



AI-Powered Stock Analysis and Trading Platform

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Application Overview

- **Goal:** Revolutionize investment strategies using advanced AI algorithms and data analysis.
- **Core Function:** Provides users with tailored stock recommendations, real-time market insights, **various trading strategies, synchronous detailed portfolios, and mock of authentic stock trading.**
- **User Experience:** Features a user-friendly interface to help individuals make informed decisions.
- **Benefit:** Promotes efficient trading practices for novice and experienced investors alike.
- **Key Enabler:** Combines Artificial Intelligence with robust data sources.



Outline

- System Architecture
- Primary Functionality
- Technical Details
- Contribution



System Architecture - Distributed Design

Front-end

- **Original Page**
 - Login & Registration
 - Simple Stock
 - Multiple Stocks
 - User Management (Adding Balance, Password Change)
 - AI-driven Chart Analysis & Investment Advice
- **New Functionalities**
 - Virtual Portfolio for Mock Trading
 - Real-time Stocks & Prices
 - Trading Strategies (Coupled and Basket)
 - Brief Overview of Holding
 - Winner & Loser

Back-end

- **Server**
 - Express / Node Server
 - Route Management
- **API Design**
 - RESTFul API
 - **New API**
 - virtualPortfolio.js
 - Data Validation
 - Error Handling



System Architecture



System Architecture - Database Description

User table

Column name	Type	Description
email	VARCHAR(255)	PRIMARY KEY, Store users' email
password	VARCHAR(255) NOT NULL	Store user password
balance	DECIMAL(10, 2) DEFAULT 0.00	Store user balance in profile

```
1 CREATE TABLE Users (  
2     email VARCHAR(255) PRIMARY KEY,  
3     password VARCHAR(255) NOT NULL,  
4     balance DECIMAL(10, 2) DEFAULT 0.00  
5 );  
6
```

```
UPDATE Users  
SET virtual_balance = 100000.00  
WHERE email = 'vincent.tong0226@rutgers.edu';
```

The screenshot shows a database client interface with a 'Result Grid' tab. It displays the contents of the 'Users' table. The columns are 'email', 'password', and 'balance'. There are four rows of data. The first row has a blue arrow icon to its left. The second row is highlighted in blue.

email	password	balance
vincent.tong0226@rutgers.edu	\$2a\$10\$dVkyceaeEly3kYLYqB8OcQfHtTbmd...	1015.50
Yanbo	\$2a\$10\$Kb0tW7uR2wZE8kYGUUu8.JqSaNFPe...	100.00
yanbotong666@gmail.com	\$2a\$10\$YakH9UR/elt56ptShbuehzVATnUslV...	967.50

```
29 ALTER TABLE Users  
30 ADD COLUMN virtual_balance DECIMAL(10, 2) DEFAULT 100000.00;  
31
```



System Architecture - Database Description

Stock transaction table

Column name	Type	Description
timestamp	TIMESTAMP DEFAULT CURRENT_TIMESTAMP PRIMARY KEY,	To store the timestamp of every transactions. Avoid primary key conflict
email	VARCHAR(255) NOT NULL,	Store the user's email of the transaction
stock_name	VARCHAR(255)	
number	INT	Store the number of stock user bought in this transaction
current_price	DECIMAL(10, 2) NOT NULL,	
is_sold	BOOLEAN DEFAULT FALSE	It will change to 0 if the user sold all of the stock
bought__price	DECIMAL(10, 2) NOT NULL	It will get the price of the stock when it is bought

```
CREATE TABLE stock_transactions (  
    timestamp TIMESTAMP DEFAULT CURRENT_TIMESTAMP PRIMARY KEY,  
  
    email VARCHAR(255) NOT NULL,  
    `stock_name` VARCHAR(255),  
    number INT,  
    current_price DECIMAL(10, 2) NOT NULL,  
  
    `is_sold` BOOLEAN DEFAULT FALSE,  
  
    FOREIGN KEY (email) REFERENCES Users(email)  
);
```

```
ALTER TABLE stock_transactions  
ADD COLUMN is_virtual BOOLEAN DEFAULT TRUE;
```

```
ALTER TABLE stock_transactions DROP PRIMARY KEY;  
  
ALTER TABLE stock_transactions  
ADD COLUMN id INT NOT NULL AUTO_INCREMENT PRIMARY KEY FIRST;
```



System Architecture - API interface

Function	API	HTTP Method
User Login	/api/login	POST
User Registration	/api/register	POST
Password Change	/api/change-password	PUT
Deposit Money	/api/deposit	POST
Sell Stock	/api/sellStock	POST
See Holding Stocks	/api/buyAndViewStocks	GET
Get Stock Trend	/api/stock-trend	GET



API Interface (Continued)

Function	API	HTTP Method
Chart Analysis	/api/chartAnalysis	GET
AI Portfolio Prediction	/api/aiPortfolioPrediction	GET/POST
AI Personal Advice	/api/aiPersonalAdvice	GET/POST
AI Advice on Single Stock	/api/singleAdvice	GET
AI Advice on Multiple Stocks	/api/multipleAdvice	GET
Stock Q&A	/api/stockQA	POST

New API

- virtualPortfolio.js
 - Achieve new functionalities in the virtualPortfolio.html, including the instant trading, portfolio summary, batch trading, and basket orders.

Function	API	HTTP Method
Single Instant Buy (Virtual)	api/virtual-buy	POST
Single Sell (Virtual)	api/virtual-sell	POST
Get Portfolio Summary/Holdings	api/virtual-portfolio	GET
Get Single Stock Price Timeline	api./price-timeline/:symbol	GET

New API (Continued)

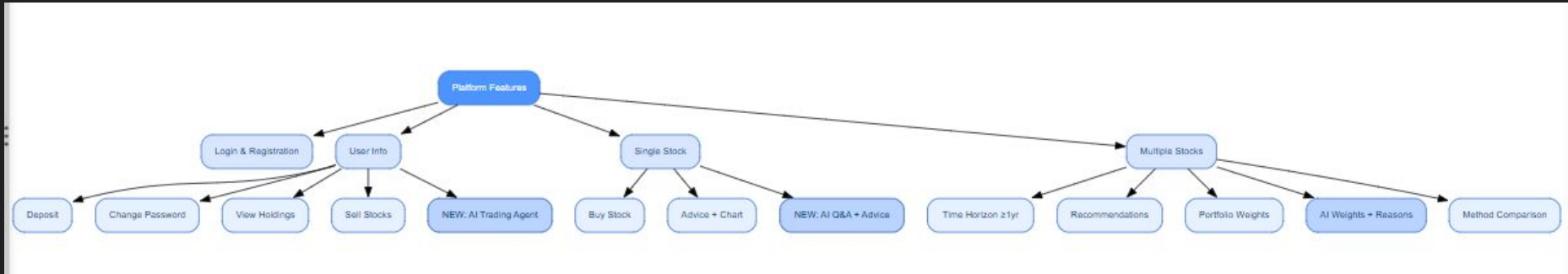
Function	API	HTTP Method
Get Total Portfolio Value Timeline	api//portfolio-timeline	GET
Backtesting	api/backtest	POST
Batch Buy (Multi-Stock)	api/batch-buy	POST
Batch Sell (Multi-Stock)	api/batch-sell	POST
Get Aggregated Basket Orders	api/basket-orders	GET
Join Basket Order	api/basket-join	POST
Execute Basket Order	api/basket-execute	POST



Primary Functionality

- Single stock prediction
- Multiple stock prediction
- User Information
- AI agent for stock forecasting

Primary Functionality - Module Overview





Key Functionality - Login logistics

- **Register: first time into the stock analysis system**
 - Username: user defines
 - Password: user defines
- **Login: after registration, register information are stored in the database**
 - Username: user input
 - Password: user input
- **Error handling:**
 - If user inputs a wrong password or nonexistent username. It will give alert

The image displays two overlapping user interface forms for a 'Stock Platform'. The background form is the 'Sign in' page, and the foreground form is the 'Create Account' page.

Sign in Form (Background):

- Title: **Stock Platform**
- Subtitle: Sign in to your account
- Fields: Username, Password
- Button: **Sign in**
- Link: Don't have an account? [Register here](#)

Create Account Form (Foreground):

- Title: **Create Account**
- Subtitle: Join our stock portfolio analysis platform
- Fields: Username, Password, Confirm Password
- Button: **Create Account**
- Link: Already have an account? [Sign in here](#)



Single Stock Module - Single Stock Analysis

- **User input**
 - **Stock ticker:** User chooses the ticker symbol
 - **Initial capital:** User inputs the amount and it can get suggestions about the stock ticker
 - **Real price:** User can view the real-time-price of the stock ticker
- **Trend chart:** User can view the historical price of the stock ticker and can click on specific date to check the closing price



Investment Advice

Basic Investment Advice

Investment Strategy:
Hold the stock.

Suggested Trading Frequency:
Quarterly

Real Price:
\$0

Stop Loss Price:
\$0

Position Size:
0 shares

Risk Analysis

Volatility:
0.00%

ATR:
0.00

Max Drawdown:
100.00%

Value at Risk (95%):
4.17%

Conditional VaR (95%):
11.33%

Risk Components

Volatility Component:
0.00

Beta Component:
1.00

Max Drawdown Component:
1.00

VaR Component:
0.04

Single Stock Module - Single Stock Prediction Logic

SMA(10) vs. LMA(horizon)	Investment Horizon (Risk Factor)	Stop-Loss Percentage (Control)	Suggested Action
$SMA(10) > LMA(horizon)$	Quarterly (Lower Risk)	Smaller	BUY
$SMA(10) > LMA(horizon)$	Annually (Higher Risk)	Larger	BUY
$SMA(10) = LMA(horizon)$	Any	Proportional to Horizon	SELL
$SMA(10) < LMA(horizon)$	Any	Proportional to Horizon	HOLD



Single Stock Module - Single Stock AI Analysis

Analysis Metrics

- Analysis metrics
- Strategy
- Frequency
- currentPrice
- maxDrawdown
- Var
- Cvar
- atr
- riskMetrics
- Volatility

Analysis Content

- Overall Market Analysis
- Risk Assessment
- Technical Analysis
- Investment Strategy
- Final Recommendation

AI Chart Analysis

As a professional stock market analyst, I've reviewed the provided data for "huohufly". However, it's crucial to highlight a significant limitation: "the provided historical price data is extremely limited and exhibits a flat price of \$6.5 across all available dates." This makes any in-depth technical or trend analysis highly speculative and unreliable. Furthermore, the "Current Price" is marked as "undefined," which is a critical missing piece of information for real-time trading decisions.

Despite these limitations, I will provide an analysis based on the available data, emphasizing the caveats.

Stock Analysis: huohufly

Data Snapshot:

- * **Stock Ticker:** huohufly
- * **Time Period Analyzed:** 1251 days (though only a small fraction is provided)
- * **Provided Historical Price Data:** A series of dates with a constant price of \$6.5.
- * **Current Price:** Undefined.
- * **Risk Metrics:** Volatility: "Hold the stock"; Max Drawdown: "\$0".
- * **Risk Components:** VAR: "0.04"; CVAR: "0 shares"; ATR: "Quarterly".

1. Overall Market Analysis (Historical Market Position, Price Trends)

Historical Market Position:

Based on the provided data, huohufly has traded at a consistent price of "\$6.5" for every single day listed. There is no historical data suggesting any deviation from this price point within the given timeframe. This lack of price fluctuation is highly unusual for a publicly traded stock and suggests either a very stable, potentially illiquid, or a placeholder asset within a simulated environment.

Price Trends:

The "trend" in the provided data is unequivocally "flat". The price has not moved up or down, indicating zero price appreciation or depreciation over the period for which data is available. This suggests a complete lack of market momentum or price discovery.

Actionable Insight: The provided data does not allow for any meaningful trend analysis. The consistent price of \$6.5 for an extended period makes it impossible to identify historical patterns or future directional biases.

2. Risk Assessment

Volatility Analysis:

The provided "Risk Metrics" states "Volatility: Hold the stock." This is a very unusual assessment given the flat price action. Typically, volatility refers to the degree of variation in trading price over time. A price of \$6.5 consistently implies "zero volatility" in terms of price swings. The instruction to "Hold the stock" might be an automated response based on a predefined threshold or a default recommendation when insufficient data for adverse volatility is present.

Maximum Drawdown:

The "Risk Metrics" indicates a "Maximum Drawdown: \$0". This is consistent with the observed flat price. A drawdown measures the peak-to-trough decline during a specific period. If the price has never moved from \$6.5, then no loss from a previous peak has occurred, resulting in a \$0 drawdown.

Risk Score:

While a specific "Risk Score" is not provided, we can infer the following:

* **Low Price Volatility:** The constant price suggests very low immediate price risk "if" the data is representative of actual market behavior.

Single Stock Module - AI for general questions

- Check API Key
- Initialize Google Gemini with Gemini API
- Define /Chat API Endpoint
- Receive User Message
- Send Message to Gemini API
- Extract AI Response
- Print AI Response with Typing Effect
- Send AI Response to Client
- Handle Errors Gracefully

AnalysisPurchaseAI Q&A

AI Stock Q&A

What is the market trend of Amazon?

Ask

As a professional stock investment advisor, I will provide an objective analysis of Amazon's (AMZN) market trend, considering its current standing, recent performance, and relevant influencing factors.

****Amazon (AMZN) Market Trend Analysis:****

Amazon, a dominant player in e-commerce, cloud computing (AWS), digital advertising, and increasingly, artificial intelligence, generally exhibits a strong, albeit often volatile, upward market trend over the long term. This trend is driven by several fundamental factors:

****1. E-commerce Dominance and Growth:****

- * ****Persistent Demand:**** Despite economic headwinds, the fundamental shift towards online shopping continues to benefit Amazon. Its vast selection, competitive pricing, and efficient logistics network (Prime) create a powerful moat.
- * ****International Expansion:**** While mature markets remain crucial, Amazon continues to invest in and expand its presence in emerging

2. ****AWS Dominance and Cloud Computing Expansion:****

* ****Analysis:**** Amazon Web Services (AWS) remains a critical growth engine and highly profitable segment. The demand for cloud computing services, driven by digital transformation across industries, AI development, and data analytics, continues to be strong. While competition is intensifying from Microsoft Azure and Google Cloud, AWS maintains a significant market share and a robust innovation pipeline.

* ****Trend Indicator:**** AWS's revenue growth has been a key indicator, and while it has experienced some deceleration from its peak, it continues to post substantial double-digit growth. Profitability from AWS often subsidizes other business segments.

* ****Future Outlook:**** The long-term trend for cloud computing remains exceptionally strong. As businesses increasingly rely on scalable, secure, and cost-effective infrastructure, AWS is well-positioned to capitalize on this secular growth trend. The rise of generative AI is expected to further boost demand for cloud resources.

3. ****Advertising Revenue Growth:****

* ****Analysis:**** Amazon's advertising business has emerged as a significant and highly profitable revenue stream. Leveraging its vast customer data and reach within its e-commerce platform, Amazon offers effective advertising solutions for brands looking to reach consumers at the point of purchase.

* ****Trend Indicator:**** Advertising revenue has consistently shown strong, often accelerating, growth rates, contributing significantly to overall profitability.

* ****Future Outlook:**** This segment is expected to continue its impressive growth trajectory as

Single Stock Module - Code for AI Q&A

```
1 // CHANGED: Import Google Generative AI
2 const { GoogleGenerativeAI } = require("@google/generative-ai");
3
4 // CHANGED: Initialize Gemini AI Client
5 const genAI = new GoogleGenerativeAI(process.env.GEMINI_API_KEY);
6 const model = genAI.getGenerativeModel({ model: "gemini-2.5-flash-lite" });
7
8 router.post('/ask', async (req, res) => {
9   try {
10     const { question } = req.body;
11     if (!question) {
12       return res.status(400).json({ error: "Question is required" });
13     }
14
15     const prompt = `
16 You are a professional stock investment advisor. Please answer the following question in English, ensuring your answer is professional, accurate and in English.
17
18 Question: ${question}
19
20 Please consider the following aspects:
21 1. If the question is about a specific stock, provide a detailed analysis.
22 2. If the question is about investment strategy, provide concrete advice.
23 3. If the question is about market trends, provide an objective analysis.
24 4. If the question is about risk control, provide practical suggestions.
25
26 Make sure your answer is:
27 1. Professional and accurate
28 2. Easy to understand
29 3. Specific and actionable
30 4. Includes necessary risk warnings
31
32 Please answer ONLY in English, no matter what language the question is.
33 `;
34
35     // CHANGED: Call Gemini API
36     const result = await model.generateContent(prompt);
37     const response = await result.response;
38     const answer = response.text();
39
40     res.json({
41       answer,
42       timestamp: new Date().toISOString()
43     });
44
45   } catch (error) {
46     console.error("Error generating AI answer:", error);
47     res.status(500).json({
48       error: "Failed to generate answer"
49     });
50   }
51 });
52
53 module.exports = router;
```

```
21 Question: ${question}
22
23 Please consider the following aspects:
24 1. If the question is about a specific stock, provide a detailed analysis.
25 2. If the question is about investment strategy, provide concrete advice.
26 3. If the question is about market trends, provide an objective analysis.
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40 const response = await result.response;
41 const answer = response.text();
42
43 res.json({
44   answer,
45   timestamp: new Date().toISOString()
46 });
47
48 } catch (error) {
49   console.error("Error generating AI answer:", error);
50   res.status(500).json({
51     error: "Failed to generate answer",
52     details: error.message
53   });
54 }
55
56
57 module.exports = router;
```

Single Stock Module - Code for AI Personal & Investment Advice

```
require("dotenv").config();
const express = require("express");
const router = express.Router();
// CHANGED: Import Google Generative AI
const { GoogleGenerativeAI } = require("@google/generative-ai");
const { pool } = require("../utils/db");

// CHANGED: Initialize Gemini AI Client
const genAI = new GoogleGenerativeAI(process.env.GEMINI_API_KEY);
const model = genAI.getGenerativeModel({ model: "gemini-2.5-flash-lite" });

router.get('/ai-personal-advice', (req, res) => {
  res.status(405).json({ error: 'Method Not Allowed' });
});

router.post('/ai-personal-advice', async (req, res) => {
  console.log(`[aiPersonalAdvice.js] POST /api/ai-personal-advice called, body:`, req.body);
  try {
    const { email } = req.body;
    if (!email) {
      return res.status(400).json({ error: "Email is required" });
    }

    const [transactions] = await pool.query('SELECT * FROM stock_transactions WHERE email = ?', [email]);
    const [user] = await pool.query('SELECT * FROM users WHERE email = ?', [email]);
    if (user[0]) {
      return res.status(404).json({ error: "User not found" });
    }

    const prompt = `
You are a professional stock investment advisor. Here are the user's historical stock transactions and current account balance. Please analyze the user's investm
User's transaction history:
${JSON.stringify(transactions, null, 2)}

User's current balance: ${user[0].balance}
`;
  }
});
```

```
require("dotenv").config();
const express = require("express");
const router = express.Router();
// CHANGED: Import Google Generative AI
const { GoogleGenerativeAI } = require("@google/generative-ai");

if (!process.env.GEMINI_API_KEY) { // CHANGED: Check for Gemini key
  console.error("❌ ERROR: Missing GEMINI_API_KEY in .env file!");
  process.exit(1);
}

// CHANGED: Initialize Gemini AI Client
const genAI = new GoogleGenerativeAI(process.env.GEMINI_API_KEY);
const model = genAI.getGenerativeModel({ model: "gemini-2.5-flash-lite" });

router.post('/chat', async (req, res) => {
  try {
    const userMessage = req.body.message;
    if (!userMessage) {
      return res.status(400).json({ error: "Message is required" });
    }

    // CHANGED: Call Gemini API
    const result = await model.generateContent(userMessage);
    const response = await result.response;
    const aiResponse = response.text();

    res.json({ response: aiResponse });
  } catch (error) {
    console.error("❌ Error calling AI API:", error.message);
    res.status(500).json({ error: "Internal Server Error" });
  }
});

module.exports = router;
```

Single Stock Module - Single Stock Purchase



Input

- Stock Symbol: user input
- Quantity: user input

If user purchases successfully, it will give the message: Stock purchase successful

A UI mockup for a stock purchase interface. It features three tabs at the top: 'Analysis', 'Purchase' (highlighted in blue), and 'AI Q&A'. Below the tabs, there's a section for 'Available Balance' showing '\$1635.00'. The main section is titled 'Stock Purchase' and includes a 'Select Stock:' dropdown menu with 'huohuf1y' selected. Below that is a 'Quantity:' input field with the placeholder text 'Enter quantity to buy'. A large green 'Buy Stock' button is positioned below the input field. At the bottom, a light green message box displays 'Stock purchase successful'.

Analysis Purchase AI Q&A

Available Balance: **\$1635.00**

Stock Purchase

Select Stock:

huohuf1y

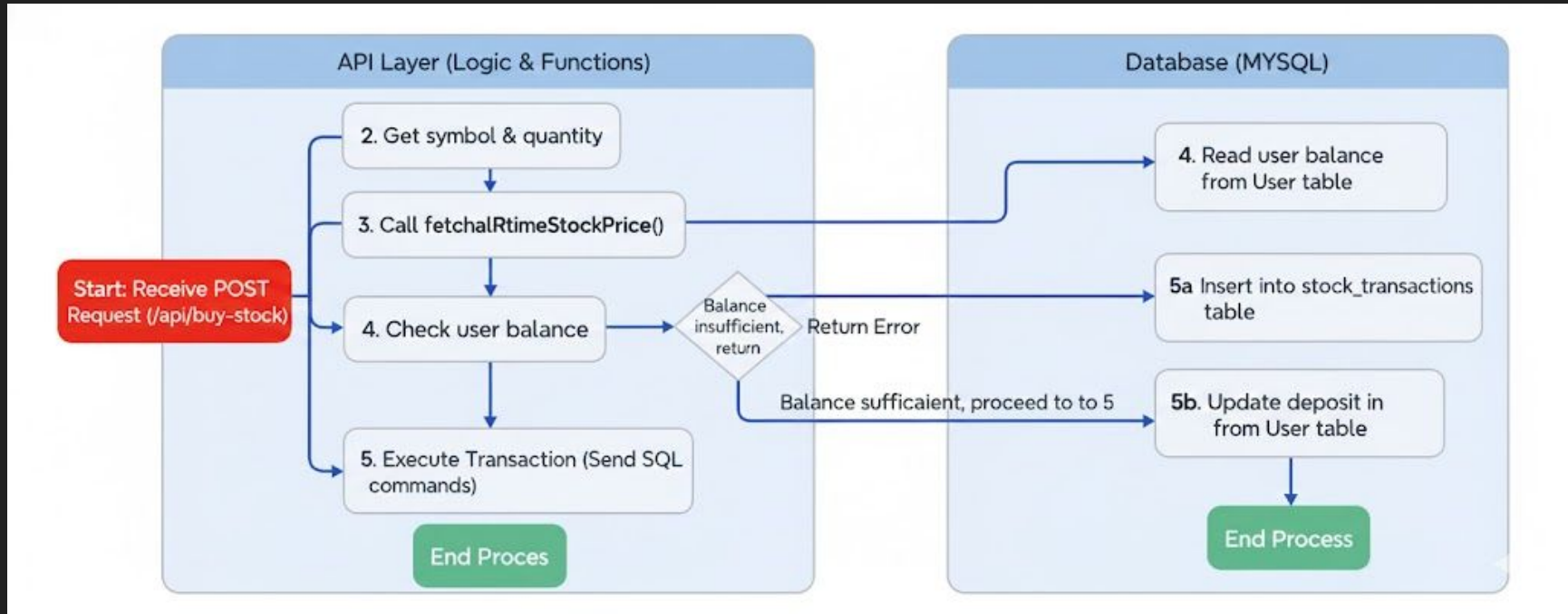
Quantity:

Enter quantity to buy

Buy Stock

Stock purchase successful

Single Stock Module - Single Stock purchase workflow





Multiple Stock Module



Multiple stock module - Multiple Stock Prediction

- **Input**
 - Investment horizon
 - The multiple of stocks you want to input
- **Output:**
 - Recommend portfolios
 - Portfolio weights
 - AI optimized weights(traditional and AI method)

StockAgent AISingle StockMultiple StocksVirtual PortfolioUser Info & AI AgentLogout

Multiple Stock Portfolio Analysis

Select Stocks

<input type="checkbox"/> huohuf1w	<input type="checkbox"/> huohuf1y	<input type="checkbox"/> huohuf2m	<input type="checkbox"/>
<input type="checkbox"/> huohuf3m	<input type="checkbox"/> huohuf6m	<input type="checkbox"/> huohuf9m	<input type="checkbox"/>
<input type="checkbox"/> plbpln1m	<input type="checkbox"/> plbpln3m	<input type="checkbox"/> plbpln6m	<input type="checkbox"/>
<input type="checkbox"/> plop1n1m	<input type="checkbox"/> plop1n1w	<input type="checkbox"/> plop1n1y	<input type="checkbox"/>
<input type="checkbox"/> plop1n3m	<input type="checkbox"/> plop1n6m	<input type="checkbox"/> plop1non	<input type="checkbox"/>

Multiple Stock Analysis Suggestion

Investment Horizon:
1 year

Number of stocks to invest in:
4

Get Stock Recommendations

Analyze Portfolio Weights

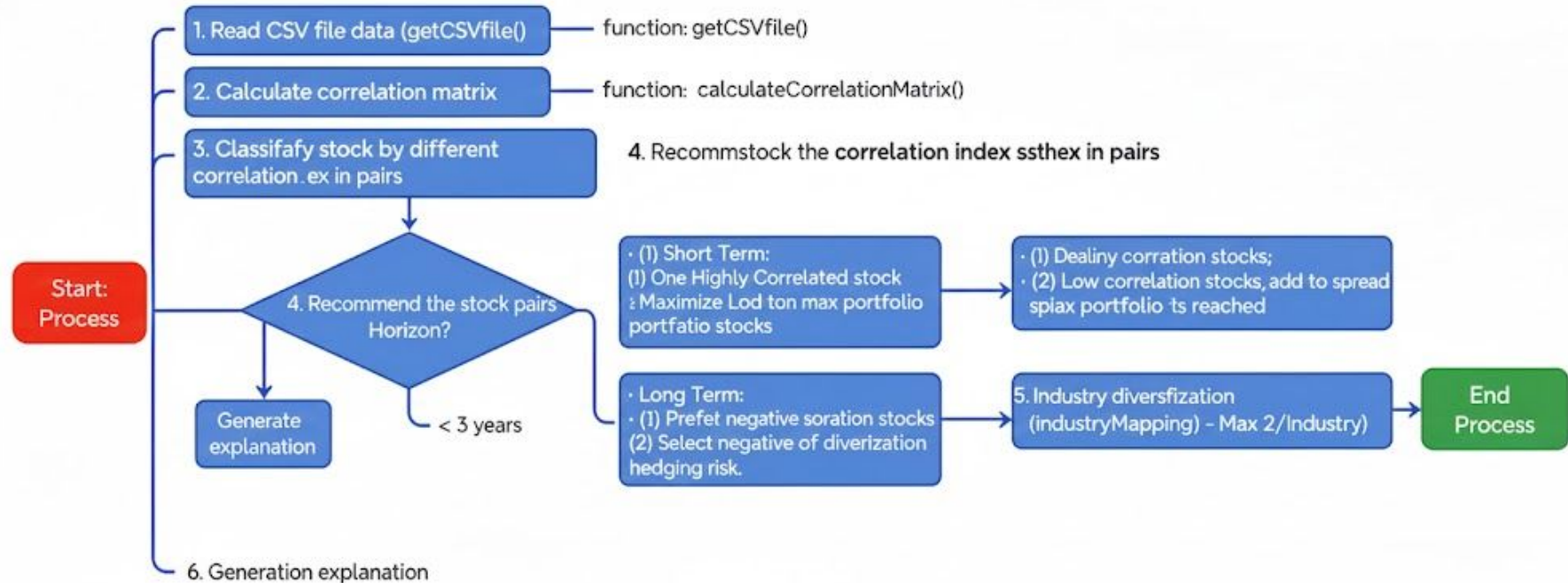
Get AI-Optimized Weights

Compare Methods



Multiple stock module - Prediction process

Key points - Correlation matrix!



Multiple stock module - Prediction Correlation Matrix



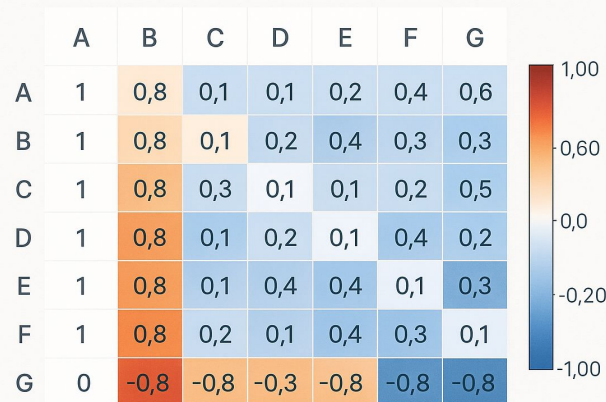
Correlation matrix is a symmetric matrix used to represent pair-to-pair correlations between a set of variables,

- **1: Perfectly positive correlation.**
- **-1: Completely negative correlation.**
- **0: No correlation.**

$$\text{Correlation}(A, B) = \frac{\text{Cov}(A, B)}{\sqrt{\text{Var}(A) \times \text{Var}(B)}}$$

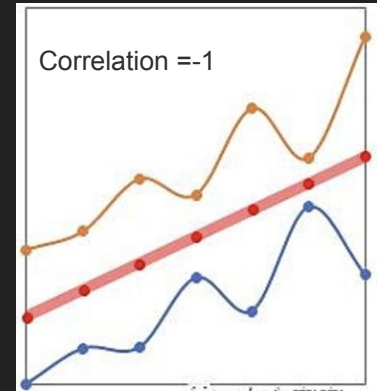
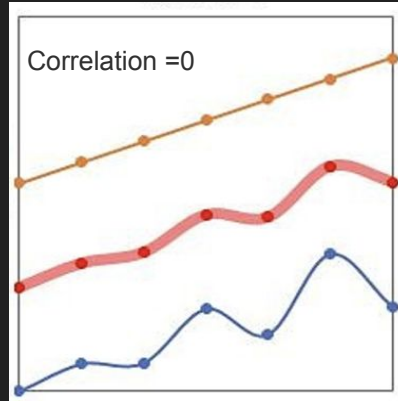
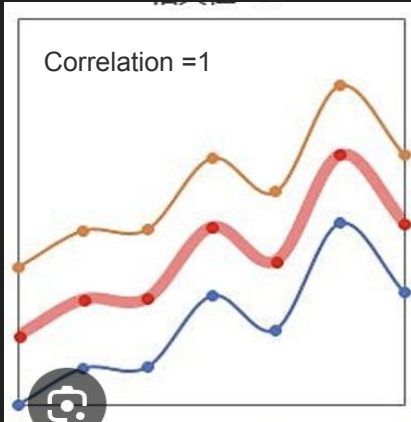
- **Covariance:** Measures the degree to which the prices of two stocks move in tandem.
- **Variance:** A measure of how much the price of a single stock fluctuates.

CORRELATION MATRIX

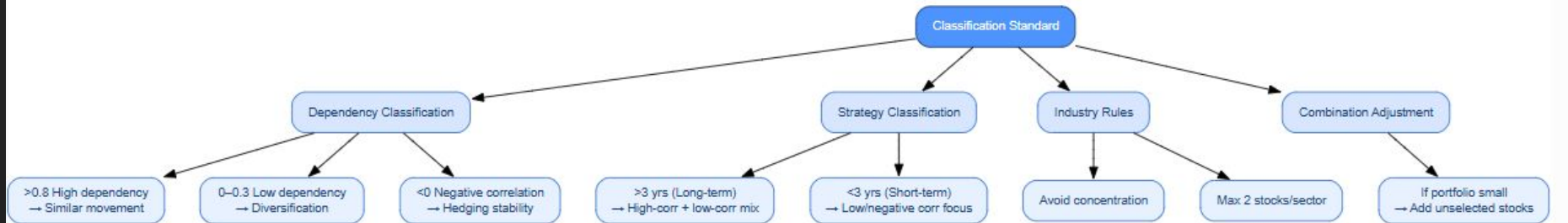


Multiple stock module - Prediction Correlation Matrix

- If two stocks are **highly correlated** their price changes may be similarly affected by the same market event, and risk cannot be spread.
- If two stocks are **negatively correlated**, price movements can be partially hedged, reducing the volatility of the portfolio.



Multiple stock module - Prediction Classification Standard



Multiple stock module - Logistics of Module Portfolio Weights

- **Initial Weight Calculation and Adjustments**

- The system first calculates an Initial Weight for each stock by adjusting it based on its individual risk and risk-adjusted return (Sharpe ratio).
- **Risk-based Adjustment:** $\text{Risk Adjustment} = \text{risk} / \text{total risk}$
- **Sharpe Ratio Adjustment:** $\text{Sharpe Adjustment} = 1 + (\text{sharpeRatio} / 2)$
- **Combined Initial Weight:** $\text{InitialWeight} = \text{Risk Adjustment} * \text{Sharpe Adjustment}$

- **Correlation Adjustment**

- Next, the initial weights are adjusted based on the Correlation Matrix.
- Logic: Stocks that are highly correlated will have their weights reduced because they do not effectively spread risk. Stocks that are negatively correlated offer a hedging benefit, reducing the portfolio's volatility.

- **Final Normalization**

- After the initial and correlation adjustments, the sum of all calculated weights will generally not equal 1. The Normalization step ensures the total allocation equals 100%.
- Procedure: The system takes the final adjusted weight for each stock and divides it by the sum of all adjusted weights.
- Validation: The system must ensure the sum of all weights equals 1.
- **Final Normalized Weight of Stock i =** $\text{Adjusted Weight of Stock } i / \text{Sum of All Stocks' Adjusted Weight}$
- Ensures that **100%** of the designated investment capital is allocated across the portfolio.



Multiple stock module - Calculate Weights by AI

AI-Optimized Portfolio Analysis

AI Analyst's Reasoning

Stock 3 exhibits the lowest risk and a negative Sharpe Ratio, but its returns, while low, are consistently less volatile than the other options. Given the very poor Sharpe Ratios and higher volatilities of Stocks 1, 2, and 4, allocating the entire portfolio to Stock 3 provides the most stable, albeit low-return, outcome.

Traditional Weights

Stock	Weight
huohuf1y	19.32%
huohuf6m	7.75%
plbpln3m	66.34%
plop1n1w	6.60%

AI-Optimized Weights

Stock	Weight
huohuf1y	0.00%
huohuf6m	0.00%
plbpln3m	100.00%
plop1n1w	0.00%

Weight Adjustments by AI

Stock	Adjustment	Direction
huohuf1y	-19.32%	decrease
huohuf6m	-7.75%	decrease
plbpln3m	33.66%	increase
plop1n1w	-6.60%	decrease

Input:
Multiple stocks

Output:
Weights of multiple
stocks(Adjustment and AI analysis)

Multiple stock module - Calculate weights by AI



Import modules: Uses Express and Google Gemini.

Initialize Google Gemini API with apiKey in the env file.

Define POST endpoint /ai-predict:

- Accepts stock features from client.
- Constructs a prompt based on these features.
- Sends the prompt to Google Gemini for portfolio weight suggestions.
- Parses and normalizes AI's response.
- Returns the weights as a JSON array summing to 1.

Multiple stock module - AI Consideration Advantages



AI Analysis Preparation

- Constructs structured prompts
- Incorporates all stock feature information
- Sets analysis objectives and constraints

AI Model Processing

- Utilizes Gemini model for analysis
- Considers risk-adjusted returns
- Evaluates stock correlations
- Analyzes overall portfolio risk
- Takes market conditions into account

Traditional vs AI Optimization Methods

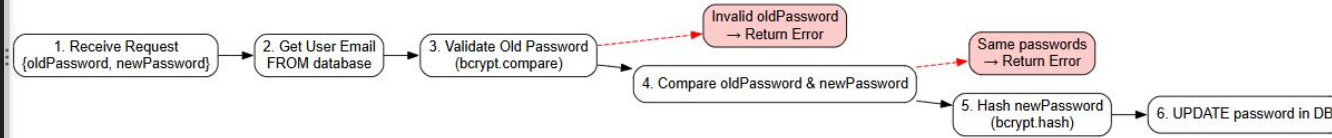
Factor	Traditional Method	AI Method
Returns Analysis	✓ Basic return calculation	✓ Advanced return analysis with market context
Risk Assessment	✓ Standard deviation	✓ Multiple risk metrics (VaR, Drawdown)
Market Conditions	✗ Not considered	✓ Current market environment analysis
Correlation Analysis	✓ Basic correlation matrix	✓ Advanced correlation with market trends
Dynamic Adjustment	✗ Static weights	✓ Dynamic weight adjustment



User Information Module



User Information Module - Change Password



StockAgent AI

Single StockMultiple StocksVirtual PortfolioUser Info & AI AgentLogout

User Information & Actions

Sell StockChange PasswordDeposit AmountLaunch AI Agent

Change Password

Old Password:

Enter your old password

New Password:

Enter your new password

Change Password



User Information Module - Deposit Money

1. Receive Request
{amount}

2. UPDATE user balance
in database

3. Release DB connection

StockAgent AI

[Single Stock](#) [Multiple Stocks](#) [Virtual Portfolio](#) [User Info & AI Agent](#) [Logout](#)

User Information & Actions

[Sell Stock](#)

[Change Password](#)

[Deposit Amount](#)

[Launch AI Agent](#)

Deposit Amount

Current Balance: **\$1835.00**

Amount:

Enter amount to deposit

Deposit

StockAgent AI

127.0.0.1:3000 says
deposit successful

[Portfolio](#) [User Info & AI Agent](#) [Logout](#)

User Information & Actions

[Sell Stock](#)

[Change Password](#)

[Deposit Amount](#)

[Launch AI Agent](#)

Deposit Amount

Current Balance: **\$1835.00**

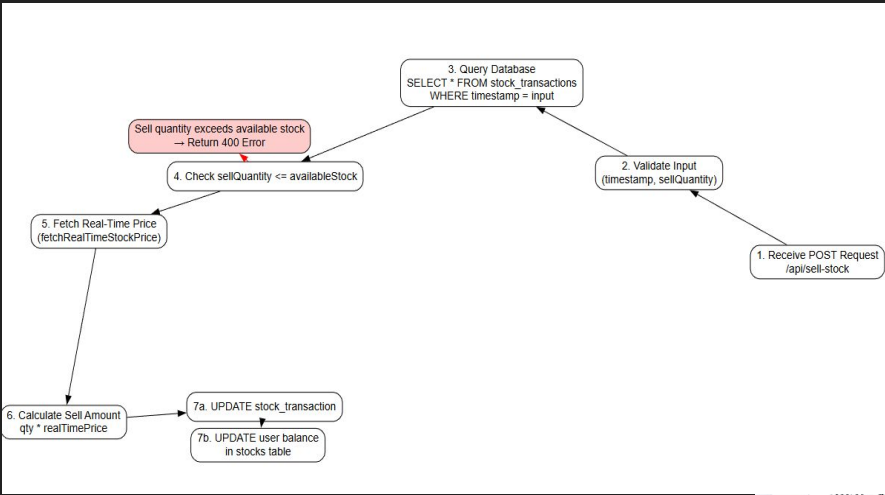
Amount:

200

Deposit



User Information Module - Sell Stock



2025-12-03 22:27:36

huohuf1w

10

Sell

2025-12-03 22:27:56

huohuf1y

20

Sell



AI personalized Investment Advice

User input

- User email
- User transaction history
- User current balance

Analysis Content

- Investment style
- Analysis of Trading Patterns
- Risk analyze
- Recommendations for action steps

AI Personalized Investment Advice

Based on your historical transactions and account balance.

Get AI Personalized Investment Advice

Hello Vincent, Thank you for providing your transaction history and current account balance. I've reviewed your data to understand your investment activity and identify areas for personalized advice.

****Analysis of Your Investment Style:**** Based on your transaction history, here are my observations about your investment style: *

****Focus on Large-Cap Tech Stocks:**** You show a clear preference for established technology companies, with significant activity in Apple (AAPL), Amazon (AMZN), Google (GOOGL), and Nvidia (NVDA). This suggests an interest in growth-oriented companies with strong market positions. *

****Active Trading:**** You've made multiple buy and sell transactions for several stocks within a short period (e.g., AAPL, AMZN, AMD). This indicates an inclination towards active trading rather than a purely buy-and-hold strategy. *

****Exploration of Other Sectors:**** While tech is dominant, you've also ventured into other sectors like industrials (UPS) and financial services (JPM, V), and even a seemingly speculative stock ("huohuf1w", "huohuf2m", "huohuf1y"). *

****Virtual Trading:**** All your transactions are marked as virtual. This is a great way to learn and test strategies without real financial risk. It's

strategies without real financial risk. It's important to remember that simulated trading does not perfectly replicate the psychological pressures and real-world complexities of live investing. *

****Recent Activity Focused on Accumulation:**** Your most recent transactions (November 25th onwards) show you consistently buying shares in AAPL, AMZN, TSLA, and starting to accumulate ORCL, V, and UPS. You also have a few open positions in NVDA, ORCL, V, AAPL, UPS, and TSLA. *

****Zero-Price Transactions:**** Some transactions for "huohuf1w" and "huohuf1y" show a "current_price" of "0.00". This could indicate these are newly listed virtual stocks, have zero current market value in your simulation, or represent a specific scenario within your trading platform. These are highly speculative and should be approached with extreme caution. *

****Current Portfolio Snapshot (Based on your open positions):**** This is a snapshot of your holdings as of your latest transactions. Please note that "current_price" in your data refers to the price at the time of the transaction, not the absolute current market price. *

****Apple (AAPL):**** * 10 shares @ \$277.97 * 50 shares @ \$283.09 * 49 shares @ \$276.81 * 5 shares @ \$284.01 * ****Total AAPL: 114 shares**** (Average purchase price around \$279.88) *

****Amazon (AMZN):**** * 10 shares @ \$238.04 * 10 shares @ \$236.88 * 51 shares @ \$223.83 * 50 shares @ \$221.24 * 9 shares @ \$220.60 * 4 shares @ \$216.71 * ****Total AMZN: 134 shares**** (Average purchase price around \$225.58) *

****Tesla (TSLA):**** * 20 shares @ \$418.37 * 51 shares @ \$400.16 * 10 shares @ \$403.58 * ****Total TSLA: 81 shares**** (Average purchase price



Virtual Portfolio



Core Features

- Virtual stock trading with \$100,000 initial balance
- Real-time price tracking via Finnhub API
- Automatic portfolio updates every 30 seconds
- Virtual balance management

Virtual Portfolio Tracker

Single Trade

Batch Orders

Hedge Analysis

Buy Stocks

Selected Stocks:

Select stocks from the list below

Buy Date (Optional - for historical simulation)

YYYY-MM-DD

Click to select date in English format (Year-Month-Day)

Buy Selected Stocks

Select Stocks

Search stocks...

☐ AAPL

☐ ABBV

☐ ABT

☐ ADBE

☐ AMD

☐ AMGN

☐ AMZN

☐ AVGO

☐ AXP

☐ BA

Portfolio Summary

Virtual Balance
\$82,179.70

Total Invested
\$7,513.07

Total P/L
\$2,702.55

P/L %
+35.97%

Holdings

Symbol	Qty	Avg Price	Current	P/L	P/L %	Action
NVDA	20	\$88.48	\$184.22	\$1,914.80	+108.21%	Sell
V	3	\$156.69	\$325.42	\$506.18	+107.68%	Sell
VZ	2	\$20.82	\$41.12	\$40.59	+97.48%	Sell
PFE	2	\$13.17	\$25.56	\$24.78	+94.08%	Sell
AAPL	15	\$265.74	\$280.29	\$218.20	+5.47%	Sell
UPS	1	\$94.22	\$96.06	\$1.84	+1.95%	Sell
TMUS	1	\$204.09	\$207.61	\$3.52	+1.72%	Sell
ABBV	4	\$230.24	\$228.40	-\$7.36	-0.80%	Sell

Trading Features

- Single Trade: Buy individual stocks with quantity selection
- Batch Orders: Execute multiple buy/sell orders simultaneously
- Hedge Analysis: Analyze stock correlation to find hedging opportunities and reduce portfolio risk

Single Trade

Batch Orders

Hedge Analysis

Batch Order Entry

Create multiple buy/sell orders at once

Buy

Select stock

Qty

BUY

+ Add Order

Order Date (Optional)

YYYY-MM-DD

Click to select date in English format

Execute All Orders

Single Trade

Batch Orders

Hedge Analysis

Buy Stocks

Selected Stocks:

Select stocks from the list below

Buy Date (Optional - for historical simulation)

YYYY-MM-DD

Click to select date in English format (Year-Month-Day)

Buy Selected Stocks

Select Stocks

Search stocks...

☐ AAPL

☐ ABBV

☐ ABT

☐ ADBE

☐ AMD

☐ AMGN

☐ AMZN

☐ AVGO

☐ AXP

☐ BA

Single Trade

Batch Orders

Hedge Analysis

Hedge Analysis (Risk Reduction)

Analyze correlation between stocks to find hedging opportunities. Stocks with negative correlation can reduce portfolio risk when held together.

Select Stocks to Analyze (2-5 stocks):

☐ GOOGL

☐ GS

☐ HD

☐ HON

☐ IBM

☐ INTC

☐ JNJ

☐ JPM

☐ KO

☐ LLY

☐ LMT

☐ LOW

☐ MA

☐ MCD

☐ META

☐ MMM

☐ MRK

Analyze Hedging Opportunities

Correlation Matrix

	ABBV	AMGN	BA
ABBV	1.00	0.44	-0.14
AMGN	0.44	1.00	0.10
BA	-0.14	0.10	1.00

High (>0.7)

Moderate

Low

Negative (Hedge)

Hedging Suggestions

ABBV + BA

$r = -0.1354$

+ Add to Batch

Buy ABBV + Buy BA (low correlation for diversification)

AMGN + BA

$r = 0.0958$

+ Add to Batch

Buy AMGN + Buy BA (low correlation for diversification)

Risk Warnings (High Correlation)

No high-correlation risk detected.





Portfolio Analysis

- Portfolio Summary
 - Virtual balance, total invested, current value
- Profit/Loss Tracking
 - Absolute and percentage calculations
- Winners & Losers:
 - Top 5 performing and worst performing stocks
- Holdings Details:
 - Symbol, quantity, avg buy price, current price, P/L
- Backtesting:
 - Test strategies on historical data with metrics (max drawdown, volatility)

Holdings						
Symbol	Qty	Avg Price	Current	P/L	P/L %	Action
V	3	\$156.69	\$329.61	\$518.76	+110.36%	<button>Sell</button>
NVDA	20	\$88.48	\$179.59	\$1,822.20	+102.97%	<button>Sell</button>
VZ	2	\$20.82	\$40.67	\$39.70	+95.34%	<button>Sell</button>
PFE	2	\$13.17	\$25.57	\$24.80	+94.15%	<button>Sell</button>
AAPL	10	\$228.93	\$284.15	\$552.20	+24.12%	<button>Sell</button>
UPS	1	\$94.22	\$98.21	\$3.99	+4.23%	<button>Sell</button>
TMUS	1	\$204.09	\$208.51	\$4.42	+2.17%	<button>Sell</button>

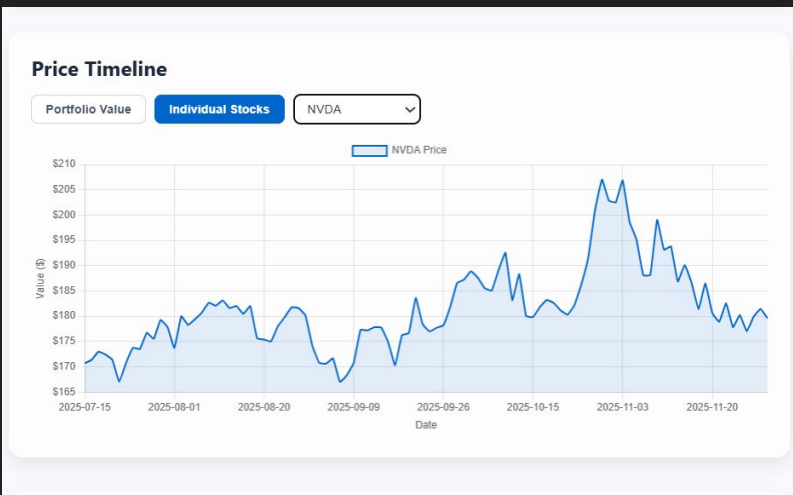
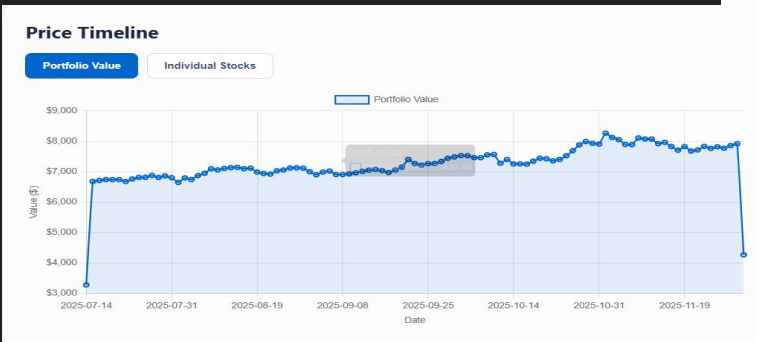
Top Winners	
V	+110.36%
NVDA	+102.97%
VZ	+95.34%
PFE	+94.15%
AAPL	+24.12%

Top Losers	
TMUS	+2.17%
UPS	+4.23%



Visualization

- Portfolio Value Timeline Chart
 - Track total portfolio value over time
- Individual Stock Price Chart
 - View price movements for specific stocks
- Real-time Data Updates
 - Charts refresh automatically with latest prices





API Usage

- Finnhub API
 - Real-time stock quotes (current price, previous close)
- Alpha Vantage API
 - Historical daily data (OHLCV)

```
FINNHUB_API_KEY=d4m9fh1r01qjidhudfe0d4m9fh1r01qjidhudfeg  
ALPHA_VANTAGE_API_KEY=4G7GFSDBJDDTJ4B7
```



AI Simulation Agent



User Information Module - AI Agent

AI Agent (Google Gemini)

- Inside the Stockagent of PromptCoder, use python app.py to run the agent
- click the button and it will go to the `http://localhost:5001`

The screenshot shows the 'StockAgent AI' web interface. At the top, there's a navigation bar with links for 'Single Stock', 'Multiple Stocks', 'Virtual Portfolio', 'User Info & AI Agent', and 'Logout'. The main section is titled 'User Information & Actions' and contains four buttons: 'Sell Stock', 'Change Password', 'Deposit Amount', and 'Launch AI Agent'. The 'Launch AI Agent' button is highlighted with a red border. Below these buttons is a 'Deposit Amount' form. The form displays the 'Current Balance: \$2035.00'. It has a label 'Amount:' followed by a text input field with the placeholder 'Enter amount to deposit'. At the bottom of the form is a green 'Deposit' button.

User Information module - AI Agent

- **API Configuration:**
 - Google Gemini API key
 - Model Name
- **Basic Settings:**
 - Number of Agents
 - Total Simulation Days
 - Daily Trading Sessions
- **Stock Initial Settings**
 - Stock A/B initial Price
- **Agent Initial Property**
 - Max/Min initial property
- **Loan Settings**
 - It will analyze two stocks
 - It will make a more comprehensive inference based on the financial reports and the market

Configure Simulation Parameters

API Configuration

Gemini API Key:

AlzaSyD3zzqEwu_ktToqNFdKLQoJ9lyBbegXZwsQ

Caution: Avoid submitting sensitive data in plaintext mode in production.

5000000.0

Min Initial Property:

100000.0

Loan Settings

Loan Types (comma-separated names, e.g., one-month,two-month):

one-month,two-month,three-month

Loan Durations (comma-separated days, corresponding to types):

22,44,66

Must match the number of loan types. Enter positive integers.

Loan Rates (comma-separated, e.g., 0.027,0.03,0.033):

0.027,0.03,0.033

Must match the number of loan types. Enter positive decimals.

Repayment Days (comma-separated list of day numbers):

22,44,66,88,110,132,154,176,198,220,242,264

Financial Reports

Seasonal Days (length of a quarter):

66

Season Report Days (comma-separated list of day numbers, typically 4 values):

12,78,144,210

Financial Report A - Q1:

Last quarter's financial report of Company A. Revenue growth rate (YoY): 9.49%, Revenue million: 4483.99, Gross margin: 41.05%, Income Tax as a percentage of Revenue: 11.31%, Selling Expense Rate: 6.83%, Management Expense Rate: 3.83%, Net profit million: 856.6795, Depreciation and Amortization: 0.91%, Capital Expenditures: 2.30%, Changes in working capital: 0.82%, Cash Flow(million): 756.7537

Financial Report A - Q2:

Last quarter's financial report of Company A. Revenue growth rate (YoY): 7.38%, Revenue million: 4417.79, Gross margin: 35.68%, Income Tax as a percentage of Revenue: 11.75%, Selling Expense Rate: 8.13%, Management Expense Rate: 4.62%, Net profit million: 493.9451, Depreciation and Amortization: 1.34%, Capital Expenditures: 2.68%, Changes in



User Information Module - AI Agent

Click “Run Simulation”

Simulation Status & Live Feed

Status: Running (Processing Day 3/3)

100%

Today's Actions & Executions

Day	Sess	Agent	Type	Action	Stock	Qty	Price	Detail / Counterparty
3	3	1	Decided	sell	B	10000	40.30	-
3	2	1	Decided	sell	B	10000	40.30	-
3	2	0	Decided	sell	B	20000	40.30	-
3	1	1	Decided	sell	B	10000	40.30	-
3	1	0	Decided	sell	B	15000	40.30	-
2	1	0	Decided	sell	A	686	29.80	-
2	1	1	Decided	sell	A	686	29.80	-
1	3	0	Decided	buy	B	5000	40.60	-
1	3	1	Decided	buy	B	10000	40.50	-
1	2	1	Decided	buy	B	10000	40.50	-
1	2	0	Decided	sell	B	10000	40.40	-
1	1	1	Decided	buy	B	10000	40.50	-
1	1	0	Decided	buy	B	5000	40.50	-

Live Event Feed

Session 3 Started

Price Update (D3 S2 End): Stock A: 30.00, Stock B: 40.00

Session 2 Started

Price Update (D3 S1 End): Stock A: 30.00, Stock B: 40.00

Session 1 Started

Loan Decision (Day 3): Agent 1 decided not to take a loan.

Loan Decision (Day 3): Agent 0 decided not to take a loan.

----- Day 3 Started -----

Forum Post (Day 2 End): Agent 1 says:

****Subject: Day 2 - Trading Thoughts & Strategy Recap****

Hey traders,

Just wrapping up Day 2 here. It was an interesting session.

For ****Company A****, my previous plan was to exit our position due to its declining revenue and operational bottlenecks, despite the new CEO and potential for future improvement. The market orders showed some selling pressure, confirming our decision to step away from A for now.

On the flip side, ****Company B**** continues to



User Information Module - AI Agent

Live Event Feed

Forum Post (Day 1 End): Agent 1 says:

****Aggressive Trader's Take: Stock B Momentum Continues, A to Watch****

Hey everyone,

Just wrapped up another day and wanted to share some quick thoughts.

For ****Stock B****, the momentum is still strong. We saw good buying activity around the 40.5 mark, reinforcing the short-term bullish outlook. I've been loading up on this one and will continue to monitor it closely. The expected growth is significant, and while there are always whispers of caution (data reliability, government checks), the market seems to be looking past those for now. Keep an eye on further price appreciation.

****Stock A**** remains a steady ship. While revenue trends haven't been explosive, the new leadership and exploration of new avenues offer potential. For now, it's more of a holding play for me, waiting for clearer signs of the turnaround to

Live Event Feed

Forum Post (Day 1 End): Agent 0 says:

"Conservative approach today. Took some profit on B, maintaining a strong core holding. Watching A for signs of a turnaround. No new loans taken. Keep an eye on B's continued momentum, but be aware of underlying risks. Happy trading!"

Prediction (for Day 2): Agent 1 -> Loan:no, BuyA:no, SellA:no, BuyB:yes, SellB:yes

Prediction (for Day 2): Agent 0 -> Loan:no, BuyA:no, SellA:no, BuyB:no, SellB:yes

Price Update (D1 S3 End): Stock A: 30.00, Stock B: 40.00

Session 3 Started

Price Update (D1 S2 End): Stock A: 30.00, Stock B: 40.00

Session 2 Started

Price Update (D1 S1 End): Stock A: 30.00, Stock B: 40.00

Session 1 Started

Loan Decision (Day 1): Agent 1 decided to **take Loan**

Live Event Feed

Forum Post (Day 2 End): Agent 1 says:

****Subject: Day 2 - Trading Thoughts & Strategy Recap****

Hey traders,

Just wrapping up Day 2 here. It was an interesting session.

For ****Company A****, my previous plan was to exit our position due to its declining revenue and operational bottlenecks, despite the new CEO and potential for future improvement. The market orders showed some selling pressure, confirming our decision to step away from A for now.

On the flip side, ****Company B**** continues to be our focus. Its strong growth trajectory, positive future outlook, and robust financials are still the key drivers. We took advantage of the opportunity to increase our holdings in B by buying an additional ****67072 shares**** at ****40.1****.

Our current portfolio is heavily weighted towards B, reflecting our confidence in its



Frontend Design

- HTML: overall layout
- Two forms:
 - Login form and registration form, with the login form displayed by default, and the registration form shown when a button is clicked.
- Element breakdown:
 - Input fields: Used for the user to enter their username and password (<input> tag).
 - Buttons: Used for the user to perform login or registration actions (<button> tag).



Technical Details

- Frontend
 - HTML, CSS, JavaScript for user interaction.
- Backend
 - Node.js with Express.js for server-side logic.
- Database: MySQL for storing user and stock data.
- APIs: Facilitate communication between frontend and backend.
- Utility Libraries:
 - bcrypt.js (Hash users' password)
 - Csv-parser (Read CSV file)
 - Moment.js
 - Math.js (Used to calculate some functions for stock broadcast)



Demo



Contribution

- **Yiwei Li**
 - Backend Design and programming
 - Ai Agent Design and programming
- **Yanbo Tong**
 - Google Slides Design
 - Program Report (Part 5 - System Evaluation)
 - Frontend Design : Client-Friendly UI Page
- **Haoyang Guo**
 - Implement the frontend and backend of virtual portfolio system
 - using real-time stock API



Thank You!