IBM Project

Report

On

Predictive Time Series Analysis Using LSTM and Flask

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Palwinder S

Submitted to

Faculty of Engineering and Technology

Institute of Computer Technology

Ganpat University

Year - 2025

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CERTIFICATE

This is to certify that the **IBM/ Industry** Project work entitled **"Predictive Time Series Analysis Using LSTM and Flask"** by NITYAM CHETAN BHOJANI (22162122002),TRIVEDI CHIRAG RAJESHBHAI (22162172005) and PATEL SHIVAMKUMAR SUNILBHAI (21162101019) of Ganpat University, towards the partial fulfillment of requirements of the degree of Bachelor of Technology – Computer Science and Engineering, carried out by them in the CSE(BDA). The results/findings contained in this Project have not been submitted in part or full to any other University / Institute for award of any other Degree/Diploma.

Name & Signature of Internal Guide

Prof. Umang Thakkar

Name & Signature of Head

Prof. Dharmesh Darji

Place: ICT - GUNI

Date:

ACKNOWLEDGEMENT

IBM/Industry Internship project is a golden opportunity for learning and self-development. I consider myself very lucky and honored to have so many wonderful people lead me through in completion of this project. First and foremost, I would like to thank Dr. Rohit Patel, Principal, ICT, and Prof. Dharmesh Darji, Head, ICT who gave us an opportunity to undertake this project. My grateful thanks to Prof. Umang Thakkar & Palwinder S (Internal & External Guides) for their guidance in project work Predicting Application Rating of Google Play Store, who despite being extraordinarily busy with academics, took time out to hear, guide and keep us on the correct path. We do not know where would have been without his/her help. CSE department monitored our progress and arranged all facilities to make life easier. We choose this moment to acknowledge their contribution gratefully.

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ABSTRACT

Stock market prediction is a complex task that involves analyzing historical data and leveraging advanced machine learning models to forecast future trends. This project aims to develop a **Stock Market Prediction System** using **Flask, React.js, Redis, and Deep Learning models (ANN, RNN, LSTM, and GRU)** to predict stock prices for major companies such as Apple, Microsoft, Google, Amazon, and NVIDIA. The system integrates **Alpha Vantage API** for real-time and historical stock data retrieval, with **Flask** serving as the backend for model processing and API management. The frontend, built with **React.js**, provides an intuitive user interface where users can input stock symbols and visualize predictions using interactive graphs. **Redis** is utilized for caching to enhance API response time and optimize performance. The deep learning models are implemented using **TensorFlow/Keras**, where LSTM and GRU architectures are leveraged for sequential data processing to improve predictive accuracy. Security is a critical aspect of the project, with **Checkmarx ZAP scanning** ensuring vulnerability detection and mitigation in the web application. The models undergo rigorous training and validation, with performance metrics such as **Mean Absolute Error (MAE) and Root Mean Squared Error (RMSE)** used to assess accuracy.

This system provides investors and financial analysts with a data-driven approach to stock market predictions, offering a scalable and efficient solution for making informed investment decisions. Future enhancements include incorporating **Transformer models, sentiment analysis from news data, and real-time data streaming** to further refine predictions and improve usability.

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CHAPTER 1: INTRODUCTION

CHAPTER 1 INTRODUCTION

Stock market prediction is an essential task in financial analytics, providing investors with insights into market trends, enabling informed decision-making, and optimizing investment strategies. Traditional approaches relied on statistical models and domain expertise, but with advancements in machine learning and deep learning, more accurate predictions can be achieved using computational models. This project aims to develop a Stock Market Prediction System that leverages deep learning techniques such as Artificial Neural Networks (ANN), Recurrent Neural Networks (RNN), Long Short-Term Memory (LSTM), and Gated Recurrent Units (GRU) to forecast stock prices.

The system is built using Flask and React.js for web-based interaction, with Redis for optimized caching and Alpha Vantage API for stock data retrieval. Security is ensured using Checkmarx ZAP for vulnerability detection. The key objective is to provide an efficient, scalable, and real-time stock price prediction solution with a user-friendly interface.

CHAPTER 2: PROJECT SCOPE

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This project aims to build a robust stock prediction application by integrating deep learning models with a web-based UI. The key scopes include:

- Real-time and historical stock data retrieval using Alpha Vantage API.
- Implementation of deep learning models (ANN, RNN, LSTM, and GRU) to analyze sequential data.
- Development of a web application using Flask (backend) and React.js (frontend) for interactive visualization.
- Performance optimization using Redis caching.
- Security implementation using Checkmarx ZAP vulnerability scanning.
- Graphical visualization of stock price trends for users to compare actual vs. predicted values.
- Future enhancement possibilities, such as integrating Transformer models and sentiment analysis from news sources.

CHAPTER 3: SOFTWARE AND HARDWARE REQUIREMENTS

Software Requirements:

- Programming Languages: Python, JavaScript (React.js)
- Frameworks: Flask (backend), React.js (frontend)
- Libraries: TensorFlow, Keras, Pandas, NumPy, Matplotlib, Plotly, Scikit-learn
- Database & Caching: Redis
- APIs: Alpha Vantage API for stock data
- Security Tools: Checkmarx ZAP for vulnerability scanning

Hardware Requirements:

- Processor: Intel i5/i7 or AMD equivalent
- RAM: Minimum 8GB (Recommended 16GB for training models)
- Storage: At least 50GB free space (SSD preferred for faster computation)
- GPU: Recommended for deep learning model training (NVIDIA RTX 2060 or higher)

CHAPTER 4: PROCESS MODEL

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The project follows an Agile Development Model, ensuring iterative improvements and incremental deployment. The major phases include:

1. Requirement Analysis: Understanding project goals, data sources, and user needs.
2. Design & Planning: Structuring the system architecture, defining APIs, and selecting ML models.
3. Implementation: Developing the backend, frontend, and model integration.
4. Testing & Validation: Evaluating model accuracy, debugging, and refining the UI.
5. Deployment & Optimization: Deploying the application with Redis caching and security enhancements.
6. Maintenance & Future Enhancements: Incorporating user feedback and expanding features.

CHAPTER 5: PROJECT PLAN

5.1 List of Major Activities

1. Data Collection & Preprocessing
2. Model Selection & Training
3. Model Evaluation & Tuning
4. Backend API Development
5. Frontend Development
6. Integration & Testing
7. Security Assessment
8. Deployment & Performance Optimization
9. User Testing & Feedback Incorporation
10. Final Documentation & Submission

5.2 Estimated Time Duration in Days

Activity	Estimated Duration (Days)
Data Collection & Preprocessing	10
Model Selection & Training	15
Model Evaluation & Tuning	12
Backend API Development	10
Frontend Development	10
Integration & Testing	10
Security Assessment	7
Deployment & Optimization	7
User Testing & Feedback	5
Final Documentation	5

CHAPTER 6: IMPLEMENTATION DETAILS

6.1 Flow Chart of Implementation

A structured flowchart representing the pipeline from data collection to UI interaction.

6.1.1 Data Collection

- Fetching stock market data from Alpha Vantage API.
- Storing and organizing data for preprocessing.

6.1.2 Understanding Data

- Analyzing trends in historical stock prices.
- Identifying key influencing factors for prediction.

6.1.3 Data Visualization

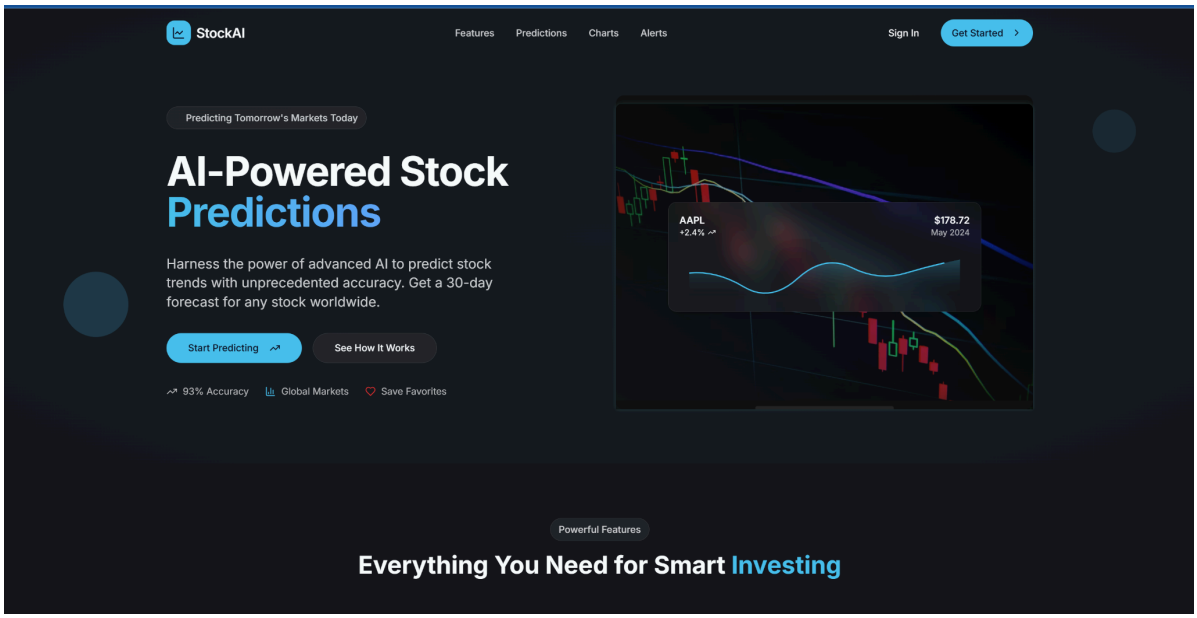
- Implementing Plotly and Matplotlib for interactive graphs.
- Comparing actual vs. predicted stock prices over time.

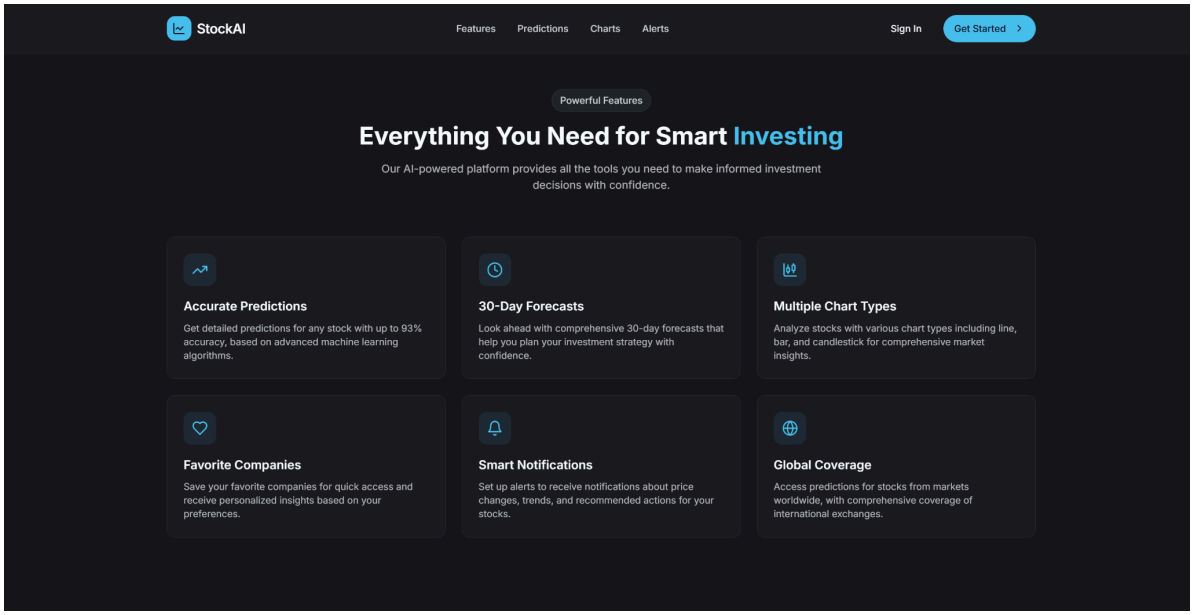
6.1.4 Data Cleaning and Sentiment Analysis

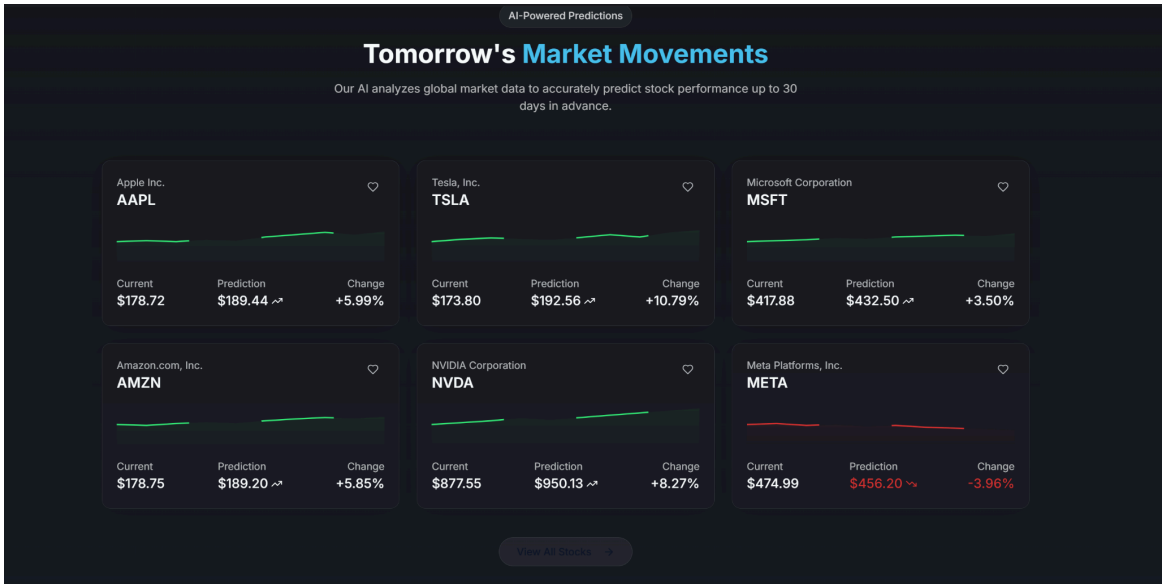
- Handling missing values, normalizing, and removing inconsistencies.
- Future enhancement: Sentiment analysis from news data to improve accuracy.

6.2 Implementation Screenshot

Landing Page:



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Prediction $192.56
Change +10.79%
Microsoft Corporation
MSFT
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Prediction $432.50
Change +3.50%
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AMZN
Current $178.75
Prediction $189.20
Change +5.85%
NVIDIA Corporation
NVDA
Current $877.55
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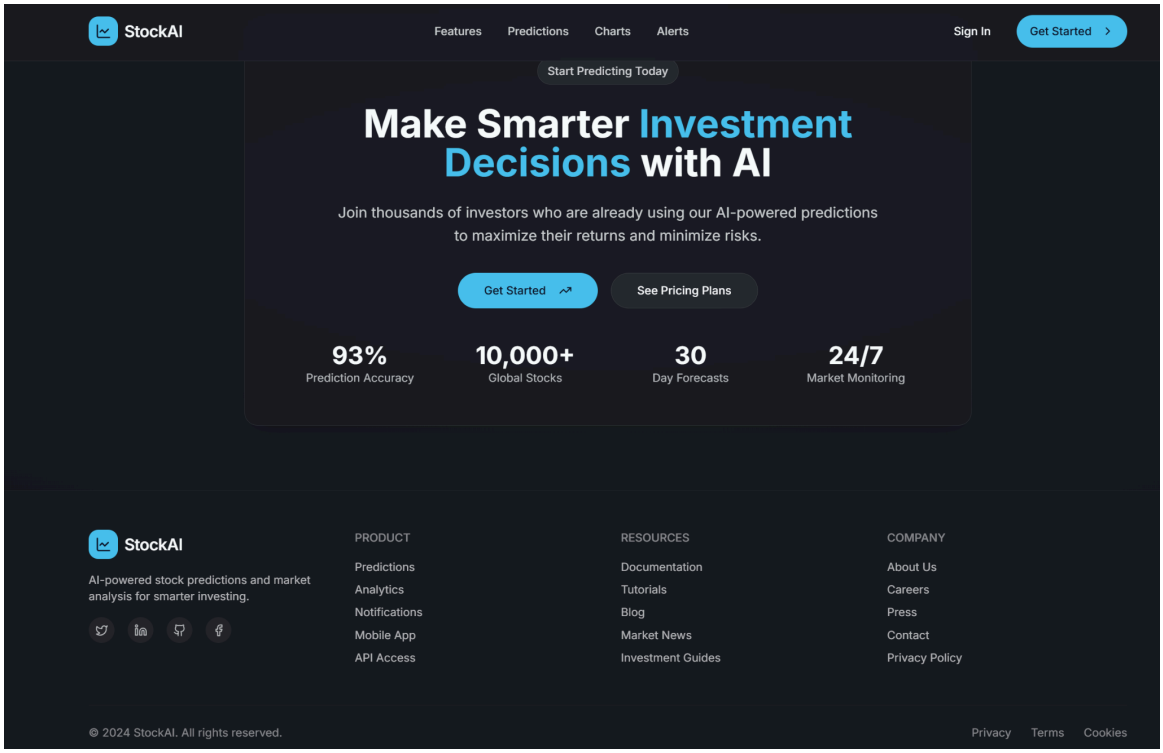
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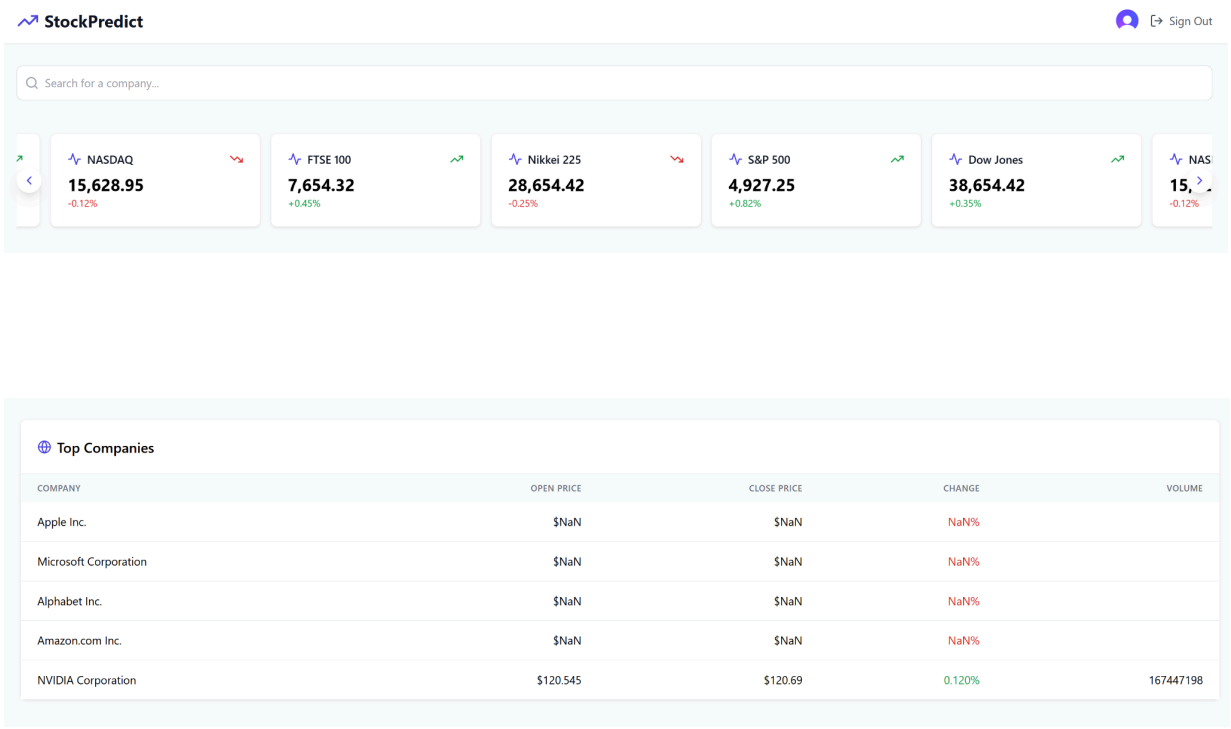
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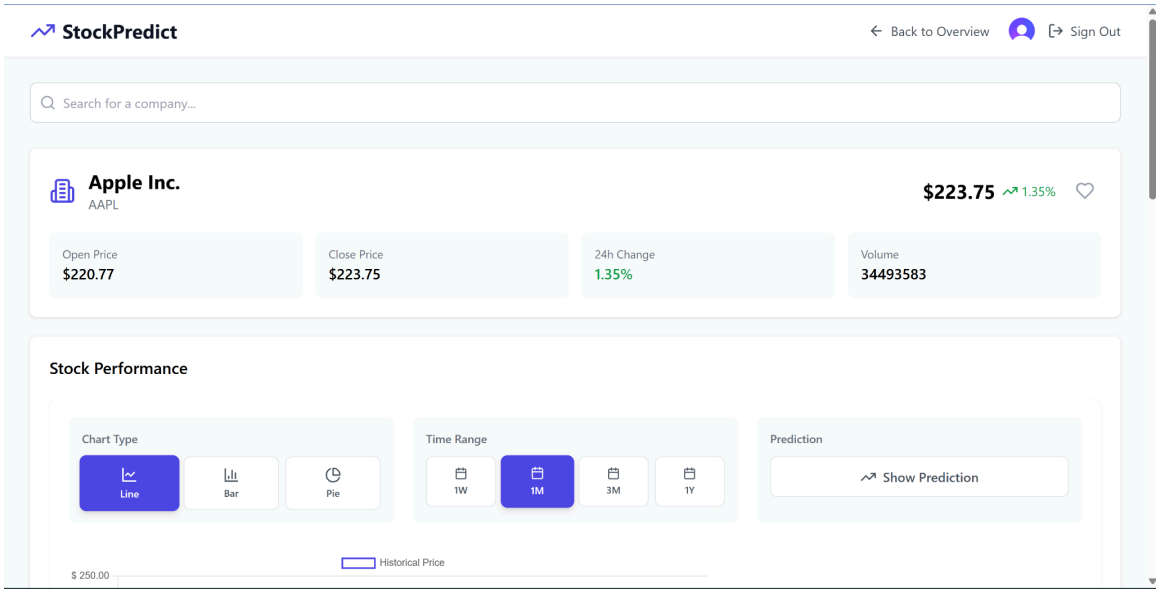

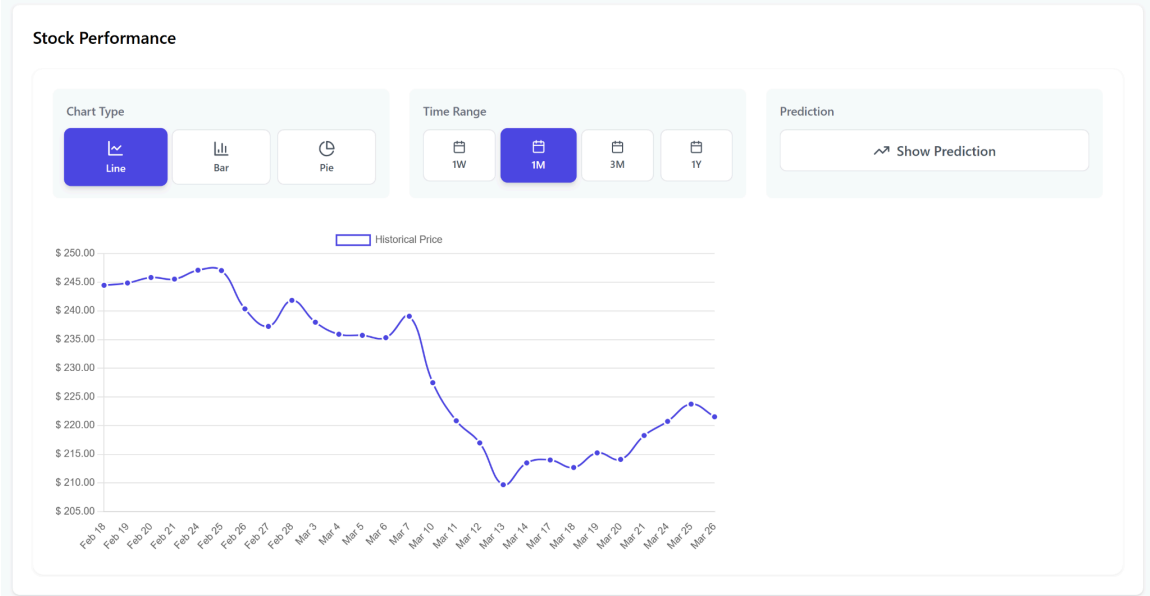

Company Overview

Apple Inc. designs, manufactures, and markets smartphones, personal computers, tablets, wearables, and accessories worldwide. The company offers iPhone, a line of smartphones; Mac, a line of personal computers; iPad, a line of multi-purpose tablets; and wearables, home, and accessories comprising AirPods, Apple TV, Apple Watch, Beats products, and HomePod. It also provides AppleCare support and cloud services; and operates various platforms, including the App Store that allow customers to discover and download applications and digital content, such as books, music, video, games, and podcasts, as well as advertising services include third-party licensing arrangements and its own advertising platforms. In addition, the company offers various subscription-based services, such as Apple Arcade, a game subscription service; Apple Fitness+, a personalized fitness service; Apple Music, which offers users a curated listening experience with on-demand radio stations; Apple News+, a subscription news and magazine service; Apple TV+, which offers exclusive original content; Apple Card, a co-branded credit card; and Apple Pay, a cashless payment service, as well as licenses its intellectual property. The company serves consumers, and small and mid-sized businesses; and the education, enterprise, and government markets. It distributes third-party applications for its products through the App Store. The company also sells its products through its retail and online stores, and direct sales force; and third-party cellular network carriers, wholesalers, retailers, and resellers. Apple Inc. was founded in 1976 and is headquartered in Cupertino, California.

https://www.apple.com

Industry **Consumer Electronics**	Sector **Technology**
CEO **Mr. Timothy D. Cook**	Employees **150,000**

Key Statistics

Market Cap **$3.36T**	Beta **1.18**	Avg. Volume **52,855,600**	Last Dividend **$1.00**
52-Week Range **164.08-260.1**	Exchange **NASDAQ Global Select**	Currency **USD**	IPO Date **12/12/1980**

Contact Information

(408) 996-1010

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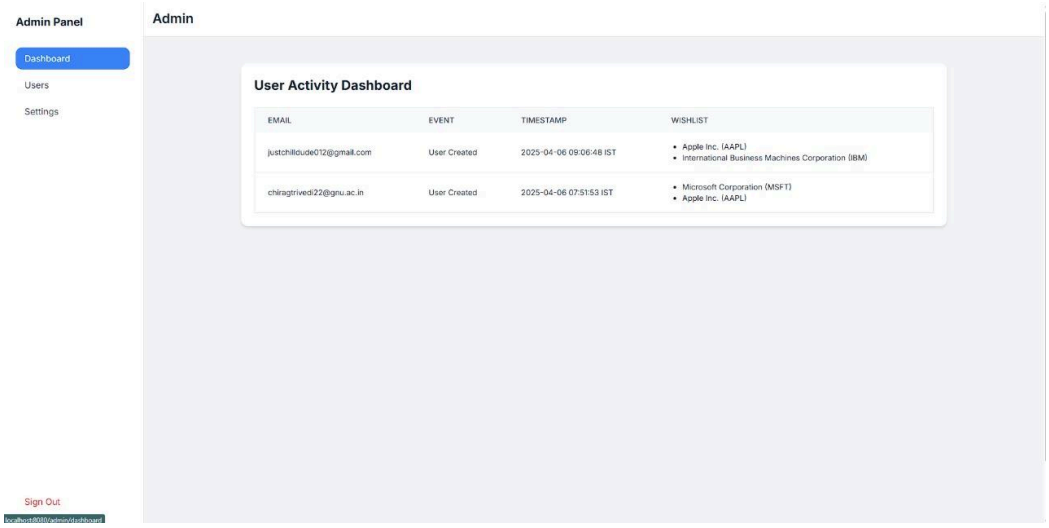
Admin Dashboard:



CHAPTER 7: CONCLUSION AND FUTURE WORK

Conclusion

This project successfully implements a stock market prediction system using deep learning models with an interactive web application. The Flask backend ensures smooth model deployment, while React.js enhances user experience. The inclusion of Redis for caching improves response time, and security assessments using Checkmarx ZAP ensure a secure deployment.

Future Work

- Implementing Transformer-based deep learning models for improved accuracy.
- Integrating news sentiment analysis to refine predictions.
- Enabling real-time stock tracking with dynamic data streaming.
- Expanding to additional financial markets beyond stocks.

CHAPTER 8: REFERENCE

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