

# CSCE 689: Programming LLMs - Course Project

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## MarketPulseAI: One-Stop Application for Personalized Stock Portfolio Optimization

Link to website: [Market-Pulse-AI](https://market-pulse-ai.streamlit.app)

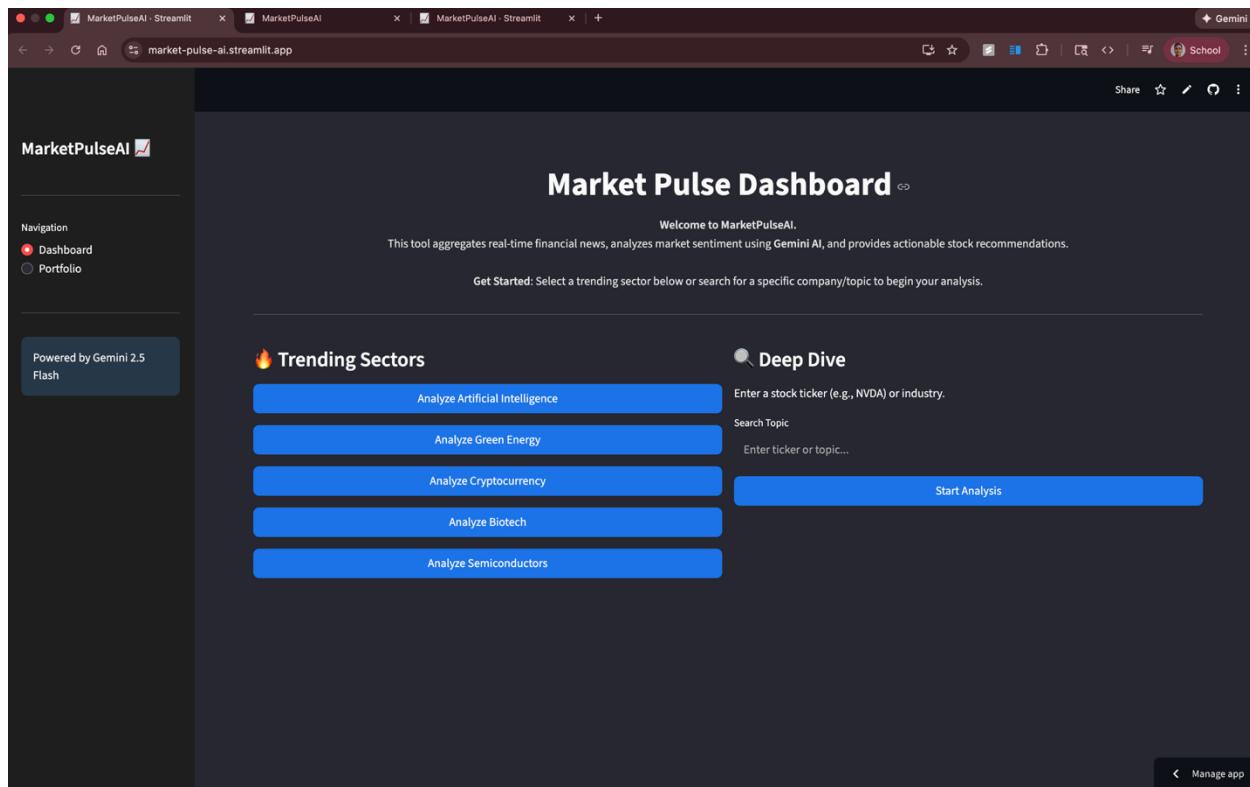


Fig 1: Market Pulse AI dashboard

### 1. My Vision and the Platform's Core Purpose

My primary goal of this project was to move beyond generic financial news summaries and deliver an accessible, explainable, and adaptive platform for retail investors.

I wanted to create a system that analyzes the "Market Pulse" of the market using AI and allows users to maintain their investment tracks and stay fully current with the latest sector-based news.

The result is a comprehensive application- **Market Pulse AI**, deployed on Streamlit, where the reasoning capability of LLMs is directly connected to a persistent portfolio tracking system powered by Supabase.

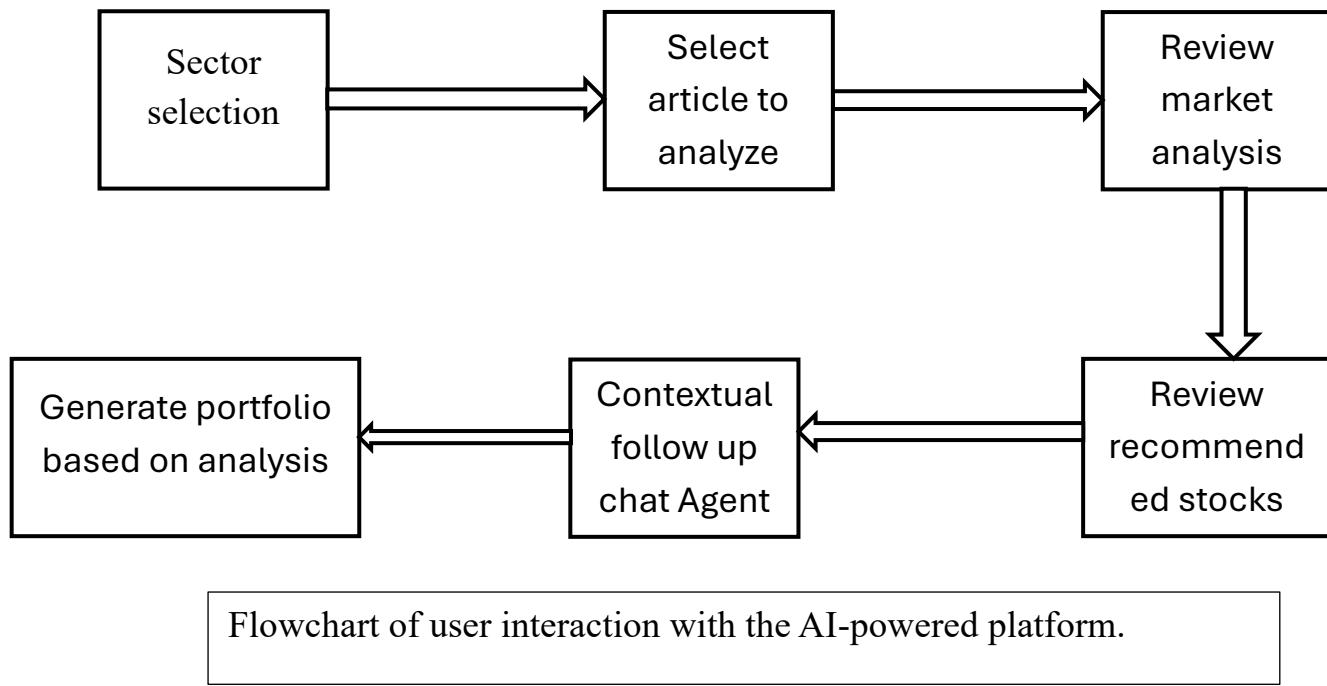
## 2. Implementation Architecture

I designed the system using a three-tiered, resource-efficient architecture:

- Frontend (Dashboard): Built with **Streamlit** and custom CSS for a professional, premium user interface, ensuring easy local and public deployment.
- Analysis Engine: The core intelligence runs on the Google Gemini API (**gemini-2.5-flash**), responsible for structured data extraction and reasoning.
- Data and Persistence Layer: I chose Supabase DB to ensure the user's portfolio data is persistent. Market data acquisition utilizes duckduckgo-search for news and yfinance for real-time stock prices.

## 3. End-to-End User Flow and Feature Exploration

The application guides the user through a structured investment analysis workflow, providing multiple points of detailed, context-aware information.



## Step 1: Sector Selection and News Ingestion

The user begins by choosing an area of focus:

- Industry Choice: The application provides a set of predefined industries to explore, or the user can input any new industry they want to research.
- Data Freshness: Upon selection, the app immediately fetches the top 10 latest articles within a 3-day window to cover the most current news in that sector.

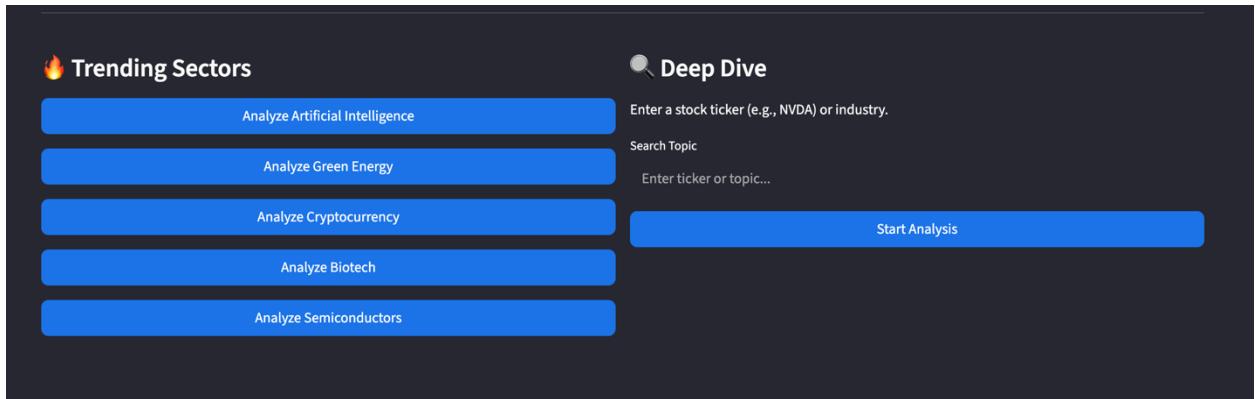


Fig 2: Entry point of dashboard to select industry to analyze

## Step 2: Selective Analysis and LLM Processing

I give the user control over the analysis inputs:

- Article Triage: The user is presented with the latest articles and has the choice to select which articles to analyze using the LLM. This ensures the LLM's analysis is focused exactly on the events the user considers most relevant.
- Detailed Analysis Output: The LLM processes the selected reports and provides a detailed analysis in bullet points.

## Latest News for: Semiconductors

 Data Freshness

Source	Date	Headline	Article Link
The Motley Fool	2025-12-06T22:35:00+00:00	Should You Buy Navitas Semiconductor Stock Before 2026?	<a href="#">Read Article</a>
The Motley Fool	2025-12-06T12:30:45+00:00	Why Navitas Semiconductor stock crashed in November	<a href="#">Read Article</a>
The Motley Fool	2025-12-05T02:23:00+00:00	This Semiconductor Stock Is Up 165% in 2025. 1 Reason This Could Be Just the Beginning.	<a href="#">Read Article</a>
Barchart	2025-12-05T00:00:00+00:00	This Semiconductor Stock Is Up 435% in the Past 6 Months and Can Gain Another 40% from Here	<a href="#">Read Article</a>
Seeking Alpha	2025-12-05T18:02:00+00:00	Taiwan Semiconductor: I Don't Think Growth Is About To End	<a href="#">Read Article</a>
Seeking Alpha	2025-12-04T11:46:00+00:00	SOXQ: The Semiconductor ETF Riding The AI Boom	<a href="#">Read Article</a>
Barchart	2025-12-05T14:22:02+00:00	Is ON Semiconductor stock outperforming the Nasdaq?	<a href="#">Read Article</a>
Insider Monkey	2025-12-06T03:56:00+00:00	10 Fastest-Growing Semiconductor Stocks to Buy	<a href="#">Read Article</a>
Insider Monkey	2025-12-04T17:54:44+00:00	ON Semiconductor (ON) Soars 11% on Aggressive Expansion Plan	<a href="#">Read Article</a>
American Association of Individual	2025-12-03T23:48:00+00:00	Which Is a Better Investment, Amkor Technology, Inc. or Teradyne, Inc. Stock?	<a href="#">Read Article</a>

**Select Articles for Analysis**

Uncheck irrelevant articles to improve analysis quality.

**Should You Buy Navitas Semiconductor Stock Before 2026?**

Source: The Motley Fool | Date: 2025-12-06T22:35:00+00:00

This is a promising stock to ride the artificial intelligence (AI) infrastructure boom, but it won't be a smooth ride for investors.

**Why Navitas Semiconductor stock crashed in November**

Source: The Motley Fool | Date: 2025-12-06T12:30:45+00:00

Fig 3: Fresh article fetch and article selection section

### Step 3: Sentiment and Stock Recommendation

This step delivers the core decision-support intelligence:

- Sentiment Metric: I implemented a clear and actionable sentiment analysis metric: Positive, Neutral, or Avoid. This insight immediately helps the user reconsider their portfolio exposure for the selected industry.
- Stock Suggestions: The application provides a suggestion for 5 stocks that the user can explore. These suggestions are categorized with explicit actions: buying, selling, or watching for future. Each recommendation is justified by event-based reasoning.
- Along with stock suggestion, the LLM provides short info on the stock's short term vs long term growth plan and buy/sell option.

The screenshot shows the MarketPulseAI web application. The top navigation bar includes a logo, user profile, and a search bar. The left sidebar has a 'Navigation' section with 'Dashboard' and 'Portfolio' options, and a note 'Powered by Gemini 2.5 Flash'. The main content area is titled 'Market Analysis: Semiconductors'. A green header bar says 'Market Sentiment: POSITIVE'. Below it, the 'Executive Summary' section discusses the rebound of the semiconductor industry in 2024, historical context, short-term outlook, and key risks. A 'Stock Recommendations' section is also present.

Fig 4: Positive market sentiment for Semiconductor industry

The screenshot shows the MarketPulseAI web application. The top navigation bar includes a logo, user profile, and a search bar. The left sidebar has a 'Navigation' section with 'Dashboard' and 'Portfolio' options, and a note 'Powered by Gemini 2.5 Flash'. The main content area is titled 'Market Analysis: cryptocurrency'. A red header bar says 'Market Sentiment: NEGATIVE'. Below it, the 'Executive Summary' section discusses the current downturn in the cryptocurrency market, corporate crypto strategies, future prospects, and key risks. It highlights the shift towards more regulated and integrated financial ecosystems.

Fig 5: Negative market sentiment for cryptocurrency industry

#### Step 4: Contextual Discussion (The Chat Analyst)

One main point of concern for users is the follow up question based on the analysis. Users would like to build more confidence on result by asking follow-up questions. To resolve follow-up questions, I integrated the Chat Analyst:

- Context-Based Queries: The user has an option to discuss context-based queries with a Chat Analyst.
- Grounded Reasoning: This chat feature is highly context-aware, able to help the user with more analysis directly related to the articles and sentiment reports currently on screen.

**Stock Recommendations**

Stock	Description	Action	Est. Price	Analysis Summary
NVTS	Navitas Semiconductor	Action: BUY	Est. Price: \$9.48	Positioned for incredible long-term growth in AI data center power control (GaN/SiC) validated by an Nvidia partnership, but faces significant near-term revenue declines and potential stock volatility during its strategic transition.
AMD	Advanced Micro Devices, Inc.	Action: BUY	Est. Price: \$217.97	Exhibits strong revenue growth and highly positive analyst sentiment with significant upside potential. Demonstrates robust capabilities in AI compute with Instinct MI300X GPUs and an open software stack, reinforced by strategic partnerships.
MTSI	MACOM Technology Solutions Holdings, Inc.	Action: BUY	Est. Price: \$184.10	Shows consistent execution and strong full-year revenue growth, with a robust early-2026 outlook. Has improved long-term potential in high-speed optical components for data centers (800G and 1.6T applications), reflected in increased analyst price targets.

**Ask the Analyst**

Ask follow-up questions about the analysis above.

**why is TER Avoid and not buy?**

TER (Teradyne) is rated "AVOID" despite its very strong growth potential (AAII Growth Grade A) driven by demand for automated test systems and robotics. The primary reason for the "AVOID" recommendation is its valuation: it is rated 'Ultra Expensive' (AAII Value Grade F) with a very high P/E ratio, suggesting significant overvaluation despite its strong growth prospects.

Fig 6: Stock recommendation to users based on sight with real time stock price updates

## Step 5: Persistent Portfolio Management

This feature ensures long-term utility and tracking:

- Portfolio Addition: The detailed analysis info and suggested stocks are then added to the portfolio. Users can review their added stocks and its corresponding buy/sell value.
- A sub section under Strategy Details provide users with a short note on long term vs short term stock opinion to either buy or sell.

- Real-Time Data: The app fetches the stock price in real time when the portfolio is viewed, providing the current value alongside the user's entry price.
- Persistence: The entire portfolio is stored using Supabase DB, ensuring that users can easily track their industry of interest, stay up-to-date with the latest news, and resolve their queries across sessions.
- The portfolio segment of the dashboard has the functionality for users to download the stock recommendations as a CSV file for further deeper analysis.

**My Portfolio**

**Semiconductors**

Ticker	Name	Recommendation	Price	Date Added	Short Term Plan	Long Term Plan
NVTS	Navitas Semiconductor	BUY	9.48	2025-12-06	Monitor revenue trends and progress of product strategy transformation; be prepared for potential earnings surprises.	Hold for 3-5 years to capitalize on the substantial revenue growth expected from new products.

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**Green Energy**

Ticker	Name	Recommendation	Price	Date Added	Short Term Plan	Long Term Plan
NTPCGREEN	NTPC Green Energy	WATCH	0	2025-12-06	Track progress on new projects and policy developments in the renewable energy sector.	Hold for significant long-term growth.
GEOJITFSL	Geojit Financial Services	WATCH	0	2025-12-06	Observe market sentiment and accumulate shares gradually, focusing on value buying opportunities.	Maintain a long-term holding to benefit from sector recovery.
SAGILITY	Sagility Ltd	WATCH	0	2025-12-06	Monitor performance closely and look for entry points during market consolidation phases.	Hold for potential significant appreciation.
BCLIND	BCL Industries	WATCH	0	2025-12-06	Monitor progress on capacity expansion plans and the impact of commodity price trends.	Hold to benefit from sustained growth.
DIAMONDPOWER	Diamond Power Infrastructure	WATCH	0	2025-12-06	Expect increased trading volume and potential price rally. Exercise caution due to geopolitical risks.	Evaluate the sustainability of future operations.

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**Cryptocurrency**

Ticker	Name	Recommendation	Price	Date Added	Short Term Plan	Long Term Plan
BTC	Bitcoin	BUY	39.55	2025-12-06	Consider buying on significant dips, acknowledging continued volatility amidst weak market conditions.	Accumulate strategically, anticipating eventual price recovery.
COIN	Coinbase Global, Inc.	WATCH	269.73	2025-12-06	Watch for overall crypto market sentiment improvement and increased institutional adoption.	Consider accumulation on dips, betting on institutional growth.
DOGE	Dogecoin (Representative Altcoin)	AVOID	0	2025-12-06	Liquidate any speculative altcoin holdings; avoid new entries into meme coins or hi-risk assets.	Avoid unless a clear, sustainable trend emerges.

Fig 7: Portfolio table and results after analysis

<b>id</b>	<b>created_at</b>	<b>Ticker</b>	<b>Name</b>	<b>Sector</b>	<b>Recommendation</b>	<b>Price</b>	<b>Short Term Plan</b>
9	2025-12-06T21:54:28.121607+00:00	BTC	Bitcoin	Cryptocurrency	BUY	39.55	Consider buying on significant dips, acknowledging continued volatility amidst widespread institutional interest.
8	2025-12-06T21:54:26.872726+00:00	COIN	Coinbase Global, Inc.	Cryptocurrency	WATCH	269.73	Watch for overall crypto market sentiment improvement and increased institutional participation.
7	2025-12-06T21:54:25.522131+00:00	DOGE	Dogecoin (Representative Altcoin)	Cryptocurrency	AVOID	0.0	Liquidate any speculative altcoin holdings; avoid new entries into meme coins or levered positions.
6	2025-12-06T21:52:26.473397+00:00	MSFT	Microsoft Corp	micron technology	BUY	483.16	Consider adding to existing positions or initiating new ones, capitalizing on its current market leadership and AI integration.
5	2025-12-06T21:52:23.55277+00:00	NVDA	NVIDIA Corp	micron technology	BUY	182.41	Initiate or add to a position, especially if further market weakness in AI stocks occurs.
4	2025-12-06T21:52:20.668828+00:00	AMD	Advanced Micro Devices	micron technology	BUY	217.97	Accumulate shares on any market pullbacks or sector-specific dips, targeting potential earnings beat.
3	2025-12-06T15:50:59.432126+00:00	ORCL	Oracle Corp.	Database/Cloud	BUY	112.3	Buy for cloud growth.
2	2025-12-06T15:50:59.432121+00:00	MSFT	Microsoft Corp.	Artificial Intelligence	BUY	415.0	Accumulate on dips.
1	2025-12-06T15:50:59.432102+00:00	TSLA	Tesla Inc.	Automotive	WATCH	245.5	Monitor for breakout above \$250.

Fig 8: Portfolio exported to CSV file.

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#### 4. Addressing Technical Challenges

The main challenges I faced were maintaining accuracy and relevance in financial narratives interpreted by the LLM and managing API reliability/quotas.

Challenge	Solution Implemented
Hallucination Risk	Added strict System Instructions ("Guardrails") to the LLM prompt, forcing it to stick to the context of the ingested news and justify recommendations with evidence.
API Stability	Implemented tenacity-style retry logic with exponential backoff on all Gemini API calls to gracefully handle occasional timeouts and prevent failures from stopping the analysis.
Inconsistent Sentiment	I planned to average multiple events per sector and enforce reasoning citation checks to mitigate conflicting news tones.
Context Base Chat Analyst	The chat analyst function is grounded in the articles provided and analyzed and does not provide unnecessary details out of context.
Data Accuracy	Main challenge was to scrape recent data to get quality articles and retrieving accurate stock price for the recommended stocks.

## **5. Qualitative Analysis of results.**

This project is qualitatively successful and highly useful in five key areas, primarily by overcoming the limitations of generic AI finance tools and providing **explainable, actionable intelligence** for the user.

- Explainable and Trustworthy Reasoning: The system provides event-backed proposals that require the LLM to justify suggestions with clear citations and context from the analyzed news. This eliminates black-box recommendations, building user trust.
- Adaptive and Personalized Analysis: Users can select their specific sector (predefined or custom) and filter the articles used for analysis, ensuring the output is highly relevant and adaptive to their unique portfolio and interests, unlike static market overviews. Moreover, the articles fetched are recent within 3 day window from major US news articles and the articles are available for cross checking sources.
- Actionable Decision Support: By translating complex narratives into a simple, actionable metric (Positive, Neutral, or Risky) and providing specific stock actions (buying, selling, or watching), the system serves as a direct, high-utility input for investment decisions.
- Seamless Workflow Consolidation: The application integrates real-time news analysis, LLM reasoning, a Contextual Chat Analyst, and a persistent portfolio tracker (Supabase DB) into a single platform. This consolidates the user's research and tracking workflow, providing a high degree of qualitative utility.
- Enhanced User Clarity via Dialogue: The Contextual Chat Assistant allows users to resolve ambiguities and ask follow-up questions directly grounded in the analysis, elevating the system from a report generator to an interactive, decision-support layer.

We see that the platform is successful in assisting users to generate industry-specific insights for their choice of industry. Moreover, we see that based on results and output, the platform delivered its AI-powered insight to act as a financial intelligence tool that users can utilize as a research partner for in depth exploration of stock and portfolio optimization.

## **6. Conclusion and Future Utility**

The seamless flow I designed, from targeted news ingestion to persistent portfolio tracking, ensures the user is continually updated with the latest market narratives and equipped with LLM-generated, explainable investment rationale.

The ability to deliver explainable, adaptive financial insights directly linked to a long-term investment tracking platform is the strongest utility of MarketPulseAI.

My future roadmap is focused on enhancing this intelligence further, primarily through RAG-based systems to strengthen evidence citation and Agentic Automation to evolve the platform into an always-on financial monitoring assistant. Along with this, I would like to add personalization to the application to allow user authentication to enable a robust personal portfolio tracking system.