Project Documentation: AI-Powered Stock and Sentiment Analysis Dashboard

1. Introduction

This document provides a formal overview of the Stock and Sentiment Analysis Dashboard, outlining its functionality, technology stack, implementation details, and improvements made. The project is designed to fetch real-time stock market data, extract financial news, conduct sentiment analysis, and visualize insights through an interactive dashboard.

The key objectives of the system are:

- To monitor live stock price movements using interactive candlestick charts.
- To analyse sentiment trends from financial news headlines.
- To display sentiment insights using bar charts and heatmaps.

The project is developed using Streamlit as the frontend framework, Yahoo Finance API for stock data retrieval, and Natural Language Processing (NLP) techniques for sentiment analysis.

2. Technology Stack

Frontend and UI Development

- Streamlit: Used for developing the interactive dashboard.
- Plotly: Employed for visualizing stock price movements and sentiment data.

Backend and Data Processing

- Yahoo Finance API (yFinance): Fetches real-time stock market data.
- Google News RSS (feedparser): Scrapes financial news headlines related to a given stock symbol.
- TextBlob (Natural Language Processing Library): Conducts sentiment analysis on extracted news headlines.

- Pandas: Handles data manipulation and structuring for visualization.

3. System Implementation and Features

Stock Price Monitoring

The system retrieves real-time stock price data from the Yahoo Finance API at one-minute intervals for the current trading day. The data includes:

- Open price (Price at the start of the interval).
- High price (Highest price within the interval).
- Low price (Lowest price within the interval).
- Close price (Final price at the end of the interval).

The stock price data is visualized using a candlestick chart implemented with Plotly, allowing users to track market trends effectively.

Financial News and Sentiment Analysis

News Data Extraction

- The system fetches Google News RSS feeds to retrieve the latest stock-related headlines.
- It extracts the top 10 news articles relevant to the given stock symbol.

Sentiment Analysis Using TextBlob

- Each news headline is processed using TextBlob NLP to determine its sentiment polarity:
    - Positive sentiment: Indicates favorable market trends.
    - Negative sentiment: Suggests market concerns or bearish movement.
    - Neutral sentiment: No significant impact detected.

Visualization of Sentiment Data

Sentiment Bar Chart

- A bar chart is generated using Plotly Express to display sentiment scores.
- Headlines are positioned above the bars instead of on the side to improve readability.
- Sentiment scores are represented on the x-axis, while news headlines are arranged accordingly.

Sentiment Heatmap

- A heatmap is implemented to represent sentiment scores in a structured format.
- The issue of overlapping sentiment scores has been resolved to ensure better visibility.
- The color scale ranges from red (negative sentiment) to green (positive sentiment) to provide a clear indication of market sentiment.

4. User Interface Adjustments and Improvements

Several modifications were made to optimize the display and layout of charts:

- Reorganized the order of visualization:
    - First, the stock price chart is displayed.
    - Second, the sentiment bar chart is presented.
    - Third, the sentiment heatmap is shown.
- Fixed positioning of headlines in the sentiment bar chart by placing them directly above the corresponding bars.
- Resolved overlapping sentiment scores in the heatmap, ensuring clear representation.

5. Deployment and Hosting

The project can be deployed on various cloud platforms, including:

- Streamlit Cloud: A lightweight solution for easy deployment.
- Railway.app or Replit: Suitable for hosting Streamlit applications with minimal configuration.
- Frontend URL: https://xnl-21bce2223-llm1.streamlit.app/
- Backend URL: https://stock-dashboard-backend-production.up.railway.app/
- GitHub URL: https://github.com/Mudit1404/XNL-21BCE2223-LLM-1

6. Future Enhancements

Potential improvements to enhance the system include:

- Advanced Sentiment Analysis: Using VADER or FinBERT for more precise financial sentiment detection.
- Expanded Data Sources: Incorporating data from Bloomberg, Reuters, and SEC filings for comprehensive market insights.
- Enhanced UI/UX: Transitioning to a Next.js and Tailwind CSS framework for a more refined financial dashboard experience.

7. Conclusion

This project successfully integrates real-time stock market tracking with financial news sentiment analysis into a user-friendly dashboard. The implemented improvements ensure accurate sentiment representation and enhanced readability of visualizations. The system lays a strong foundation for future expansion, including AI-driven market predictions, deeper financial insights, and improved trading decision support.

I would like to express my sincere gratitude to XNL Innovations for providing me with this incredible opportunity to work on this project. It has been a challenging yet rewarding experience, allowing me to deepen my understanding of financial data analysis, sentiment tracking, and full-stack

development. Throughout this journey, I encountered several challenges, including integrating multiple APIs, handling real-time data updates, and deploying a seamless frontend-backend system. These tasks were not only time-consuming but also required meticulous debugging and optimization to ensure accuracy and efficiency. Despite the complexities, I remained dedicated and put forth my best efforts to deliver a robust and functional solution. This assignment has been an invaluable learning experience, helping me grow both technically and professionally. I truly appreciate XNL Innovations for entrusting me with this project as part of the placement process, and I look forward to leveraging these learnings to contribute effectively in future roles.