ADANI UNIVERSITY

Faculty of Engineering Science and Technology

Project Idea Submission

Stock Market Analysis & News Sentiment Dashboard SentiMarket

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Contents

1   Project Overview

Stock market participants rely on both quantitative price data and qualitative financial news to understand market behavior. However, analyzing historical stock prices alongside continuous financial news manually is time-consuming and inefficient. Individual investors, students, and financial analysts struggle to correlate market sentiment with price movements effectively.

This project proposes a comprehensive web-based dashboard called **SentiMarket** that integrates stock price analysis with financial news sentiment analysis, enabling users to visualize market trends and sentiment patterns in a single platform. The application will serve as both an analytical tool and an educational platform for understanding market dynamics.

The system will provide real-time insights into how public sentiment, as reflected in financial news, correlates with stock price movements, helping users make more informed decisions and understand market psychology.

2   Problem Statement

Current challenges faced by investors and market analysts include:

- **Information Fragmentation:** Investors and learners analyze stock prices and financial news on separate platforms, leading to disconnected insights and incomplete understanding of market behavior.

- **Manual Correlation Analysis:** Understanding how market sentiment influences stock price movement requires manual correlation between news events and price changes, which is time-intensive and prone to bias.

- **Lack of Sentiment Quantification:** Financial news is abundant, but most platforms do not quantify the sentiment or provide aggregated sentiment trends that can be easily correlated with price data.

- **Limited Educational Tools:** Students and novice investors lack accessible tools that demonstrate the relationship between market sentiment and price action in an interactive manner.

- **Data Overload:** The sheer volume of financial news makes it difficult to identify which news items are most relevant to specific stocks and how they impact investor sentiment.

There is a clear need for an integrated analytical system that combines historical stock data with news sentiment analysis to provide clearer, actionable insights into market behavior while serving as an educational platform for understanding financial markets.

3 Project Objectives

3.1 Primary Objectives

- Design and develop a full-stack web application for integrated stock and sentiment analysis

- Implement robust data fetching mechanisms for historical stock prices from reliable financial APIs

- Integrate financial news aggregation with automatic sentiment classification

- Create interactive and responsive data visualizations for market trends

- Develop correlation analysis between sentiment patterns and price movements

3.2 Secondary Objectives

- Perform basic technical analysis including moving averages, volatility, and trend indicators

- Build a user-friendly dashboard with intuitive navigation and real-time updates

- Implement data caching and optimization for improved performance

- Create a watchlist feature for tracking multiple stocks simultaneously

- Develop comparative analysis tools for multiple stocks

- Provide educational resources explaining sentiment analysis and technical indicators

4 Project Scope

4.1 Inclusions

- Educational and analytical use for learning market dynamics

- Historical stock data analysis with various time ranges (1 month to 5 years)

- Real-time financial news aggregation from multiple sources

- Sentiment analysis using Natural Language Processing techniques

- Interactive charts and visualization tools

- User account management with personalized watchlists

- Multi-stock comparison capabilities

- Technical indicator calculations and visualizations

- Export functionality for charts and data

4.2 Exclusions

- Real-time trading capabilities or brokerage integration

- Investment recommendations or financial advice

- Automated trading algorithms or bot development

- Cryptocurrency or forex market analysis

- Heavy machine learning model training from scratch

- Payment processing or premium subscription features

- Mobile application development (web-responsive only)

4.3 Limitations

- Uses publicly available financial APIs with rate limits

- Employs rule-based or pre-trained sentiment analysis models

- Data accuracy depends on third-party API reliability

- Historical data availability limited by API providers

- Sentiment analysis accuracy may vary based on news source quality

5 System Features

5.1 Stock Data Analysis Module

- **Stock Selection:** Search and select from thousands of stock tickers (e.g., AAPL, NVDA, TSLA, GOOGL)

- **Historical Data Fetching:** Retrieve price data for customizable date ranges

- **Price Visualizations:**

  - Candlestick charts showing open, high, low, close (OHLC)

  - Line charts for closing price trends

  - Volume bar charts

  - Percentage change indicators

- **Statistical Analysis:**

  - Daily, weekly, and monthly returns calculation

  - Moving averages (Simple Moving Average and Exponential Moving Average)

- Bollinger Bands for volatility measurement

- Standard deviation and variance analysis

- Price range and average calculations

5.2 Financial News Sentiment Module

- **News Aggregation:** Fetch latest financial news articles for selected stocks from multiple sources

- **Sentiment Classification:**

  - Positive sentiment (bullish indicators)

  - Neutral sentiment (informational)

  - Negative sentiment (bearish indicators)

  - Sentiment intensity scoring (0-100 scale)

- **Sentiment Analytics:**

  - Daily aggregate sentiment scores

  - Sentiment trend visualization over time

  - Most positive and negative news identification

  - Source credibility indicators

- **News Features:**

  - Article headlines with sentiment labels

  - Publication date and source information

  - Direct links to original articles

  - Keyword extraction and topic clustering

5.3 Correlation Analysis Module

- Overlay visualization of stock price and sentiment trends

- Identification of sentiment spikes corresponding to price changes

- Correlation coefficient calculation between sentiment and returns

- Event timeline showing major news and price movements

- Lag analysis to determine sentiment leading or lagging indicators

5.4 Dashboard and Visualization

- Interactive, responsive charts using modern visualization libraries

- Real-time data updates with automatic refresh options

- Multiple chart types (line, candlestick, area, bar)

- Zoom and pan capabilities for detailed analysis

- Time range selectors (1D, 5D, 1M, 3M, 6M, 1Y, 5Y, All)

- Stock performance summary cards with key metrics

- Sentiment distribution pie charts

- Downloadable charts and reports in PNG/PDF format

5.5 User Management Features

- User registration and authentication

- Personalized watchlist creation and management

- Portfolio tracking (educational purposes only)

- Customizable dashboard layouts

- Saved search history

- Notification preferences for sentiment alerts

6 System Architecture

6.1 Frontend Architecture

Technology Stack:

- **Framework:** React.js with functional components and hooks

- **State Management:** Redux or Context API for global state

- **Routing:** React Router for single-page application navigation

- **Visualization Libraries:**

  - Chart.js for basic charts
  - Recharts for advanced interactive visualizations
  - TradingView lightweight charts for candlestick displays

- **UI Framework:** Material-UI or Tailwind CSS for responsive design

- **HTTP Client:** Axios for API communication

- **Form Handling:** Formik with Yup validation

6.2 Backend Architecture

Technology Stack:

- **Framework:** Python with FastAPI (modern, fast, async support)

- **Authentication:** JWT (JSON Web Tokens) for secure user sessions

- **Data Processing:**

  - Pandas for data manipulation and analysis
  - NumPy for numerical computations

6.3 Database Architecture

Primary Database:

- **MongoDB** for flexible schema and document storage

- Collections:

  - Users (authentication and profile data)
  - StockData (cached historical prices)
  - NewsArticles (fetched news with sentiment scores)
  - Watchlists (user-created stock lists)
  - SentimentHistory (aggregated daily sentiment data)

6.4 External APIs and Services

- **Stock Price APIs:**

  - Yahoo Finance API (yfinance library) for historical data
  - Alpha Vantage as backup source
  - Twelve Data API for additional market data

- **Financial News APIs:**

  - NewsAPI for general financial news
  - Finnhub for stock-specific news and company data
  - Alpha Vantage News Sentiment API

6.5 Deployment Architecture

- **Frontend Hosting:** Vercel or Netlify for React application

- **Backend Hosting:** Heroku, Railway, or AWS EC2

- **Database Hosting:** MongoDB Atlas cloud service

- **CI/CD:** GitHub Actions for automated testing and deployment

7 Tentative Website Flow and Page Structure

This section outlines the complete user journey through the SentiMarket application, describing each page, its purpose, and the features it contains.

7.1 Page 1: Landing Page (Home)

Route: /

Purpose: First point of contact for new visitors, showcasing the platform's value proposition and key features.

Components and Features:

- Hero section with compelling headline: "Understand Markets Through Data and Sentiment"

- Brief description of what SentiMarket offers

- Eye-catching animated chart showing sample stock and sentiment correlation

- Key features grid highlighting:

    - Real-time sentiment analysis

    - Historical price tracking

    - Technical indicators

    - Multi-stock comparison

- Call-to-action buttons: "Get Started" and "View Demo"

- Statistics section showing platform metrics (number of stocks tracked, news articles analyzed, active users)

- Testimonials or use cases section

- Footer with links to About, Contact, Terms of Service, Privacy Policy

    User Actions:

- Click "Get Started" → Navigate to Registration page

- Click "View Demo" → Navigate to Demo Dashboard

- Click "Login" → Navigate to Login page

- Scroll to learn more about features

7.2 Page 2: User Registration

Route: /register

Purpose: Allow new users to create an account for personalized features.

Components and Features:

- Registration form with fields:

  - Full Name

  - Email Address (with validation)

  - Password (with strength indicator)

  - Confirm Password

  - Optional: Investment experience level

  - Optional: Areas of interest (Technology, Healthcare, Finance, etc.)

- Terms of Service and Privacy Policy checkboxes

- CAPTCHA for security

- "Sign Up" button with loading state

- "Already have an account? Login" link

- Social sign-up options (Google, GitHub) - optional

- Success message and automatic redirect to Dashboard

  Validation Rules:

- Email format validation and uniqueness check

- Password minimum 8 characters with uppercase, lowercase, and numbers

- All required fields must be filled

- Real-time field validation feedback

7.3 Page 3: User Login

Route: `/login`

Purpose: Authenticate existing users to access personalized features.

Components and Features:

- Login form with fields:

  - Email Address

  - Password (with show/hide toggle)

  - "Remember Me" checkbox

- "Login" button with loading state

- "Forgot Password?" link

- "Don't have an account? Sign Up" link

- Social login options (Google, GitHub) - optional

- Error messages for invalid credentials

- Session management with JWT tokens

- Automatic redirect to Dashboard upon successful login

  Security Features:

- Account lockout after 5 failed attempts

- Secure password hashing

- HTTPS enforcement

7.4 Page 4: Main Dashboard

Route: `/dashboard`

Purpose: Central hub for users to view their watchlist, market overview, and quick access to analysis tools.

Components and Features:

- **Top Navigation Bar:**

  - SentiMarket logo

  - Search bar for stock lookup

  - Navigation menu: Dashboard, Analysis, News, Watchlist, Compare, Education

  - User profile dropdown with Settings and Logout

- **Market Overview Section:**

  - Major market indices (S&P 500, NASDAQ, Dow Jones) with current values

  - Today's market sentiment summary (bullish/bearish/neutral)

  - Top gainers and losers cards

- **Watchlist Widget:**

  - List of user's saved stocks with mini-charts

  - Current price, percentage change, and sentiment indicator

  - Quick add/remove buttons

  - "Add Stock" button to expand watchlist

  - Sorting options (by name, price change, sentiment)

- **Recent Analysis Section:**

  - Recently viewed stocks with thumbnail charts

  - Quick access to detailed analysis

- **Trending Stocks:**

  - Most searched or analyzed stocks on the platform

  - Sentiment trend indicators

- **News Highlights:**

  - Top 5 most impactful news stories of the day

  - Sentiment labels and affected stocks

  User Actions:

- Search for any stock → Navigate to Stock Analysis page

- Click on watchlist item → Navigate to Stock Analysis page

- Click on trending stock → Navigate to Stock Analysis page

- Click "View All News" → Navigate to News Feed page

- Manage watchlist items

7.5 Page 5: Stock Analysis Page

Route: `/analysis/:ticker`

Purpose: Comprehensive analysis page for individual stocks with price data, technical indicators, and sentiment analysis.

Components and Features:

- **Stock Header:**

  - Company name and ticker symbol

  - Current price with real-time updates

  - Day change (absolute and percentage)

  - Day range, 52-week range

  - Market cap, P/E ratio, dividend yield

  - "Add to Watchlist" button

- **Interactive Price Chart:**

  - Candlestick or line chart toggle

  - Time range selector (1D, 1W, 1M, 3M, 6M, 1Y, 5Y, All)

  - Volume chart below price chart

  - Zoom and pan functionality

  - Technical indicator overlays (selectable):

    * Simple Moving Average (SMA 20, 50, 200)

    * Exponential Moving Average (EMA)

    * Bollinger Bands

  - Drawing tools for trend lines

- **Technical Indicators Panel:**

  - Moving averages table with values

  - Volatility metrics (standard deviation, beta)

  - Support and resistance levels

  - Trading volume analysis

- **Statistics Summary:**

  - Returns: Daily, weekly, monthly, yearly

  - Average volume

  - Volatility percentage

– Correlation with market index

- **Sentiment Analysis Section:**

  – Overall sentiment gauge (positive/neutral/negative)

  – Sentiment trend chart (last 30 days)

  – Recent news headlines with sentiment scores

  – Sentiment distribution breakdown

- **Correlation Visualization:**

  – Dual-axis chart showing price and sentiment over time

  – Highlighted events where sentiment preceded price movement

  – Correlation coefficient display

  User Actions:

- Adjust time range and view different periods

- Toggle technical indicators on/off

- Switch between chart types

- Click news headlines → Navigate to News Detail

- Export chart as image or data as CSV

- Compare with another stock

7.6 Page 6: News Feed Page

Route: /news

Purpose: Aggregated view of financial news across all stocks with filtering and sentiment analysis.

Components and Features:

- **Filter Sidebar:**

  – Filter by sentiment (Positive, Neutral, Negative)

  – Filter by stock ticker

  – Filter by date range

  – Filter by news source

  – Filter by sector/industry

  – "Apply Filters" and "Reset" buttons

- **News List:**

- Card-based layout for each news article

- Article headline

- Source and publication date

- Sentiment badge (color-coded)

- Sentiment score (0-100)

- Related stock tickers as tags

- Brief summary or snippet

- "Read More" link to original article

- "View Stock Analysis" button

- **Sorting Options:**

  - Most recent first

  - Most positive sentiment

  - Most negative sentiment

  - Highest sentiment impact

- **Pagination:**

  - Load more functionality or traditional pagination

  - Items per page selector

- **Top Stories Section:**

  - Featured news with highest market impact

  - Trending topics word cloud

  User Actions:

- Apply filters to narrow down news

- Click on article → Opens external link in new tab

- Click stock ticker → Navigate to Stock Analysis

- Sort news by different criteria

- Share news articles on social media

7.7 Page 7: Stock Comparison Page

Route: `/compare`

Purpose: Side-by-side comparison of multiple stocks for performance and sentiment analysis.

Components and Features:

- **Stock Selection Interface:**

  - Search and add up to 4 stocks for comparison

  - Selected stocks displayed as removable chips

  - "Compare" button to generate analysis

- **Comparison Charts:**

  - Normalized price performance chart (percentage change from start date)

  - Side-by-side sentiment trend comparison

  - Volume comparison chart

  - Returns comparison (bar chart for different time periods)

- **Comparison Table:**

  - Metrics comparison table with columns for each stock:

    * Current price
    * Day change
    * YTD return
    * 1-year return
    * Volatility
    * Average sentiment score
    * Market cap
    * P/E ratio

  - Visual indicators for best/worst performers

- **Correlation Matrix:**

  - Heatmap showing correlation between selected stocks

  - Numerical correlation coefficients

- **Sentiment Comparison:**

  - Sentiment distribution pie charts for each stock

  - Comparative sentiment trend lines

User Actions:

- Add or remove stocks from comparison

- Adjust time range for comparison

- Export comparison report

- Click on individual stock → Navigate to Stock Analysis

- Save comparison as preset for future reference

7.8 Page 8: Watchlist Management Page

Route: `/watchlist`

Purpose: Detailed management of user's saved stocks with organization and tracking features.

Components and Features:

- **Watchlist Organization:**

    - Create multiple watchlists (e.g., "Tech Stocks", "Growth Portfolio", "Dividend Stocks")
    - Drag-and-drop to reorganize stocks
    - Rename or delete watchlists

- **Stock Cards in Grid/List View:**

    - Company logo and name
    - Current price and change
    - Mini price chart (sparkline)
    - Current sentiment indicator
    - Quick action buttons: Analyze, Remove, Notes

- **Bulk Actions:**

    - Select multiple stocks for bulk operations
    - Compare selected stocks
    - Export selected stocks data
    - Move to different watchlist

- **Watchlist Analytics:**

    - Overall watchlist performance
    - Sector distribution chart
    - Average sentiment across watchlist

- Best and worst performers

- **Add Stock Interface:**

  - Search bar with autocomplete

  - Quick add from trending or suggested stocks

- **Notes and Tags:**

  - Personal notes for each stock

  - Custom tags for categorization

  - Color-coding options

  User Actions:

- Create, rename, or delete watchlists

- Add or remove stocks

- Organize stocks within lists

- View detailed analysis for any stock

- Compare multiple stocks

- Add notes or tags to stocks