and receive performance insights. Develop a mobile version of the platform for real-time access and convenience, enabling predictions on the go.

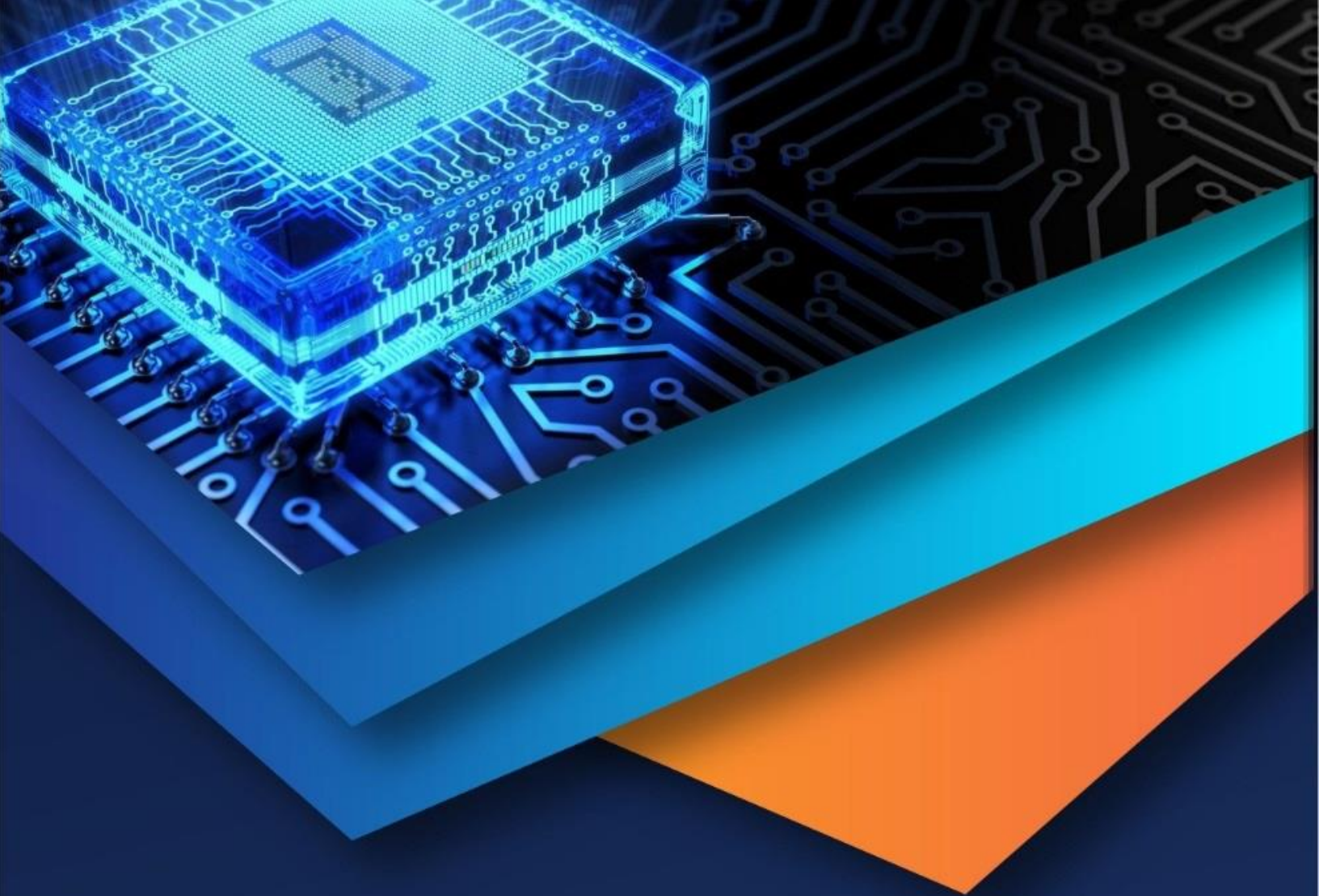
Expand charting tools with candlestick patterns, technical indicators, and customizable dashboards for deeper market insights. Adapt features based on user preferences, search history, and feedback to deliver more tailored investment suggestions. Extend the system to cover multiple stocks.

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