AI-Driven Algorithmic Trading Project

Project proposal & Statement of Work

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Revision History Table		Template Date 03/15/2025
Version/No	Summary of Changes	Date
V.1.1	Initial Draft	03/20/2025
V.1.2	Executive Summary, User Research, and Deliverables sections updated	03/28/2025
V.1.3	Timeline updated	03/31/2025
V.2	New Proposal	07/04/2025

Table 1 Revision History

Contents

1. Executive Summary

The Executive Summary was written by Hemant Kumar B K.

The AI-Driven Algorithmic Intraday Trading System is designed to develop an automated strategy for intraday trading of stocks and Exchange Traded Funds (ETFs) in the AI (Artificial Intelligence) and EV (Electric Vehicle) sectors. The system uses advanced technologies to support better trading decisions. A major component is TimeGPT—a state-of-the-art time-series forecasting model—that predicts intraday price movements.

The system also uses real-time news sentiment analysis by leveraging the News API and Large Language Models (LLMs) to extract trade signals from news headlines. This hybrid approach combines quantitative forecasts with qualitative analysis, giving a complete picture of market behavior in the AI, EV, and related ETF sectors.

The strategy is developed using Backtrader for research and backtesting, with strong risk management features like stop-loss and take-profit rules. Performance reporting is done through data visualization, which helps to clearly show trading activity and results. The project is divided into modular tasks, with team members responsible for data acquisition, cleaning, TimeGPT integration, news sentiment analysis, strategy development, backtesting, and system integration.

Disclaimer:
It is important to note that this project is primarily a research and evaluation platform for studying algorithmic trading strategies. The system is not intended for live market trading. Any profitability observed during backtesting is likely due to retrospective optimization and should not be considered a guarantee of success in real trading environments.

Table 2 shows the preliminary division of responsibilities among the team members for the intraday algorithmic trading strategy.The project tasks have been divided to leverage team member's strengths across key areas of development, including data handling, TimeGPT and news sentiment integration, strategy development, and backtesting.

Team Member	Feature responsibility
Sanjeevteja Ponugumati, Rohith V S	Data Acquisition, Cleaning, Visualization & Management TimeGPT Integration and Forecasting
	Trading Strategy Research & Development
Aman Singh, Chaithanya Konda	News API Integration and Sentiment Analysis
Hemant Kumar BK, Chaithanya Konda	Intraday Trading Strategy Logic
	Backtesting and Performance Analysis

Table 2 Preliminary Feature Responsibilities

2. User/Market research

The user/market research was written by Aman singh

2.1 Overall Market

The global online trading platform market was valued at USD 10.15 billion in 2024 and is projected to grow from USD 10.82 billion in 2025 to USD 16.71 billion by 2032, with a CAGR of 6.4% (Fortune Business Insights, 2025). Growth is driven by demand for real-time insights, AI-powered forecasting, and mobile access. There's rising interest in tools that blend historical price data and news sentiment, especially within sectors like AI and EVs, for better decision-making and automation.

2.2 Existing Competitors

- **Robinhood:** Popular due to its simplicity but lacks advanced forecasting and detailed news analysis.
- **TradingView:** Offers extensive charting capabilities but has limited real-time news integration and predictive analysis features.
- **Bloomberg Terminal:** Highly comprehensive but extremely costly and complex, not suitable for typical individual traders.

Our system differentiates itself by uniquely combining real-time news analytics from NewsAPI with advanced predictive modeling from TimeGPT, providing powerful yet intuitive insights specifically designed for intraday traders.

2.3 User Insights

Potential users, such as traders, financial analysts, and investors, require robust, reliable, and efficient intraday trading systems. Key needs include:

- Ability to automate intraday trading strategies in the AI, EV, and ETF sectors.
- Tools to effectively incorporate news sentiment into trading models for these sectors.
- AI-driven solutions for more informed and dynamic trading decisions within the AI, EV, and ETF markets.

This project aims to address these needs by providing a sophisticated solution tailored to the unique demands of intraday trading in the AI, EV, and ETF sectors.

3. Product Features

The primary deliverable of this project is a well-defined algorithmic intraday trading strategy, along with supporting documentation and analysis. This includes:

- A clear description of the strategy's logic and rules.

- Implementation of the strategy using Python and relevant libraries (e.g., Backtrader, TimeGPT API client, News API client, LLM API client).
- Backtesting results and performance analysis.
- Analysis of the impact of news sentiment on trading decisions.

Features/Components:

- 3.1 Data Acquisition and Management
- 3.2 TimeGPT Integration and Forecasting
- 3.3 News API Integration and Sentiment Analysis
- 3.4 Intraday Trading Strategy Logic
- 3.5 Backtesting and Performance Analysis

3.1 Data Acquisition and Management

This component focuses on obtaining and preparing the necessary data for the intraday trading strategy.

- **Obtain historical intraday price data:** We will use the yfinance Python library to download historical price data for the selected AI, EV, and ETF stocks. The data will include open, high, low, close prices, and volume at intraday intervals (e.g., 1-hour, 30-minute).
- **Implement data cleaning and preprocessing:** We will implement techniques to handle missing data, outliers, and any inconsistencies in the data. This may involve filling missing values, smoothing noisy data, and ensuring data is properly formatted for analysis.
- **Store and organize data:** The cleaned and preprocessed data will be stored in a suitable format (e.g., pandas DataFrames) and organized for efficient access during TimeGPT forecasting and backtesting.

3.2 TimeGPT Integration and Forecasting

We will use the TimeGPT API to predict the next price movement using all available past data. In our current setup, we plan to forecast the upcoming 30-minute candle based on historical information available up to that moment. To provide detailed insights into market dynamics without overwhelming our computational resources, we will initially use 60 days of 5-minute intraday data as our input dataset. This approach gives us a granular view of short-term price fluctuations while keeping the data manageable. In the future, we may experiment with using 30-minute interval data or extend the dataset to cover up to three months, to assess whether these adjustments lead to even marginal improvements in forecasting accuracy.

TimeGPT Use Transparency:

TimeGPT is used in our project primarily to model historical price patterns and trends in intraday data. At present, it does not directly incorporate social or news inputs; these are processed separately via our sentiment analysis pipeline. Our model is configured to predict the next 30-minute candle. While

TimeGPT operates as a black-box, meaning its internal workings are not fully transparent, this is acceptable for our educational project. The purpose here is to gain practical experience with state-of-the-art forecasting methods, assess their performance, and understand their limitations in a controlled, simulated trading environment. Our goal is to establish even a window of marginally accurate forecasting rather than to create a production-ready trading system.

Note: Retail stock exchange prices are highly efficient and nearly "locked," meaning that any predictable movements are quickly exploited by the market. Therefore, even marginal forecasting accuracy is valuable for our research.

3.3 News API Integration and Sentiment Analysis

- We will fetch financial news using the News API from reliable sources to obtain relevant headlines about the selected stocks. For the sentiment analysis of these headlines, we have decided to use open-source models that are more suited to financial text than a hosted API like Google Cloud NLP, which might incur costs even with student credits.
- Our primary model will be **FinBERT**, as it is pretrained on financial data and available for free via Hugging Face. In addition, we will use **VADER**—a completely free model available within the NLTK library—and we also plan to consider **Twitter-RoBERTa** for capturing social sentiment from platforms like Twitter. We will compare the performance of FinBERT, VADER, and Twitter-RoBERTa to validate our sentiment analysis pipeline and select the model that provides the most reliable insights for our trading strategy.
- To avoid data leakage, we will enforce a strict cutoff by using only the news published up to the start of each prediction interval in our analysis. This ensures that future news data does not influence our current predictions, keeping our forecasting process solely based on past information.
- Using these free, open-source models offers a cost-effective solution with minimal latency. This approach is ideal for our research and evaluation purposes, and it can be easily run on platforms such as Google Colab, CyVerse, and Jetstream.

3.4 Intraday Trading Strategy Logic

This component defines the core rules of the intraday trading strategy.

- **Define rules for generating buy and sell signals:** We will define clear and specific rules for generating buy and sell signals based on a combination of TimeGPT forecasts and news sentiment signals. This may involve using thresholds, weightings, or other techniques to combine the signals.
- **Incorporate technical indicators:** We may incorporate technical indicators (e.g., moving averages, Relative Strength Index (RSI), Bollinger Bands) to further refine the trading signals.

- **Implement risk management rules:** We will implement risk management rules to protect capital and limit potential losses. This will include stop-loss orders to automatically exit losing positions and take-profit orders to secure profits.

Risk Mitigation

To further mitigate potential risks, we will implement the following contingency plans:

- **API Failures:** We will implement error handling and retry mechanisms for API calls to the News API and TimeGPT. If an API becomes temporarily unavailable, the system will pause trading and log the error.
- **TimeGPT Unavailability:** In case of extended TimeGPT API downtime, the strategy will have a fallback mechanism to continue trading based on technical indicators alone. This ensures continued operation, albeit with potentially reduced accuracy.

Note: This system is developed solely as a research and simulation tool. It will not be deployed in live markets. Any apparent profitability seen during backtesting is based on historical data analysis and should be interpreted accordingly.

3.5 Backtesting and Performance Analysis

This component involves evaluating the trading strategy using historical data.

- **Backtesting:**
  We will use the Backtrader Python library to simulate the execution of the trading strategy on historical data.

- **Performance Metrics:**
  We will calculate and analyze key performance metrics such as total return, Sharpe ratio (a measure of risk-adjusted return), drawdown (the maximum loss from a peak to a trough), and win rate to evaluate the strategy's performance.

- **Impact of News Sentiment:**
  We will assess how news sentiment affects the strategy’s performance and identify any notable patterns or relationships.

Evaluation Benchmarks:
To objectively evaluate the performance of our intraday trading strategy, we will use the following benchmarks:

- **Historical Period:**
  We will backtest the strategy over the past 3 years, covering periods of both high and low volatility in the AI and EV sectors, which helps assess the robustness of the strategy across different market conditions.

- **Sharpe Ratio:**
  A Sharpe ratio greater than 1.0 will be considered successful, indicating that the strategy generates sufficient returns relative to its risk.

- **Maximum Drawdown:**
  We aim to keep the maximum drawdown below 20% to manage potential losses and ensure the stability of the strategy.

- **Baseline Comparison:**
  We will compare our strategy's performance against a dual baseline:

    - Passive benchmarks such as investments in relevant ETFs (e.g., QQQ for technology and ARKK for innovation).

    - Naïve intraday strategies, such as a simple moving average (SMA) crossover approach.
      This combined baseline will help validate the added value of incorporating sentiment analysis and TimeGPT forecasts.

3.6 Visualization and UI Planning

While our priority is developing a robust and backtested trading algorithm, we also recognize the importance of clear, interactive reporting for analysis and decision support. To ensure user-friendly outputs, we plan to use **Power BI** for performance visualization in the final stages of development.

Planned Use of Power BI:

We aim to build a **dynamic performance dashboard** using Power BI, which will:

- **Connect to cleaned and backtested trading data** exported from Python (e.g., CSV/Excel from Backtrader results).

- **Display key metrics** like Sharpe Ratio, total return, drawdown, and win rate via customizable visuals.

- **Use filters/slicers** to let users explore results by time period, stock symbol, or news sentiment score.

- Present **interactive charts**, such as:

    - Equity curve (profit over time)

    - Bar charts for strategy performance by sector

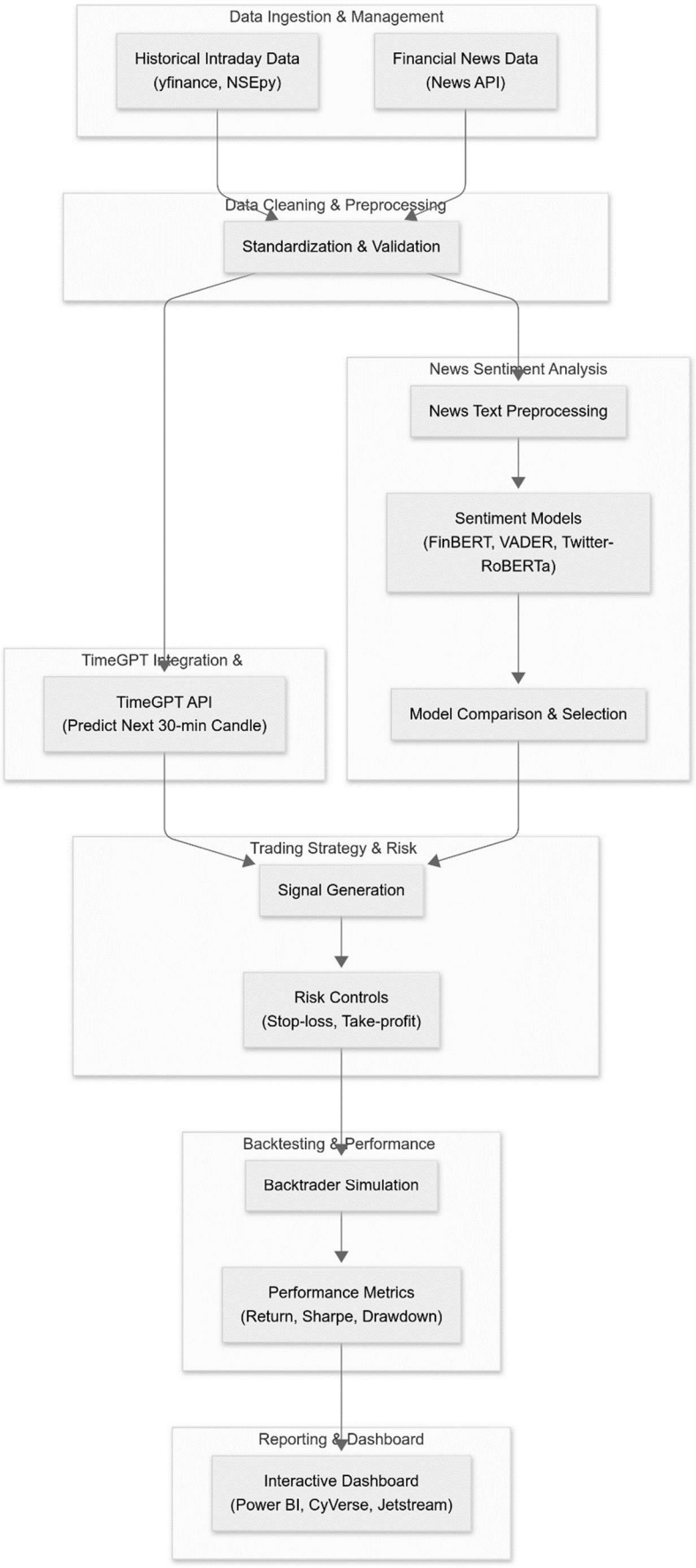
- Candlestick charts (imported from trading logs) for trade entry/exit visualization
- Pie charts showing win/loss ratio by strategy condition or time window

Additional UI Considerations:

- If time allows, we may design **wireframes** or simple dashboards using **Figma** to showcase how traders might interact with sentiment scores and alerts.
- Power BI will be chosen over full-stack development due to its **ease of integration**, **low learning curve**, and **professional appearance**.

These visual components are considered **Phase 4 priorities**, following core strategy development and validation. They will help communicate the value and performance of the algorithm clearly to end-users, stakeholders, and judges during the final showcase.

3.7 System Architecture



4. Project Timeline & Gantt Chart

Project Phases

The project is structured into the following phases:

- Phase 1: Data Acquisition and Preparation: This phase focuses on gathering and cleaning the necessary historical and real-time data.
- Phase 2: Strategy Development and Backtesting: This phase involves designing, implementing, and backtesting the intraday trading strategy.
- Phase 3: Performance Analysis and Optimization: This phase focuses on evaluating the strategy's performance and fine-tuning its parameters.
- Phase 4: Documentation and Presentation: This phase involves creating comprehensive documentation and preparing the final project presentation.

Table 3 outlines the project's key milestones and their corresponding target completion dates.

Milestone	Date
Project Initiation and Team Formation	
Project Proposal Finalization	
Detailed Requirements Specification	
Data Acquisition Module Development	
Data Acquisition Module Complete	
TimeGPT API Integration	
Historical Data Collection	
News API Integration	
LLM Sentiment Analysis Implementation	
Intraday Trading Strategy Design	
Backtesting Framework Setup	
Strategy Backtesting and Optimization	
Performance Analysis	
Final Documentation	
Poster Preparation	
Project Demonstration	
Performance Monitoring Dashboard Complete	
System Integration and Testing Complete	
Final Documentation Complete	
Poster Demo	04/28/2025
Poster Final Demo	05/02/2025
iShowcase	05/07/2025

Table 3: Milestone Schedule

Gantt Chart and Timeline Description

You can view our live and interactive Gantt chart here:
[Asana Gantt Chart – Project Timeline](**https://app.asana.com/0/1209854912470220/1209854803360147**)

This chart outlines our task schedule, milestones, and dependencies for each phase of the project. It will be continuously updated as the project progresses.

5. Ethics

Table 4 evaluates the ethical considerations of the project.

S.No	Question	Y/N/M
1	Could the algorithm be used for market manipulation?	Mitigatable (Need careful risk management to avoid unintended market impact; backtesting is crucial.)
2	Could the algorithm unfairly advantage certain market participants?	Mitigatable (Strategy aims for consistent intraday profits, not exploitation of others; careful backtesting to ensure fair play.)
3	Is the data used to train and test the algorithm free from bias?	Medium Risk (Historical price data generally reflects market activity; news sentiment analysis requires careful source selection to mitigate bias.)
4	Could the algorithm lead to unintended consequences in the market?	Maybe (Intraday strategies have less risk of long-term instability than HFT; ongoing monitoring is important.)
5	Does the algorithm adhere to regulatory guidelines for trading?	Y (While our backtesting is done with historical data, we acknowledge that live trading is subject to regulations from bodies such as the SEC and FINRA. We will design our system with these regulations in mind.)
6	Is the algorithm transparent in its decision-making process?	Medium Risk (Code and logic are documented; intent to make sentiment analysis's influence clear.)
7	Are there potential security risks associated with the algorithm?	N (Algorithm operates on local data; no direct access to external systems.)
8	Does the algorithm respect user privacy and data security?	Y (No user data collected; focus is on stock price data.)
9	Is the algorithm environmentally sustainable?	Y (Computational resources are within standard levels; no significant environmental impact.)
10	Is the algorithm developed in a responsible and ethical manner?	Y (Team is committed to ethical development; ongoing discussions on potential ethical concerns.)

Table 4: Ethics

6. Approvals

The signatures of the people below indicate an understanding of the purpose and content of this document by those signing it. By signing this document, you indicate that you approve of the proposed project outlined in this Statement of Work, the division of work, the Ground Rules and that the next steps may be taken to create a Product Specification and proceed with the project.

This document is the initial project proposal for the AI-Driven Algorithmic Trading. Any deviations from the Preliminary Design Review (PDR) have been clearly documented. For all requirements not specified in this Statement of Work (SOW), the Product Requirements Document (PRD) will remain in effect.

Table 6 shows the required approvals for the project proposal, including the names, titles, signatures, and dates of those approving

Approver Name	Title	Signature	Date
Hemant Kumar BK	Team Project Manager		
Aman Singh	Team Member		
Chaithanya Konda	Team Member		
Rohith Velan Singaravelu	Team Member		
Sanjeevteja Ponugumati	Team Member		
	Project Manager		
	Advisor		
	Instructor		

Table 5: Approvals

Table 6 details the authors responsible for writing each section of the document and provides the word count for each section."

Section	Author	Word Count
1. Introduction	Hemant Kumar BK	
2. User/Market research	Aman Singh	
3. Final Product Deliverable & Features	All team members	
4. Project Timeline & Gantt Chart	Hemant Kumar BK	
5. Ethics	Sanjeevteja Ponugumati	
6. Approvals	Rohith Velan Singaravelu	

Table 6: Section Authors and Word Counts

7. Appendix

1) Project Team Responsibilities

- The Project Manager will set up and facilitate a weekly call/meeting with the Faculty Advisor. The Project Team will provide weekly status updates to the Faculty Advisor including upcoming deliverables, critical issues, and any adjustments to the Project Plan.
- Documents will be provided to the Faculty Advisor with adequate time for review and signature. The time necessary for review will be agreed with the Advisor. The minimum review time will be 3 days prior to the document due date.
- Design files will be provided to the Faculty Advisor as requested in a format agreed to with the Advisor.
- Support requirements will be clearly requested from the Faculty Advisor with the dates required and an adequate time for fulfilling the request.
- Modification requests to the Project Plan by Faculty Advisor will be reviewed and agreed to within 1 week of the request.

2) Faculty Advisor Responsibilities

- The Faculty Advisor will provide knowledge and expertise to help the group stretch their skills.
- The Faculty Advisor will participate in a weekly or bi-weekly call/meeting with the Project Team to review the project status, upcoming deliverables, priorities, issues, and progress to the agreed Project Plan.
- The Faculty Advisor will provide document review, feedback and approval, rejection, approval with contingencies with adequate time for the Project Team to meet the course due dates.
- The Faculty Advisor will provide feedback to requested support requirements from the Project Team. This includes feedback and guidance on design implementations decisions, design files, test plans, test procedures and test results.
- The Faculty Advisor shall provide technical advice and guidance to the Project Team answering inquiries approximately 1 hour per week.
- Modifications to the Project Plan by the Project Team will be resolved and documented within 1 week of the request.
- Grade the finalized project using a skill-based rubric
- Attend iShowcase in May.

A. Ground Rules

As a team and as individual team members, we agree to:

1. **Stay focused on our objectives and goals.**
   Each time the team meets, we will clearly define our objectives and desired outcomes at the beginning of the meeting. We will politely remind team members if we are getting off track.
2. **“Sidebar” any issues that are relevant but not consistent with the immediate objectives.**
   Occasionally, important matters are raised that are not relevant to the immediate goals of the meeting. To keep the group on track, but avoid losing the issue, create a “sidebar” where these topics can be listed and discussed later.

3. **Listen when others are speaking.**
   We will listen and consider others' input before adding our own comments.
4. **All viewpoints will have an opportunity to be heard.**
   We understand that some team members may be quieter than others. We will make an effort to get each team member's viewpoint and that no one dominates the discussion.
5. **Differences of opinion will be discussed respectfully**
   We will identify areas of agreement before assessing areas of disagreement. We will encourage each other to look beyond our own point of view. We will discuss different ideas respectfully. As a team, we will weigh the merits of different opinions and agree on a process for choosing a direction. All team members will respect and follow the decision or direction.
6. **Look for the good points in new ideas.**
   We will endeavor to explore the value in each idea as we assess and select our path forward.
7. **Focus on the future, not the past.**
   We will use our past experience to inform our decisions, but focus the discussion on the future objectives. Blame for past performance is counterproductive, we will focus on finding solutions.
8. **Agree upon specific action items and next steps.**
   At the end of each meeting and discussion, we will summarize and agree on specific next steps, action items and assignments.
9. **Accountability**
   As team members, we will each be responsible for our individual assignments and contribution to achieving the team objectives and goals. We will honor our responsibilities and not let our team members down.