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Developing A Simulated Stock Trading Application

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Chapter 1

Introduction

The primary reason for developing this simulated stock trading application is to provide users with a realistic and educational experience in financial markets. By allowing users to trade virtual stocks in real-time based on actual market data, the application aims to:

1. **Enhance Financial Literacy**

Users can learn about the dynamics of the stock market, understand trading strategies, and develop investment skills without any financial risk.

2. **Educational Tool**

The application serves as a platform for educational institutions to teach students about financial markets and trading.

3. **Risk-Free Environment**

Users can practice trading and experiment with different strategies in a risk-free environment, helping them build confidence before engaging in real-world trading.

4. **User Engagement**

By incorporating features such as portfolio management, real-time stock price tracking, and educational resources, the application aims to engage users and keep them motivated to learn and improve their trading skills.

5. **Research and Development**

The development process itself provides an opportunity to explore various technologies, programming languages, and development tools, contributing to the developer's knowledge and expertise.

Ultimately, this application aims to create a comprehensive simulated trading envi-

ronment that benefits both users and developers by enhancing financial knowledge and technical skills.

1.1 Key Differences and Significance

The primary difference between this simulated stock trading application and existing similar applications lies in its focus on simplicity and accessibility. Due to the high cost of obtaining advanced information from stock APIs, this application is designed to provide users with a basic index investment experience. This approach has several significant advantages:

1. Focus on Basic Information

By concentrating on fundamental data, users can better understand the core principles of stock trading without being overwhelmed by complex information. This makes the application more approachable for beginners.

2. Lower Barrier to Entry

The simplified index investment experience lowers the barrier to entry, making it easier for novice investors to start learning and practicing trading strategies. This user-friendly approach encourages more people to engage with the application.

In summary, this application stands out by providing a straightforward and beginner-friendly trading experience, making it an ideal starting point for those new to the world of stock trading.

1.2 Target users

1. Beginners

Individuals new to stock trading who want to learn the basics in a risk-free environment.

2. Students

Educational institutions can use the application as a teaching tool for courses related to finance and investment.

3. Casual Investors

Users who want to practice and refine their trading strategies without the

pressure of real financial stakes.

This application aims to provide a comprehensive and accessible platform for users to learn and practice stock trading, making it an ideal starting point for those new to the world of finance.

`hyperref`

1.3 The Link of This Website

<https://stocksimulation.main.jp/index.php>

Chapter 2

User documentation

This chapter, along with images, briefly explains what functions are available on each page, how users can manipulate them, and what to expect when using them. It also briefly explains the important underlying logic of the site, such as how to calculate valuation gains/losses, for the non-expert.

2.1 Use case diagram

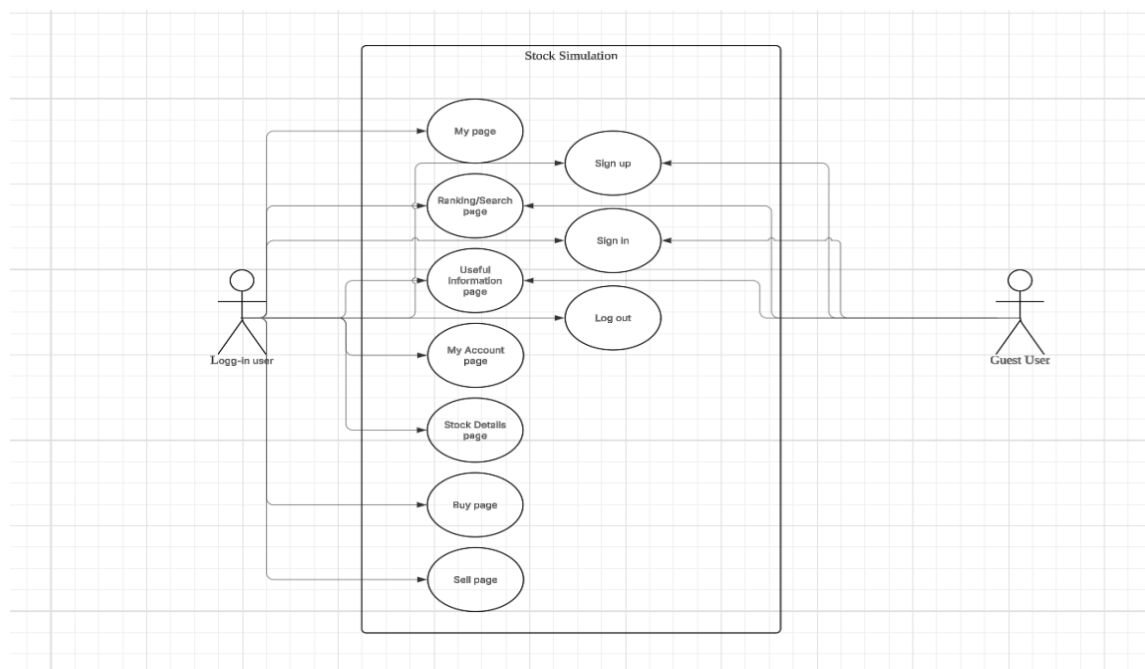


Figure 2.1: Use case diagram

2.2 Web site components and actions

1. Header & Hamburger Menu (Common Across Pages)

- **Header Logo:**

- Logged-in users → Redirect to Initial Page
- Guests → Redirect to My Page

- **Hamburger Menu:**

- If logged in: Show US time, market status, search, links to My Page, Rankings, Info, My Account, Logout
- If not logged in: Show US time, market status, search, links to Rankings, Info, Sign In, Sign Up

2. Footer (common to every page)

Displays a link to the API used and a copyright statement; common design across all pages.

3. Initial page

Introduces the site's purpose and displays an S&P500 chart. Users can switch between 1 month, 3 months, 6 months, 1 year, 5 years, and 10 years views, and check daily changes and moving averages (5, 25, 50 days).

4. Sign-in page

Allows users to log in using a username or email and password. Successful login redirects to My Page; errors show the reason for failure.

5. Sign-up page

Allows new users to create an account with username, email, and password. Passwords are securely hashed and must include at least 5 characters, one letter, and one number. Upon success, users are redirected to My Page; errors are displayed if registration fails.

6. My page

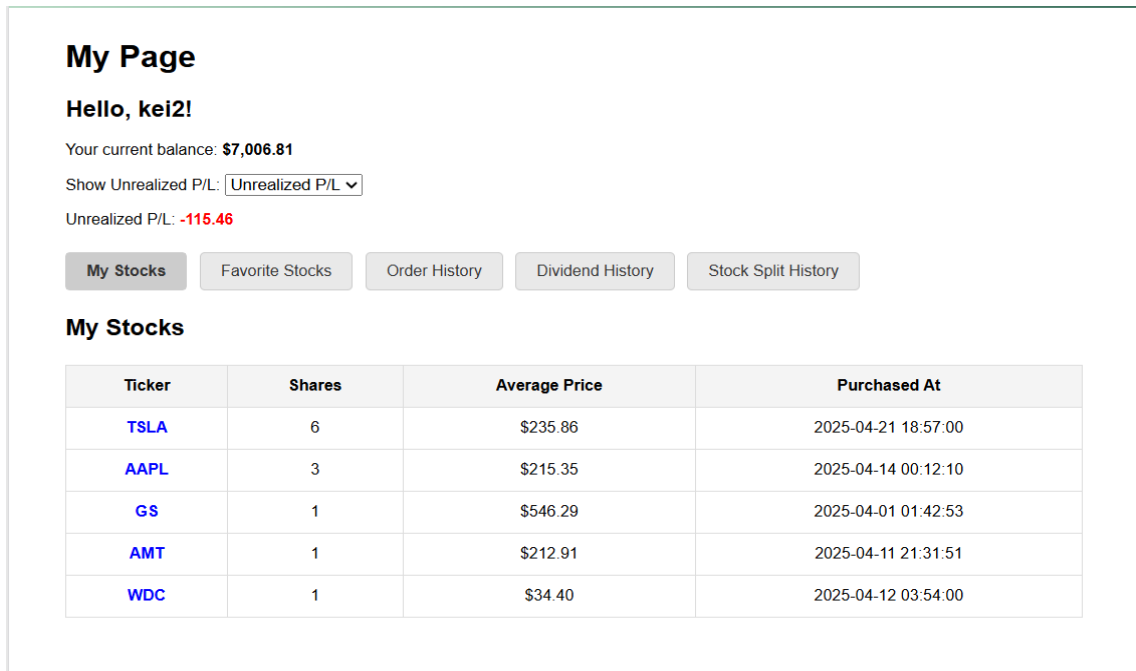


Figure 2.2: my page

The most fundamental page displays the user's name and balance while logged in. The user's name and balance are also displayed, with buttons to switch between P&L and Daily Value. Below that, there is a navigation for stocks owned, favorite stocks, order history, dividend history, and split history, and each list is displayed by clicking on it. The favorite issues list can be un-listed by clicking on the "remove" button in the "favorite issues" action. The order and dividend histories are paginated 15 lines at a time, in anticipation of a large number of entries.

7. Ranking/Search page

S&P 500 constituent list

Sector: All Basic Materials Communication Services Consumer Cyclical Consumer Defensive Energy Financial Services Healthcare Industrials Real Estate Technology Utilities

Sort By: None Apply

Company Name (Symbol)	Sector	Industry	Latest Price (USD)	Daily Change (%)	Dividend Yield (%)	Revenue	ROE	PER
Agilent Technologies Inc (A)	Healthcare	Diagnostics & Research	103.00	-6.08%	0.90%	6,533,000,192	0.21%	23.62
Apple Inc (AAPL)	Technology	Consumer Electronics	188.38	-7.29%	0.49%	395,760,009,216	1.37%	29.90
AbbVie Inc (ABBV)	Healthcare	Drug Manufacturers - General	186.96	-7.28%	3.51%	56,334,000,128	0.62%	78.23
Airbnb Inc (ABNB)	Consumer Cyclical	Travel Services	106.66	-6.41%	-	11,102,000,128	0.32%	25.95
Abbott Laboratories (ABT)	Healthcare	Medical Devices	124.44	-5.46%	1.90%	41,949,999,104	0.31%	16.29
Arch Capital Group Ltd (ACGL)	Financial Services	Insurance - Diversified	87.83	-8.78%	0.00%	17,440,000,000	0.22%	7.85
Accenture plc (ACN)	Technology	Information Technology Services	285.06	-5.44%	1.96%	67,221,491,712	0.27%	23.52
Adobe Systems								

Figure 2.3: Ranking/Search page

S and P's 500 stocks are listed and are intended to help users discover new stocks. The search can be narrowed down by sector, and sorted by market capitalization, stock price, daily price-to-book ratio, dividend yield, sales volume, and capital adequacy ratio. The table below shows each stock's Company Name (Symbol), Sector, Industry, Latest Price (USD), Daily Change (%), Dividend Yield (%), Revenue, ROE, PER, PBR, Market Cap, Equity Clicking on the Company Name (Symbol) will take you to the detailed page of that stock.

8. Useful Info page

Useful Information

News

Technical Terms

Here you can find the latest news related to the stock market, press releases, and more.

Date: 2025-04-08 20:30 Symbol: -

Title: Serina Therapeutics Secures \$5 Million in Funding to Support Advancement of SER-252 into Clinical Development in Advanced Parkinson's Disease

HUNTSVILLE, Ala., April 08, 2025 (GLOBE NEWSWIRE) -- Serina Therapeutics, Inc. ("Serina") (NYSE American: SER), a clinical-stage biotechnology company developing its proprietary POZ Platform™ drug optimization technology, today announced the closing of a \$5 million financing from strategic shareholders. Proceeds from the transaction will support the continued development of SER-252 (POZ-anomorphine), Serina's lead clinical candidate for Advanced Parkinson's disease, as the company prepares to initiate a Phase 1 clinical trial.

[Read More](#)

[View Source](#)

Date: 2025-04-08 20:15 Symbol: -

Title: Globalink Investment Inc. Announces Extension of the Deadline to Complete a Business Combination to May 9, 2025

New York, NY, April 08, 2025 (GLOBE NEWSWIRE) -- Globalink Investment Inc. (OTC Pink: GLLI, GLLIW, GLLIR, GLLIU) ("Globalink" or the "Company"), a special purpose acquisition company, announced today that on April 8, 2025, it caused to be deposited \$60,000 (the "Extension Payment") into its trust account (the "Trust Account") with Continental Stock Transfer and Trust Company ("Continental") to extend the deadline to complete its initial business combination from April 9, 2025 to May 9, 2025. The extension is the twenty-second extension of the deadline.

[Read More](#)

[View Source](#)

Date: 2025-04-08 20:13 Symbol: RJF.US

Figure 2.4: Useful Info page

The most recent news and a table of stock trading terminology are displayed. For news, only a portion of the news text is shown at first to improve the appearance of the site, but clicking on “read more” will take you to where you can view the entire news text. Also, you can go to the original site of the news by clicking on view source. Date is the date the news was announced, and ticker is the issue related to the news.

9. My account page

10

My Account

Username	kei2
Email	englishhungary@outlook.jp
Balance	\$7,006.81
Created At	2025-04-01 00:52:57
Last Login	2025-04-21 18:57:00

Edit Your Account Info

Username

kei2

Email

englishhungary@outlook.jp

Change Password

Current Password

New Password

Confirm New

Balance Update

Amount

☒ Increase ☐ Decrease

Save Changes

Figure 2.5: my page

This page allows users to view and update their registered information. Specifically, username, email, balance, Created At (the date the account was created), Last Login (the date the user last logged in) can be viewed. username, email, PASSWORD and balance can be updated. The balance can be freely increased or decreased on this page to allow users to trade freely, which is a feature of this site. Successful and unsuccessful transactions are displayed.

10. Stock details page

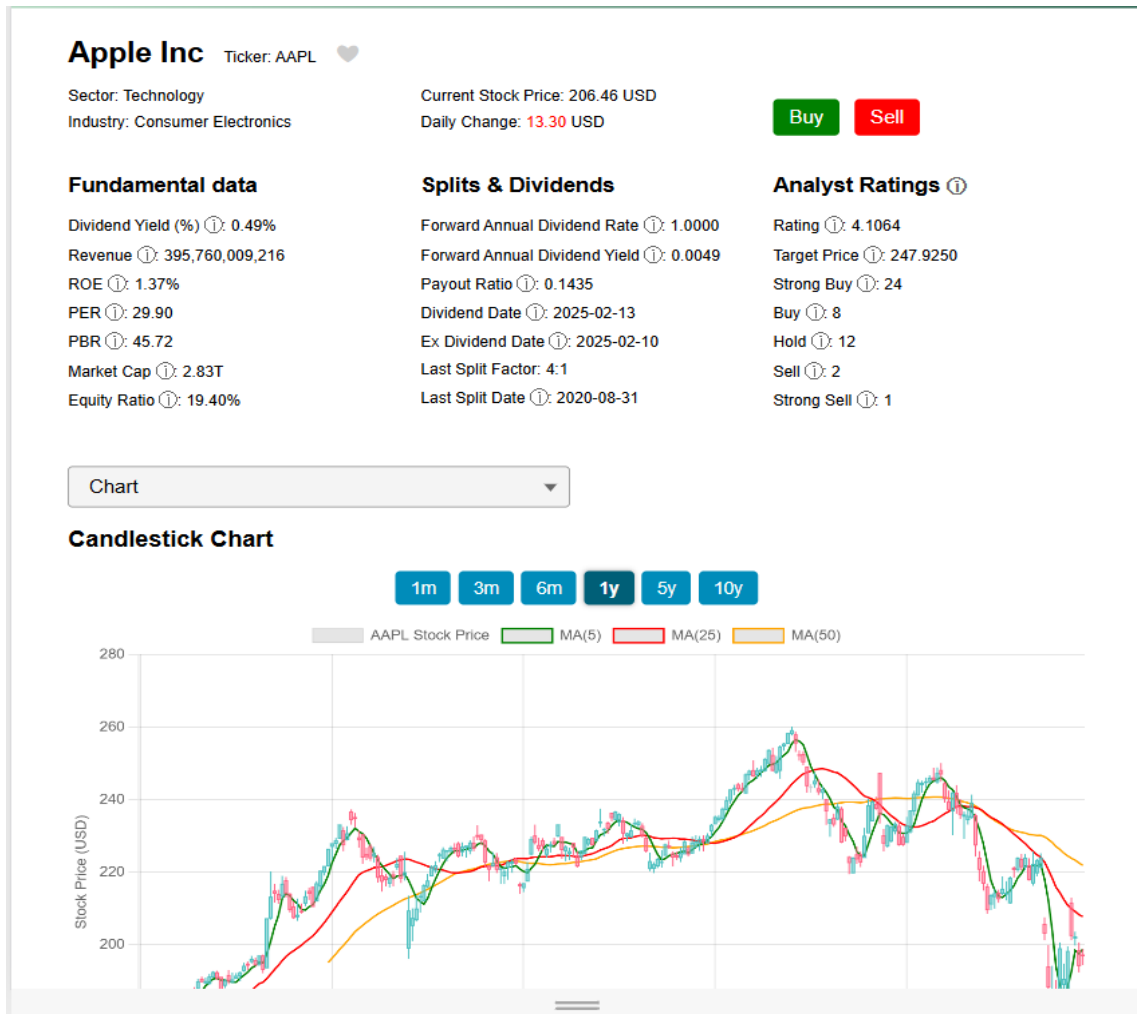


Figure 2.6: Stock Details page

In addition to the information available on the ranking/search page, the page displays a table showing real-time stock prices, company overviews, stock charts, top holders of the stock, and other historical information that can be obtained through the API. Explanations of technical terms are also provided. Click the “I” mark next to a term to see an explanation of that term. If the user is logged in, an “Unsubscribe” button and a “Buy” button (to the buy page) are displayed. If the user is logged in and holds the stock, a sell button (to the sell page) is also displayed.

11. Buy page

Buy AAPL

Current Stock Price: 206.44 USD
Daily Change: 13.28 USD

Your Holdings

Shares Owned	Average Price
3	\$215.35

Available Funds

Current Balance: \$7,006.81

Market OrderLimit Order

Place Order

Shares to Buy:

Limit Price (USD): Expires At:

Balance After Purchase: \$7006.81

Submit Order

Figure 2.7: Buy page

Displays real-time stock prices and previous day's ratios, user's holdings and balances. Real-time trading and limit trading are available. When the number of shares to be purchased is specified, the balance after the purchase is displayed below it. Note that real-time trading is not available when the market is closed in US time, but limit trading is available all the time.

12. Sell page

Sell AAPL

Current Stock Price: 199.74 USD
Daily Change: 6.58 USD

Your Holdings

Shares Owned	Average Price
3	\$215.35

Available Funds

Current Balance: \$7,006.81

Market Order

Limit Order

Place Order

Shares to Sell:

Limit Price (USD): Expires At:

Balance After Sale: \$7006.81

Submit Order

Figure 2.8: Sell page

Displays real-time stock prices and previous day's ratios, user's holdings and balances. Real-time trading and limit trading are available. When the number of shares sold is specified, the balance after the sale is displayed below the number of shares sold. Note that real-time trading is not available when the market is closed in US time, but limit trading is always available.

13. Search result page

The stocks that were found by the user's search are displayed. ticker and the company name are displayed, and clicking on the ticker takes the user to the stock details page. US stocks other than S and P are also displayed, but only limited information is available on the stock details page.

2.3 Behavior Specifications

2.3.1 Update of Real-Time Stock Prices

Real-time stock price updates are updated only when the market is open. The price is displayed to the second decimal place. If there is a price fluctuation, the price flashes to visualize the fluctuation.

2.3.2 Differences hamburger bar elements depending on the user's login status

Depending on the user's login status, different pages are accessible: My page, My account page can only be accessed after login and the logout button is only displayed after login. On the other hand, the ranking/search page and useful info page can be accessed even if the user has not logged in, and the sign in and sign up buttons are displayed instead of the logout button. The US current time and search form will be displayed from the hamburger bar, regardless of your login status.

2.3.3 How to calculate average purchase amount, Unrealized P/L and day-to-day comparison

Average purchase amount indicates the average acquisition price per share when a user purchases the same stock multiple times. $\text{Average Purchase Amount} = \text{Total Purchase Amount} \div \text{Total Number of Shares Held}$. For valuation gains/losses, the difference between the current share price and the average price per share at the time of purchase for each stock held by the user is multiplied by the number of shares held. $\text{Net unrealized gains/losses} = (\text{current share price} - \text{average purchase price}) \times \text{number of shares held}$. This value represents the gain or loss that would occur if the user were to sell his/her current holdings now. The Daily Gain/Loss is calculated as the difference between today's closing price and the previous day's closing price for each of the user's holdings multiplied by the number of shares held. $\text{Day-to-Date} = (\text{Today's Close} - \text{Yesterday's Close}) \times \text{Number of Shares Held}$.

2.3.4 Timing of Real-Time and Limit Trading

Real-time trading is only available when the US Market is open. Real-time trading is only available when the US Market is open. The buy or sell price is based on the real-time price at the moment the user presses the submit order button on the buy or sell page. Limit trades can be executed at any time, regardless of whether the US market is open or closed. The user can decide how much to buy or sell and for how long the order will be valid within a one-week period, during which time the order will be executed, pending, or canceled based on the daily stock price change and the amount set by the user when the US market closes. If the amount is not reached

within the set period, the order will be canceled, and if the amount is reached, the order will be executed.

2.3.5 Timing of Dividend and Split Reflection

Once a day, the user's holdings will be checked to see if it is a dividend or split day. You can find the dates in the list of dividends on the My page. On the dividend payment date, your balance will be automatically updated, and on the split date, your holdings will automatically change.

Chapter 3

Developer documentation

This section describes the technologies, project structure, database design, and key functionalities used in the development of the simulated stock trading application.

3.1 Tools and Techniques Used

1. Frontend Technologies

- **HTML**
Used to create the structure of a web page.
- **CSS**
Used to design and improve the look and feel of a web page.
- **JavaScript**
Used to implement processes that move on the web page (e.g., clicks, in-page updates).

2. Backend Technologies

- **PHP**
Used to process data on the server side (e.g., exchange with databases, API integration).
- **Python**
Used for automatic server-side processing, such as data acquisition and data processing.

3. Database

- MySQL

Used to store and manage data (user information, stock price information, etc.).

- JSON

Used as a lightweight data format for data exchange. In this site, it is used to store technical terms.

4. External Services

- EODHD API

Used to retrieve stock price data and company information.

- WebSocket

Used to immediately reflect real-time information such as stock prices.

- Lolipop Server

A place to get your own domain to publish and operate your web application. The database is also managed here.

3.2 Project structure

In total, 33 files, are used on this site. The following is a brief summary of the role of each file and which page it may transition to. The specific code can be found in the code submitted with this document. Also, since the Lolipop server database cannot handle data directly from the Python code, several PHP files were used as APIs.

1. **thesis/db_config.php**

The file used to make the connection to the database. Since almost all PHP files require a connection to the database, this file is the root and is referenced in almost all PHP files.

2. **thesis/index.php**

The first file of this site. It displays a description of the purpose of this site and an index of S and P. If you are not logged in, you can go to this page by clicking the logo on the header.

3. **thesis/signin.php**

The sign in button appears in the hamburger bar of the header when the user is not logged in. If the username or email does not exist in the database, or if

the password is incorrect, clicking sign in will not take you to my page and a warning message will be displayed.

4. **thesis/signin_process.php**

Connect to the database, verify the information received from signin.php, and if there is no problem, insert the information into the table.

5. **thesis/signup.php**

The sign up button appears in the hamburger bar of the header when the user is not logged in, and the user can sign up by entering the username, email, password, and password confirmation. If the username or email is duplicated in the database, or if the password and password confirmation are incorrect, clicking signup will not create the account, and a warning message will be displayed. will be displayed.

6. **thesis/signup_process.php**

Connect to the database, verify the information received from signup.php, and if there is no problem, insert the information into the table.

7. **thesis/logout.php**

Close the session and invalidate the user's login information.

8. **thesis/mypage.php**

The user's valuation profit/loss and the previous day's ratio, a list of stocks held, a list of favorite stocks, a list of order history, a list of dividend and split history, are referenced from the database and displayed.

9. **thesis/myAccount.php**

The user's account registration information is referenced from the database and displayed, allowing the user to update his/her account information, which is then reflected in the database. If the update fails, the system displays a failure message.

10. **thesis/ranking_search.php**

Key information on stocks is retrieved from the database and listed and displayed. The system implements functions to narrow down the search by section and to sort by previous day's ratio and total capitalization.

11. **thesis/useful_info.php**

News from the database, words and their meanings from technical_terms.json, and display them.

12. **thesis/technical_terms.json**

Technical terms and their meanings are stored within this site.

13. **thesis/stockDetails.php**

Real-time stock quotes and day-ahead ratios are displayed using Websocket. Detailed information about the stock, stored in a database, is mainly listed and can be viewed. Since there are many technical terms, information marks are placed next to them, and when the user clicks on the mark, the meaning of the word is displayed by referring to the `technical_terms.json` file. Also, when the user clicks on the “favorite” button, the stock is registered in the database’s favorite table. The user can also view a candlestick chart of the stock’s price movements over the past 10 years. If the user is not logged in, the favorite and buy buttons will not appear. Also, if the user is logged in but does not own the stock, the Sell button will not appear.

14. **thesis/buy.php**

The user’s balance and holdings of the stock are retrieved from a database and real-time stock prices using Websocket. If the market is closed in US time, the real-time transaction form will not be displayed.

15. **thesis/sell.php**

The user’s balance and holdings of the stock are retrieved from a database and real-time stock prices using Websocket. If the market is closed in US time, the real-time sell form will not be displayed.

16. **thesis/process_order.php**

The transaction information specified by the user in `buy.php` and `sell.php` is stored in the database. In the case of real-time trading, the status is executed (immediately), but in the case of limit trading, the status is pending, and the system checks the user’s limit price and the stock price table for the issue to see if it can be executed every day until the limit trade deadline set by the user. If this does not happen by the expiration date, the status is set to “cancel”.

17. **thesis/search.js**

JavaScript for the behavior of the hamburger bar itself and the behavior of the brand name search in the hamburger bar, common to all files.

18. **thesis/search.php**

Display the results of the brand name search in the hamburger bar.

19. **thesis/toggle_favorite.php**

When a user presses a favorite button in `stockDetails.php`, this file is used to

communicate with the database regarding registration or deregistration.

20. **thesis/styles/headfoot.css**

The header and footer design is specified in this file.

21. **thesis/api/api_sp_components.py**

Get which stocks are built into S and P from the eodhd api and pass that information to api_sp_components.php.

22. **thesis/api/api_sp_components.php**

Store the information received from api_sp_components.py in the sp500_components table.

23. **thesis/api/api_stock_price.py**

Get 10-year stock prices for S and P embedded stocks from the eodhd api and pass that information to api_stock_price.php.

24. **thesis/api/api_stock_price.php**

Store the information received from api_stock_price.py in the stock_prices table.

25. **thesis/api/api_fundamentals1.py**

Retrieve detailed information on S and P embedded stocks from the eodhd api (information pertaining to company_profiles, company_financials, company_valuation, company_technicals, splits_dividends, analyst_ratings, insider_transactions, institutional_holders, fund_holders, and esg_scores tables) from the api_fundamentals1.php and passes this information to the api_fundamentals1.php.

26. **thesis/api/api_fundamentals1.php**

The information received from api_fundamentals1.py is stored in the company_profiles, company_financials, company_valuation, company_technicals, splits_dividends, analyst_ratings, insider_transactions, institutional_holders, fund_holders, and esg_scores tables.

27. **thesis/api/api_fundamentals2.py**

Detailed information on S and P included stocks (information related to the tables outstanding_shares (annual / quarterly), earnings_history, income_statements_quarterly, balance_sheets_quarterly, and cash_flows_quarterly) is obtained from the eodhd api, and the information is passed to api_fundamentals2.php.

28. **thesis/api/api_fundamentals2.php**

The information received from `api_fundamentals2.py` is stored in the `outstanding_shares` (annual / quarterly), `earnings_history`, `income_statements_quarterly`, `balance_sheets_quarterly`, and `cash_flows_quarterly` tables.

29. **thesis/api/api_sp_summary.py**

It retrieves key information from the issue tables and passes it to `api_sp_summary.php`.

30. **thesis/api/api_sp_summary.php**

Stores the information received from `api_sp_summary.py` in the `company_profiles` table.

31. **thesis/api/api_news.py**

Retrieve news from the `eodhd` api and pass that information to `api_sp_summary.php`.

32. **thesis/api/api_news.php**

Store the information received from `api_sp_summary.py` in the `news_articles` table.

3.3 Tables

In total, 24 tables were used for this site. The following is a description of what information is stored in each table and what role each table plays.

1. **user**

User table is the most fundamental part of this site. Rows are added when a user signs up, and the necessary information is also stored when a user signs in.

2. **user_stocks**

The ‘`user_stocks`’ table tracks which stocks each user owns, including quantity and average purchase price.

3. **stock_prices**

The ‘`stock_prices`’ table stores historical daily stock prices for each ticker.

4. **orders**

The ‘`orders`’ table manages all buy and sell orders, including market/limit types, status, execution info, and optional expiration.

5. **stock_favorites**

The ‘stock_favorites’ table stores users’ favorite stocks to track, using a unique constraint per user and ticker.

6. **company_profiles**

The ‘company_profiles’ table stores general information about companies including name, sector, industry, and IPO details.

7. **company_financials**

The ‘company_financials’ table contains detailed financial metrics such as revenue, earnings, margins, growth, and estimates.

8. **company_valuation**

The ‘company_valuation’ table contains various valuation metrics for each company, such as price-to-earnings and enterprise value ratios.

9. **company_technicals**

The ‘company_technicals’ table stores technical indicators such as moving averages and beta values for each company.

10. **splits_dividends**

The ‘splits_dividends’ table holds both dividend and stock split information, including yield, payout ratio, and dates.

11. **analyst_ratings**

The ‘analyst_ratings’ table stores analyst sentiment ratings for a company, including breakdowns of buy/hold/sell recommendations.

12. **insider_transactions**

The ‘insider_transactions’ table logs share transactions made by company insiders, with relevant details including SEC link.

13. **institutional_holders**

The ‘institutional_holders’ table tracks institutions holding shares in companies, including changes and total assets.

14. **fund_holders**

The ‘fund_holders’ table records fund-level shareholding details in public companies, similar to institutional holders.

15. **esg_scores**

The ‘esg_scores’ table tracks environmental, social, and governance ratings for companies.

16. **outstanding_shares**

The ‘outstanding_shares’ table contains annual or quarterly data on the number of shares outstanding for each company.

17. **earnings_history**

The ‘earnings_history’ table stores actual and estimated EPS and revenue for company earnings releases.

18. **income_statements_quarterly**

The ‘income_statements_quarterly’ table holds quarterly financial results including revenue, expenses, and net income.

19. **balance_sheets_quarterly**

The ‘balance_sheets_quarterly’ table stores quarterly balance sheet data for each company.

20. **cash_flows_quarterly**

The ‘cash_flows_quarterly’ table contains detailed quarterly cash flow information for companies.

21. **sp500_summary**

The ‘sp500_summary’ table summarizes current stock data for companies in the SP 500 index.

22. **news_articles**

The ‘news_articles’ table stores market-related news articles including publication time, company symbols, content, and link metadata.

23. **dividend_receipts**

The ‘dividend_receipts’ table records dividend information for each user, including share count and per-share payout.

24. **stock_split_receipts**

The ‘stock_split_receipts’ table logs stock split history per user, including date, ratio, and number of shares before and after the split.

25. **news_articles**

The ‘news_articles’ table stores market-related news articles including publication time, company symbols, content, and link metadata.

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3.4 Functions and Tests

3.4.1 User Registration, Information Update, and Login

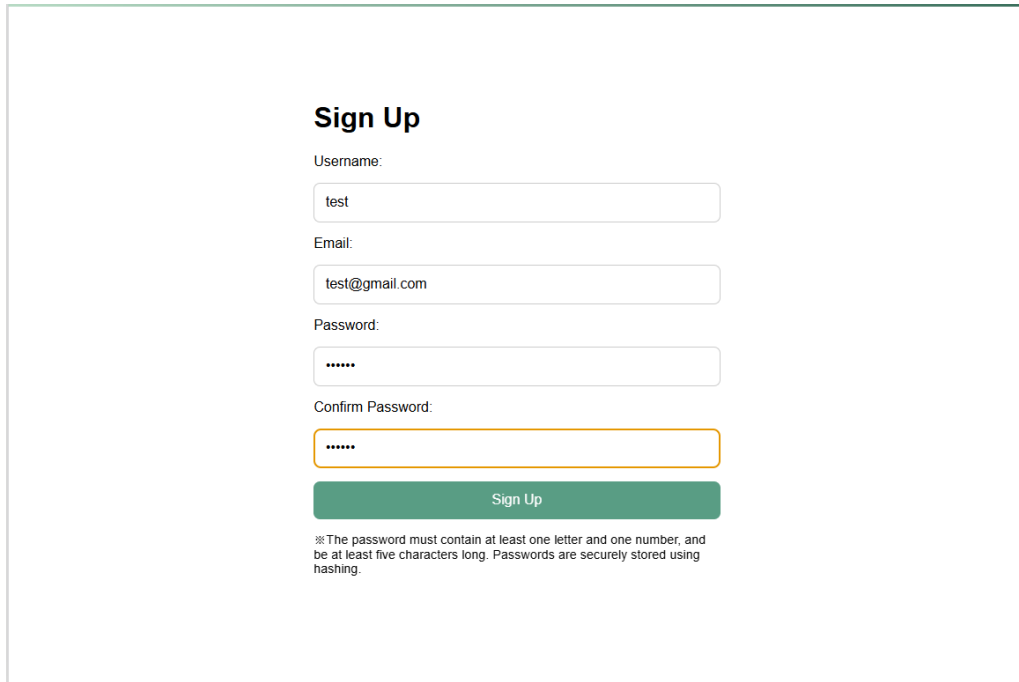
Key Functionalities

- Users can register with a username, email, and password. Passwords must meet security requirements.
- After successful registration, the user is redirected to My Page.
- Users can update profile information including username, email, password, and account balance.
- Login is verified using updated credentials.

Testing Plan for User Registration and Updates

Test Case	Expected Result	Actual Result	height
Valid registration data	Account created, redirected to My Page	Passed	
Duplicate email/username	Error message displayed, no account created	Passed	
Weak password (no number)	Error message shown about password requirements	Passed	
Profile update (valid data)	Updated info saved, confirmation shown	Passed	
Login with updated credentials	Successful login, redirected to My Page	Passed	

Table 3.1: Test Cases for User Registration and Profile Update



Sign Up

Username:

Email:

Password:

Confirm Password:

※ The password must contain at least one letter and one number, and be at least five characters long. Passwords are securely stored using hashing.

Figure 3.1: Registration form filled with valid data



	id	username	email	password_hash	balance	created_at	last_login
	34	test	test@gmail.com	\$2y\$10\$CK/cw1NoX/G1ZX9oIf5p5.JTf5LCLXn6jGRhgAP2gtL...	10000.00	2025-04-26 02:51:53	NULL

Figure 3.2: New user record confirmed in database

3.4.2 Favorite Registration and Removal

Key Functionalities

- Users can add a stock to favorites by clicking the inactive favorite button on the stockDetails page.
- Users can remove a stock from favorites by clicking the active favorite button on the stockDetails page.
- Users can remove a stock from their favorites list on My Page by clicking the remove button.

Testing Plan for Favorite Registration and Removal

Test Case	Expected Result	Actual Result
Click inactive favorite button on stockDetails page	Favorite registered successfully	Passed
Click active favorite button on stockDetails page	Favorite removed successfully	Passed
Click remove button in My Page favorite stocks list	Favorite removed successfully	Passed

Table 3.2: Test Cases for Favorite Registration and Removal

3.4.3 Dividend and Stock Split Processing**Key Functionalities**

- After US market close each day, a scheduled API script checks for dividend and stock split information.
- If the user's holdings have a dividend record date today, an entry is added to the dividend history list.
- On the dividend payment date, the dividend is credited to the user's balance.
- If a stock split occurs today, it is recorded in the split history and reflected in the user's holdings.

Testing Plan for Dividend and Stock Split Processing

Test Case	Expected Result	Actual Result
Dividend record date matches today	Entry added to My Page dividend history list	Passed
Dividend payment date matches today	Dividend credited to user's balance	Passed
Stock split date matches today	Split recorded and reflected in holdings	Passed

Table 3.3: Test Cases for Dividend and Stock Split Processing

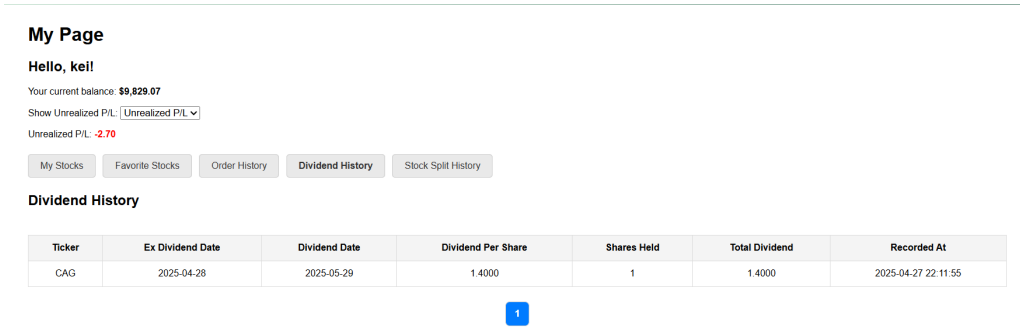


Figure 3.3: After dividend date published

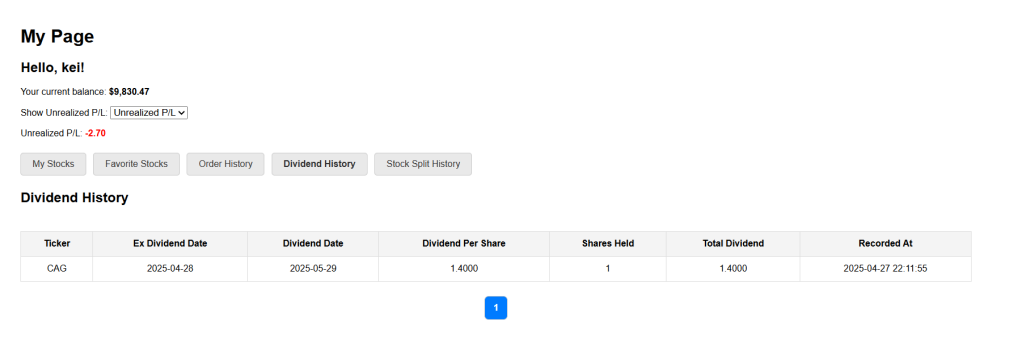


Figure 3.4: After dividend payment

3.4.4 Buying and Selling Stocks

Key Functionalities

- Real-time orders are executed immediately if market is open.
- Limit orders are checked after US market close each day through an API script.
- Orders are restricted based on available balance and holdings.
- After execution, user's balance and holdings are updated accordingly.
- Real-time trading is disabled while the US market is closed.
- Limit orders are evaluated against daily OHLC prices, and expired orders are automatically canceled.

Testing Plan for Buying and Selling Stocks

Test Case	Expected Result	Actual Result
Attempt to buy/sell exceeding balance/holdings	Transaction restricted, error shown	Passed
Successful real-time/limit trade	Balance and holdings updated correctly	Passed
Real-time trading attempted while market closed	Action restricted, error shown	Passed
Limit order evaluated after market close	Order executed if conditions met	Passed
Limit order expired	Order automatically canceled	Passed

Table 3.4: Test Cases for Buying and Selling Stocks

id	user_id	ticker	order_type	side	limit_price	shares	status	executed_price	executed_amount	executed_at	created_at	expires_at
1	2	AAPL	MARKET	BUY	NULL	1	EXECUTED	190.42	190.42	2025-04-11 06:02:25	2025-04-11 06:02:25	NULL
2	2	AAPL	MARKET	SELL	NULL	1	EXECUTED	190.42	190.42	2025-04-11 06:36:16	2025-04-11 06:36:16	NULL
3	2	AAPL	MARKET	SELL	NULL	1	EXECUTED	190.42	190.42	2025-04-11 06:36:30	2025-04-11 06:36:30	NULL
4	2	A	LIMIT	BUY	100.30	1	PENDING	NULL	NULL	NULL	2025-04-22 20:10:47	2025-04-22 16:00:00
5	2	A	MARKET	BUY	NULL	1	EXECUTED	105.70	105.70	2025-04-25 00:55:46	2025-04-25 00:55:46	NULL
6	2	A	LIMIT	SELL	106.30	1	PENDING	NULL	NULL	NULL	2025-04-27 21:21:39	2025-04-27 16:00:00
7	2	WDC	LIMIT	BUY	40.80	1	PENDING	NULL	NULL	NULL	2025-04-27 21:53:09	2025-04-27 16:00:00
8	2	WDC	MARKET	BUY	NULL	1	EXECUTED	40.78	40.78	2025-04-27 21:55:08	2025-04-27 21:55:08	NULL
9	2	CAG	MARKET	BUY	NULL	1	EXECUTED	24.45	24.45	2025-04-27 22:10:57	2025-04-27 22:10:57	NULL

Figure 3.5: The table after limit order made

id	user_id	ticker	order_type	side	limit_price	shares	status	executed_price	executed_amount	executed_at	created_at	expires_at
1	2	AAPL	MARKET	BUY	NULL	1	EXECUTED	190.42	190.42	2025-04-11 06:02:25	2025-04-11 06:02:25	NULL
2	2	AAPL	MARKET	SELL	NULL	1	EXECUTED	190.42	190.42	2025-04-11 06:36:16	2025-04-11 06:36:16	NULL
3	2	AAPL	MARKET	SELL	NULL	1	EXECUTED	190.42	190.42	2025-04-11 06:36:30	2025-04-11 06:36:30	NULL
4	2	A	LIMIT	BUY	100.30	1	CANCELLED	NULL	NULL	NULL	2025-04-22 20:10:47	2025-04-22 16:00:00
5	2	A	MARKET	BUY	NULL	1	EXECUTED	105.70	105.70	2025-04-25 00:55:46	2025-04-25 00:55:46	NULL
6	2	A	LIMIT	SELL	106.30	1	CANCELLED	NULL	NULL	NULL	2025-04-27 21:21:39	2025-04-27 16:00:00
7	2	WDC	LIMIT	BUY	40.80	1	CANCELLED	NULL	NULL	NULL	2025-04-27 21:53:09	2025-04-27 16:00:00
8	2	WDC	MARKET	BUY	NULL	1	EXECUTED	40.78	40.78	2025-04-27 21:55:08	2025-04-27 21:55:08	NULL
9	2	CAG	MARKET	BUY	NULL	1	EXECUTED	24.45	24.45	2025-04-27 22:10:57	2025-04-27 22:10:57	NULL

Figure 3.6: The table after daily limit order done

The testing outcomes confirm that the essential user-related features—such as registration, login, and profile updates—function reliably under normal and edge

case conditions. Proper validation and error handling are in place for common issues like duplicate accounts or weak passwords. These tests demonstrate the system's robustness and usability, ensuring a smooth user experience and reinforcing the application's educational purpose.

Chapter 4

Conclusion

This simulated stock trading application was developed to enhance financial literacy by providing a risk-free environment for users to explore investing. Real-time data, virtual funds, and a user-friendly interface provide an accessible learning platform for beginners, students, and casual investors.

The current version supports core features such as user registration, US stock trading, and profit and loss tracking, but several limitations were identified. Due to API constraints, intraday charts for all stocks and real-time profit and loss updates are not fully implemented, reducing responsiveness and accuracy. In addition, the current system may face scalability challenges as user volume increases, and security measures—such as input sanitization, session management, and encryption—can be further strengthened for production-grade deployment. Performance limitations, especially under high load or during simultaneous data fetches, may also impact user experience. Addressing these limitations would significantly improve the robustness and realism of the platform.

In the future, the application can be extended to support additional asset classes such as FX, cryptocurrencies, and ETFs, as well as features such as multi-currency support, a multi-language UI, and advanced analysis tools. These improvements would make the platform more comprehensive and realistic for global users.

From a development perspective, the project applied a variety of technologies—PHP, JavaScript, MySQL, Python, and WebSockets—and emphasized the importance of modular design for future scalability.

In summary, the project successfully bridged theoretical finance and practical experience. It has strong potential for future expansion into a comprehensive edu-

cational platform for global financial literacy.

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