



# 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';
```

Result Grid		
email	password	balance
vincent.tong0226@rutgers.edu	\$2a\$10\$dvkYceavEh3kYYliyQbBOcCQRfTlbind...	1015.50
yanbo	\$2a\$10\$dvkOtw7uRzWZE8KVGUJub.JqSalFPe...	100.00
yanbotong666@gmail.com	\$2a\$10\$Yak+I0URjeIbs6ptShsbueh2VAynUsV...	967.50

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

# R

# 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

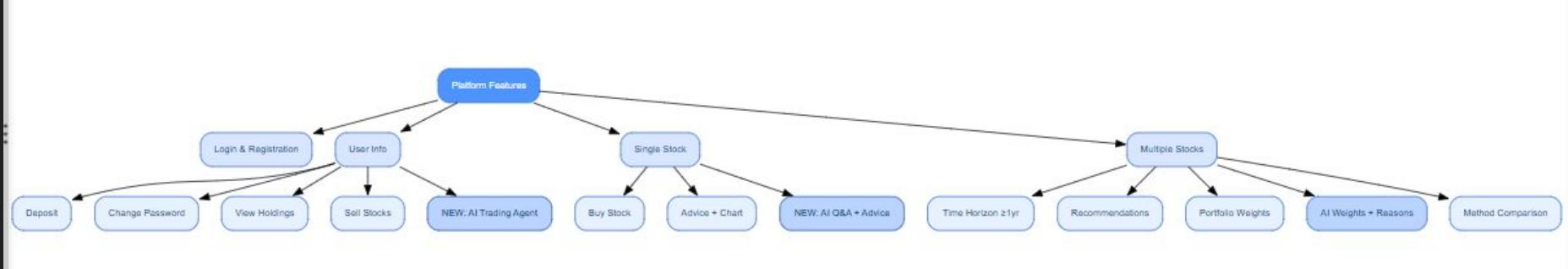


# Primary Functionality

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 mockups for a stock platform. The top mockup is titled "Stock Platform" and contains fields for "Username" and "Password", a "Sign In" button, and a link to "Register here". The bottom mockup is titled "Create Account" and contains fields for "Username", "Password", "Confirm Password", a "Create Account" button, and a link to "Sign in here". Both mockups have a light gray background and are set against a dark gray background.



# 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
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#### Risk Analysis

Stop Loss Price: \$0	Position Size: 0 shares	Max Drawdown: 100.00%
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#### Risk Components

Volatility Component: 0.00	Beta Component: 1.00	Max Drawdown Component: 1.00
-------------------------------	-------------------------	---------------------------------

Value at Risk (95%): 4.17%	Conditional VaR (95%): 11.33%
-------------------------------	----------------------------------

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

The screenshot shows a mobile-style interface with three tabs at the top: 'Analysis', 'Purchase', and 'AI Q&A'. The 'AI Q&A' tab is selected. Below it is a section titled 'AI Stock Q&A'. A text input field contains the question: 'What is the market trend of Amazon?'. Below the input field is a large blue button labeled 'Ask'. The main content area displays the AI's response, which includes an analysis of Amazon's market trend, a detailed breakdown of factors, and specific bullet points about e-commerce dominance, persistent demand, and international expansion.

What is the market trend of Amazon?

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

```
4 // CHANGED: Import Google Generative AI
5 const { GoogleGenerativeAI } = require("@google/generative-ai");
6
7 // CHANGED: Initialize Gemini AI Client
8 const genAI = new GoogleGenerativeAI(process.env.GEMINI_API_KEY);
9 const model = genAI.getGenerativeModel({ model: "gemini-2.5-flash-lite" });
10
11 router.post('/ask', async (req, res) => {
12   try {
13     const { question } = req.body;
14     if (!question) {
15       return res.status(400).json({ error: "Question is required" });
16     }
17
18     const prompt =
19       `You are a professional stock investment advisor. Please answer the following question in English, ensuring your answer is professional, accurate and in English.
20
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.
27     4. If the question is about risk control, provide practical suggestions.
28
29     Make sure your answer is:
30     1. Professional and accurate
31     2. Easy to understand
32     3. Specific and actionable
33     4. Includes necessary risk warnings
34
35     Please answer ONLY in English, no matter what language the question is.
36   `;
37
38   // CHANGED: Call Gemini API
39   const result = await model.generateContent(prompt);
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 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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29   Make sure your answer is:
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32   3. Specific and actionable
33   4. Includes necessary risk warnings
34
35   Please answer ONLY in English, no matter what language the question is.
36   ;
37
38   // CHANGED: Call Gemini API
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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 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-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}
    `;
  }
});
```

```
.....
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("X 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("X Error calling AI API:", error.message);
    res.status(500).json({ error: "Internal Server Error" });
  }
});

module.exports = router;
```



# Single Stock Module - Single Stock Purchase

## Input

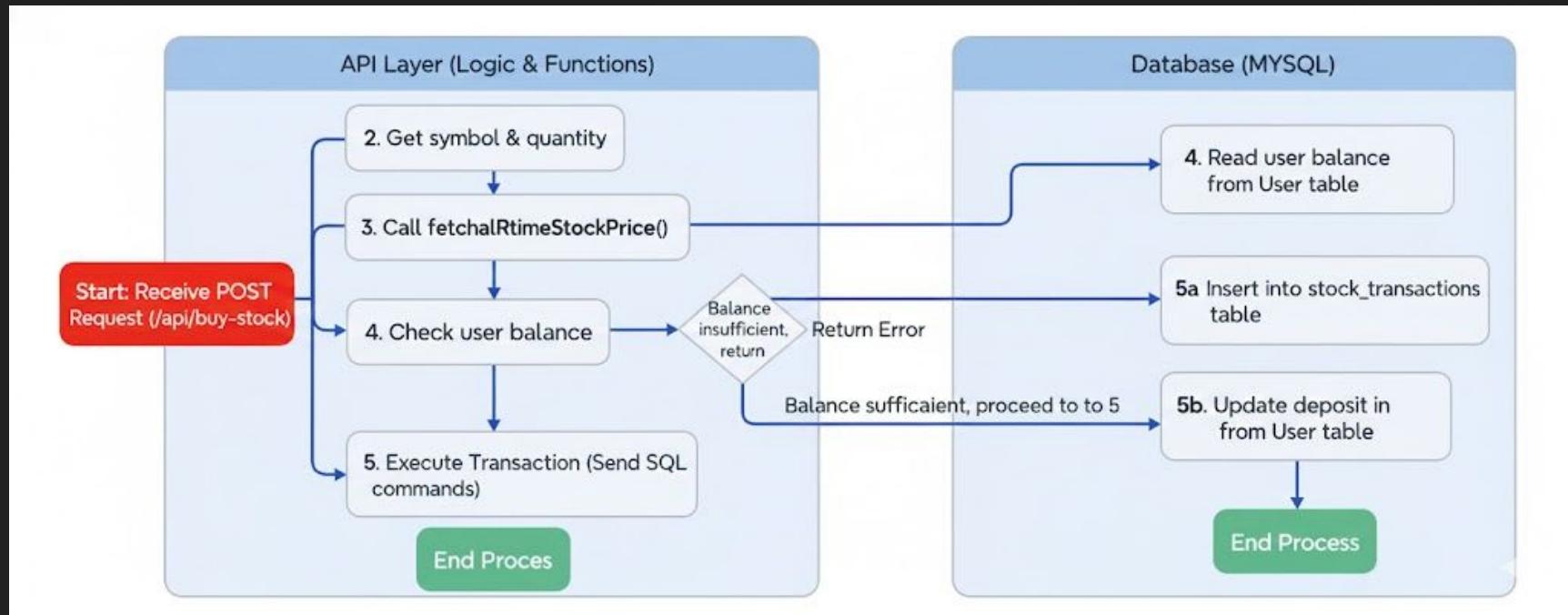
- Stock Symbol: user input
- Quantity: user input

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

The screenshot shows a user interface for a stock purchase module. At the top, there are three buttons: 'Analysis' (gray), 'Purchase' (blue, indicating the active tab), and 'AI Q&A' (gray). Below the tabs, the 'Available Balance' is displayed as '\$1635.00'. The 'Stock Purchase' section includes a dropdown menu labeled 'Select Stock' containing the value 'huohuf1y'. A text input field labeled 'Quantity' contains the placeholder 'Enter quantity to buy'. A large green button labeled 'Buy Stock' is centered below these fields. At the bottom, a green notification bar displays the message '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 AI

Single Stock    Multiple Stocks    Virtual Portfolio    User Info & AI Agent    Logout

### Multiple Stock Portfolio Analysis

Select Stocks

huohuf1w    huohuf1y    huohuf2m  
huohuf3m    huohuf6m    huohuf9m  
plbpln1m    plbpln3m    plbpln6m  
plopln1m    plopln1w    plopln1y  
plopln3m    plopln6m    plopln9m

Multiple Stock Analysis Suggestion

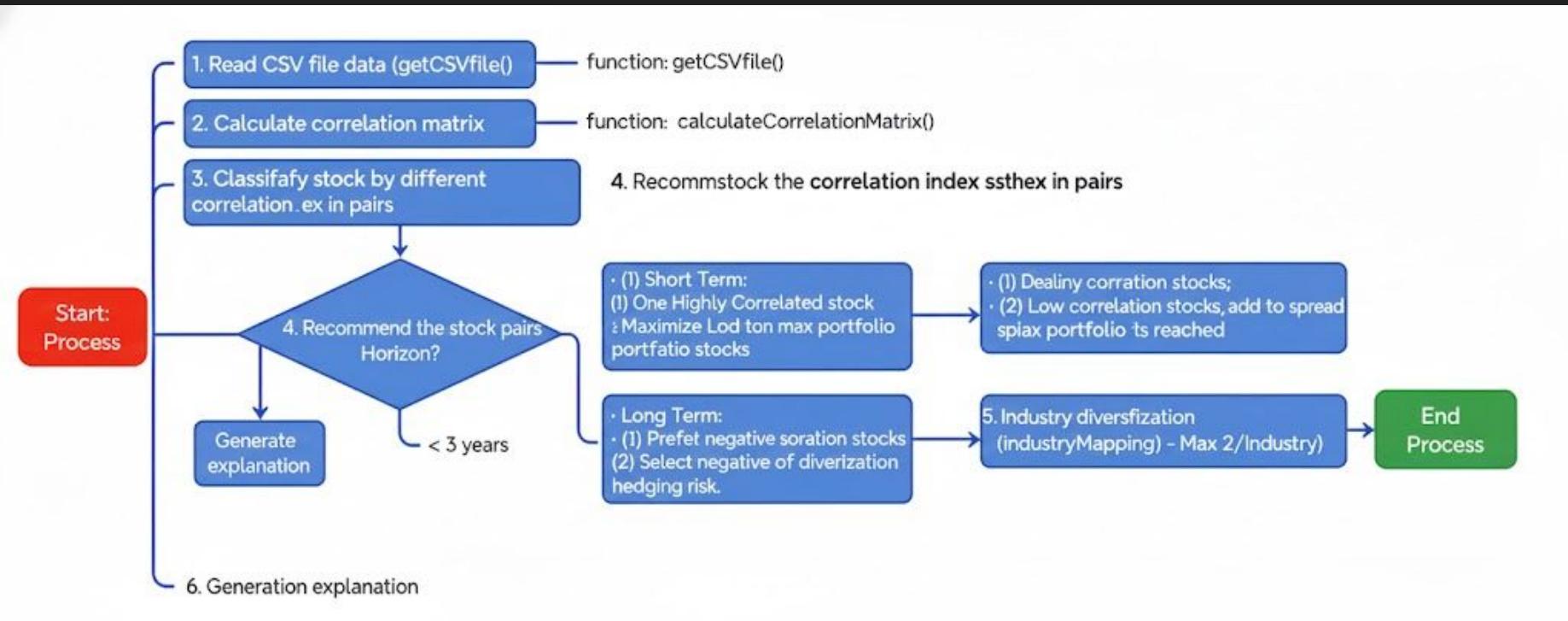
Investment Horizon: 1 year

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

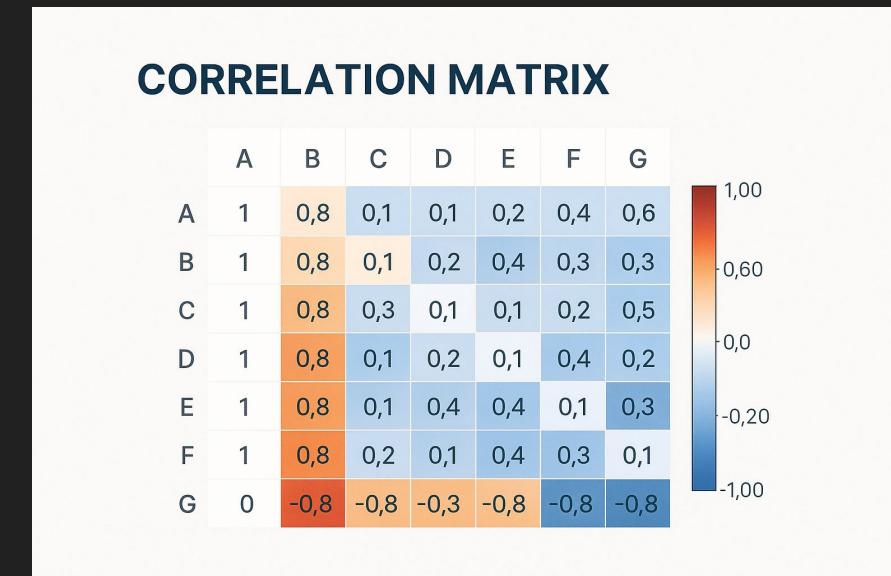


Correlation matrix is a symmetric matrix used to represent pair-to-pair correlations between a set of variables,

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

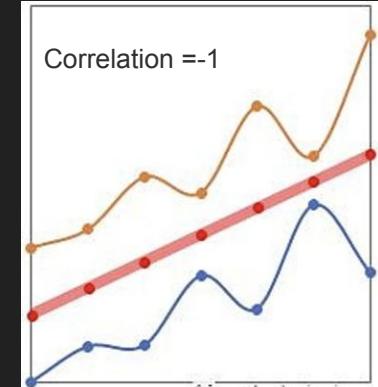
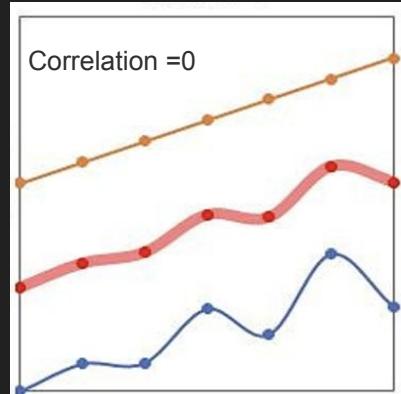
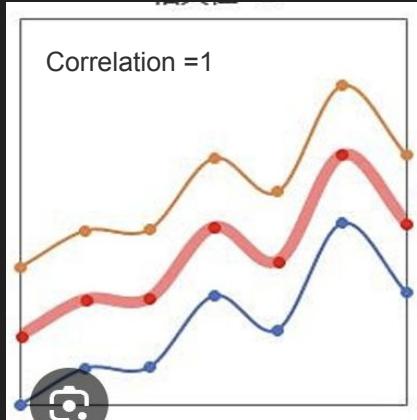
$$\text{Correlation}(A, B) = \frac{\text{Cov}(A, B)}{\sqrt{\text{Var}(A) \times \text{Var}(B)}}$$

- **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.

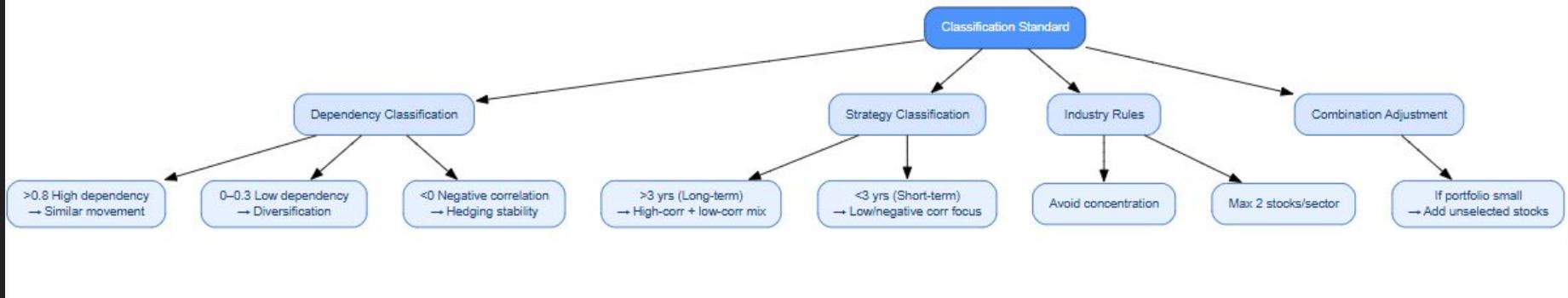


# Multiple stock module - Prediction Correlation Matrix

- 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:** Risk Adjustment = risk / total risk
  - **Sharpe Ratio Adjustment:** SharpeAdjustment =  $1 + (\text{SharpeRatio} / 2)$
  - **Combined Initial Weight:** InitialWeight = RiskAdjustment \* SharpeAdjustment
- **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 =** Adjusted Weight of Stock i / 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%
plopln1w	6.60%

### AI-Optimized Weights

Stock	Weight
huohuf1y	0.00%
huohuf6m	0.00%
plbpln3m	100.00%
plopln1w	0.00%

### Weight Adjustments by AI

Stock	Adjustment	Direction
huohuf1y	-19.32%	decrease
huohuf6m	-7.75%	decrease
plbpln3m	33.66%	increase
plopln1w	-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

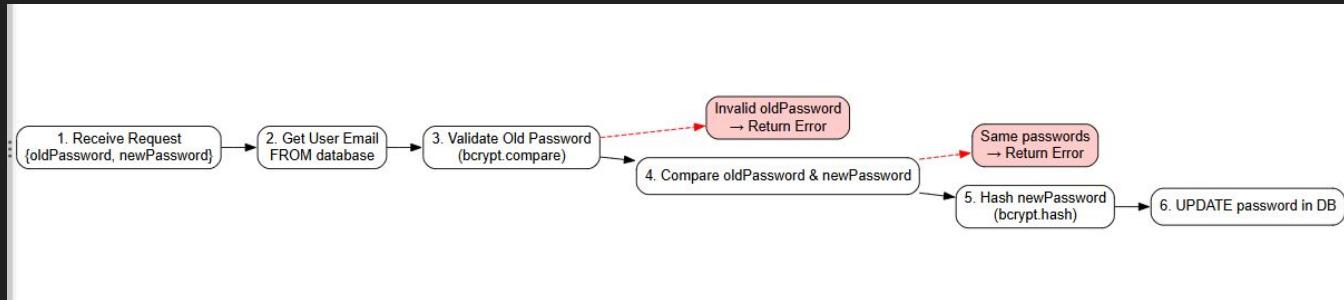
Traditional vs AI Optimization Methods		
Factor	Traditional Method	AI Method
Returns Analysis	✓ Basic return calculation	✓ Advanced return analysis with market context
Risk Assessment	✓ Standard deviation	✓ Multiple risk metrics (VaR, Drawdown)
Market Conditions	X Not considered	✓ Current market environment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



# User Information Module



# User Information Module - Change Password



The screenshot shows the StockAgent AI application interface. At the top, there is a navigation bar with links for Single Stock, Multiple Stocks, Virtual Portfolio, User Info & AI Agent, and Logout. Below the navigation bar, there is a header titled "User Information & Actions" with buttons for Sell Stock, Change Password, Deposit Amount, and Launch AI Agent. The "Change Password" button is highlighted in blue. The main content area is titled "Change Password". It contains two input fields: "Old Password" and "New Password", both with placeholder text "Enter your old password" and "Enter your new password" respectively. At the bottom of the form is a large blue "Change Password" button.



# 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**

deposit successful

**User Information & Actions**

Sell Stock   Change Password   **Deposit Amount**   Launch AI Agent

**Deposit Amount**

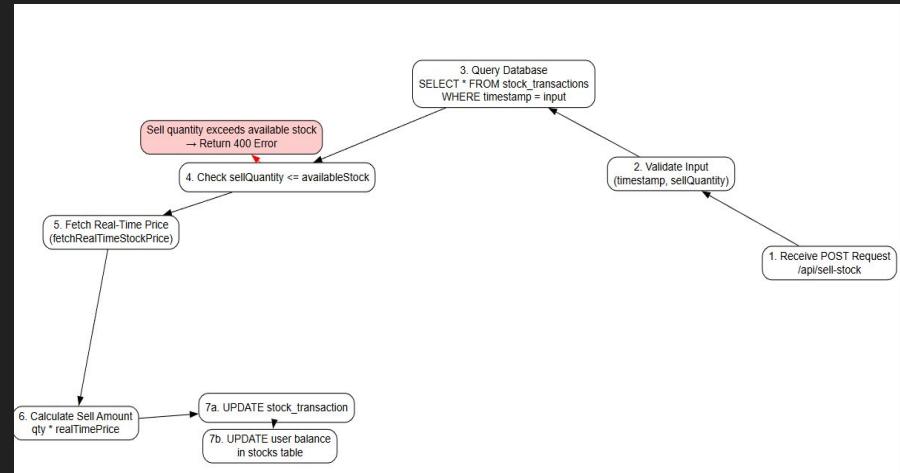
Current Balance: \$1835.00

Amount:  
200

**Deposit**



# User Information Module - Sell Stock



2025-12-03 22:27:36	huohuf1w	10	<span>Sell</span>
2025-12-03 22:27:56	huohuf1y	20	<span>Sell</span>



# 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 NVIDA, 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

**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...

<input type="checkbox"/> AAPL	<input type="checkbox"/> ABBV
<input type="checkbox"/> ABT	<input type="checkbox"/> ADBE
<input type="checkbox"/> AMD	<input type="checkbox"/> AMGN
<input type="checkbox"/> AMZN	<input type="checkbox"/> AVGO
<input type="checkbox"/> AXP	<input type="checkbox"/> 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):

<input type="checkbox"/> GOOGL	<input type="checkbox"/> GS	<input type="checkbox"/> HD	<input type="checkbox"/> HON	
<input type="checkbox"/> IBM	<input type="checkbox"/> INTC	<input type="checkbox"/> JNJ	<input type="checkbox"/> JPM	<input type="checkbox"/> KO
<input type="checkbox"/> LLY	<input type="checkbox"/> LMT	<input type="checkbox"/> LOW	<input type="checkbox"/> MA	
<input type="checkbox"/> MCD	<input type="checkbox"/> META	<input type="checkbox"/> MMM	<input type="checkbox"/> 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%

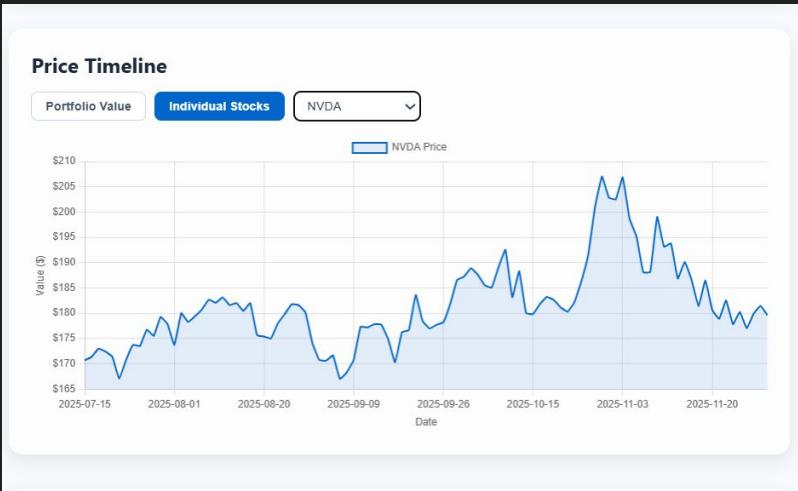
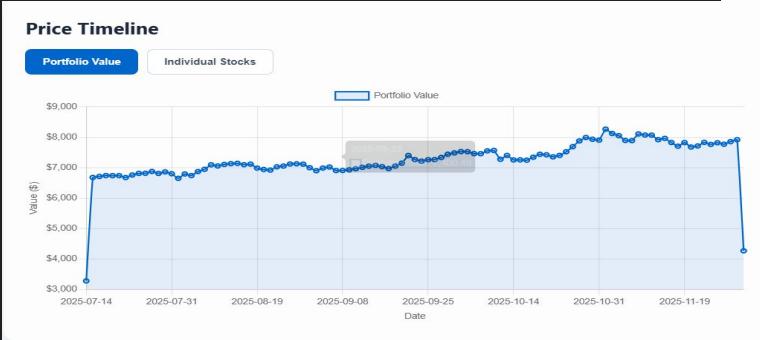
💔 Top Losers

TMUS	+2.17%
UPS	+4.23%

# R

# 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

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

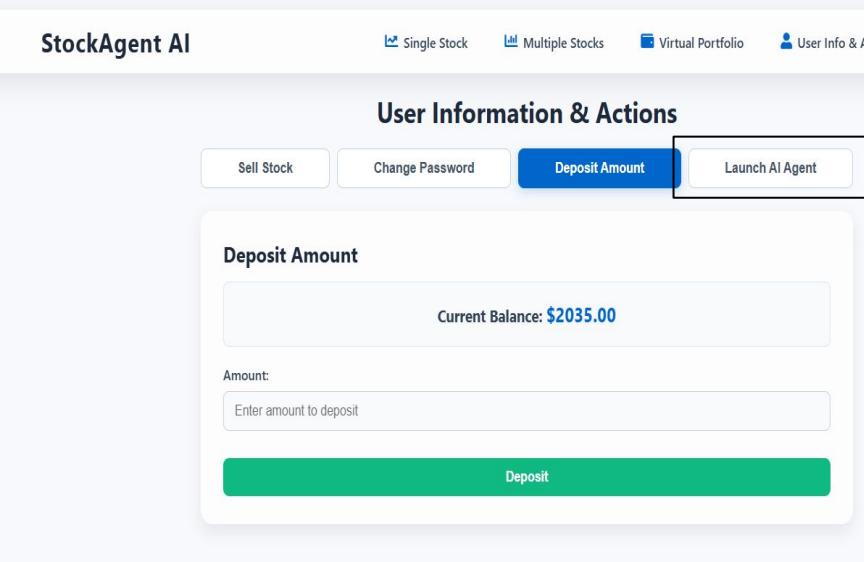
Deposit Amount

Current Balance: \$2035.00

Amount:

Enter amount to deposit

Deposit



# 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\_ktToqNFdKLQoJ9jyBegXZwsQ

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: 856.6705, Depreciation and Amortization: 0.91%, Capital Expenditures: 2.30%, Changes in working capital: 0.87%, 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\*\* continued 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:yes, 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!