

TTT Stock Market League

Report 1
Software Engineering
14:332:452

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Project Repository - https://github.com/amalhotr/SMIL_project
Report Repository - https://github.com/amalhotr/SMIL_report

February 24, 2019

Revision History:

Version Number	Date
V.1	02/10/2019
V.2	02/17/2019

Individual Contributions Breakdown:

Category	Albert Joshua C.	Yong Ho Danny L.	Ajeet M.	Raffay K.	Antoni C.	Ping L.	Chris Y.	Aryeh N.
Customer Problem Statement	20%	20%	20%		20%			20%
Glossary Of Terms				50%		25%		25%
User Stories		25%			25%		25%	25%
On Screen Requirements	35%		65%					
Stakeholders	50%		50%					
Actors & Goals					100%			
UC- Casual Description		15%			60%	15%		
UC - Use Case Diagram		100%						
UC - Traceability Matrix		10%				90%		
UC - Fully Dressed Desc.					50%	50%		
System Sequence Diagram				67%				33%
Prelim Design			100%					
User Effort Estm.	100%							
Domain Model			55%		15%	30%		

System Operation Concepts		65%						35%
Project Size		10%		90%				
Plan of Work	80%	10%		10%				
Project Management	15%	10%	30%	10%	15%	20%		

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1.Customer Problem Statement

1.a. Problem Statement

In today's world, the stock market plays a huge role in the country's economy. The stock market incorporates markets and exchanges regular activities of buying and selling shares of public companies. These activities are formally done under a defined set of regulations. The amount of people who want to be part of the stock exchange grow each and every day as an effort to increase their financial status, however the lack of experience for many hinder their ability to invest, and intimidate them from entering the markets. By introducing Thin To Thick (TTT) Stock Market League, inexperienced investors, along with experienced investors can paper trade and make real market decisions without the consequences of using real money. This will help novice investors learn the markets and gain some experience before entering the markets with their own capital.

When the user first enters the website, they will register for an account and set up a unique username and password. As part of their account, the user will be given a cash portfolio so they can immediately jump into the market. The user will then be guided on a tour of the different features and functions of the website, and learn how they can make market plays that will affect their portfolio. At the end of the tour, the user will be prompted to head to an FAQ page, where they can learn the basic terms, conditions and rules of the stock market. The user will have the option to immediately do things such as buying and selling stocks, to encourage participation right away. They can do this with the American dollar, or with the newly integrated cryptocurrency feature. The simulated stocks on the website will be constantly updated to grow

and decay with the real-life stocks they are based on, so the user will have a safe idea of which companies to start investing in right away.

To further ease novices into the market, users will be shown recommendations of safe places to invest with their portfolios. Once they have invested in a stock, they will be able to track that stock at any given time. If they do not wish to invest yet, the user can select to monitor stocks they're interested in until they're either ready to buy or move on. In addition, users will be able to offload the data of their choosing to an excel spreadsheet at any given time. This includes, but is not limited to, their current stock portfolio, balance and trading history.

Users will also be encouraged to either enter a league or create one of their own. Leagues are where users of similar strength and experience can compete according to the rules set forth by the league administrator. These rules will include the value of everyone's starting portfolio, the type of currency being used, and the length of the league. There will be two different kinds of leagues, a private and a public. Users can choose to make a public league, where the league administrator makes the rules and sets the guidelines and the league is open to join to the public. Users can also choose to make a private league, which is similar to the latter, however is not open to all users, and is by invitation only by the league admin, or invited users. Users can see how they're doing by viewing a real-time leaderboard of how much everyone else in the league has gained or lost from their starting portfolio. In addition to this, they will be able to view global leaderboards that track specific metrics of comparison for all users. There is also an option where two users can choose to compete, and compare their earnings/gains over a set period of time. This will enhance the competitiveness of the game, and provoke all users to do better.

Overall, the TTT Stock Market League hopes to give users a well understanding of the stock market. The program will be both informative and entertaining at the same time, by implementing gamification into our product it will keep users interested in our product and give them a full experience of stocks. In conclusion, the goal of our product is to give the users a more interactive way of learning the critical skills and aspects of the real world stock market by giving them a hands on experience of stocks trading.

1.b. Glossary of Terms

Bid: an offer made by an investor, trader or dealer, in an effort to buy a security, commodity or currency.

Closing price: Price of the last transaction of a particular stock completed during a day's trading session on an exchange.

Cryptocurrency: A form of digital currency which utilizes cryptographic encryption to regulate currency legitimacy and security.

Dividend: A sum of money that a company pays out to its shareholders for holding stake in the company. Typically paid out quarterly and is dependent on the profits of the company

Dividend yield: The dividend expressed as a percentage of a stock's current going market price.

Dividend reinvestment: A plan which involves taking the dividend profit made and immediately reinvesting it back into the company. Instead of making a sum of money, you will hold more equity every dividend period.

Exchange: A facility where stock brokers and traders can buy and sell securities, such as shares of stock and bonds and other financial instruments.

52 week high/low: The highest and lowest price that a stock has traded at during the previous year.

Leaderboard: An ordered list of a participant's standing with respect to other participants. It will display a player's rank and score.

League: A collection of players playing on the same leaderboard. They are in direct competition with each other for the championship of the league.

Market capitalization: the value of a company that is traded on the stock market, calculated by multiplying the total number of shares by the present share price.

Order:

Day order: an order to buy or sell a security that automatically expires if not executed on the day the order was placed.

Limit order: a direction given to a broker to buy or sell a security or commodity at a specified price or better.

Market order: a buy or sell order to be executed immediately at the current market prices.

Stop limit order: a conditional order based on a price that is not yet available in the market when the order was originally placed. Once the future price is available, a stop order will be triggered.

Payment date: The date on which shareholders of record will be sent a check for the declared dividend.

P/E ratio: Current stock price divided by trailing annual earnings per share.

Portfolio: The list of investments and holdings owned by a participants. Outlines all the stocks and shares a players owns.

Return on Investment (ROI): a performance measure used to evaluate the efficiency of an investment or compare the efficiency of a number of different investments.

Record date: Date by which a shareholder must officially own shares in order to be entitled to a dividend.

Screen Stocks: A built in application utility that will allow users to see only to stocks that meet their own defined metrics and specifications. It is essentially a filter for stocks.

Security: a tradable asset of any kind. Can include debts, equities, or derivatives.

Sector: an area of the economy in which businesses share the same or a related product or service.

Sector allocation: how much money is allocated into a specific sector of the market.

Share: a small percentage of a given company which can purchased or sold from other traders

Volume: the number of shares that changed hands during a given day.

Ticker symbol: An abbreviation used to uniquely identify publicly traded shares of a particular stock on a particular stock market.

Trading session: A period of time that comprises a single day of business in a financial market, from opening bell to its closing bell.

Additional definitions of terms can be found on
<https://www.investopedia.com/categories/stocks.asp> &
<https://www.nasdaq.com/investing/glossary/>.

2. System Requirements

2.a. User Stories

Identifier	User Story	Weight
ST-1	As a user, I can view real time stock information	10
ST-2	As a user, I can view real time cryptocurrency information	10
ST-3	As a user, I can search through stocks by their symbol or company name	8
ST-4	As a user, I can create a user account with my email address	10
ST-5	As a user, I can have a portfolio of stocks	9
ST-6	As a user, I can have a 'wallet'. In game money associated with my account	10
ST-7	As a user, I can buy stocks from the market with my in game money	10
ST-8	As a user, I can sell stocks from my portfolio in exchange for in game money	10
ST-9	As a user, I can export my portfolio information to an excel document	5
ST-10	As a user, I can earn dividends at the end of each quarter	4
ST-11	As a user, I can choose whether or not I would like to reinvest my dividends	4
ST-12	As a user, I can view a leaderboard containing a ranking by in game money of all users in the league	5
ST-13	As a user, I can create my own league and invite friends to the league	10

ST-14	As a user, I can join public leagues that anyone can join and play together	8
ST-15	As a user, I can follow a tutorial which will display pop-ups with instructions about how to use the application	4
ST-16	As a user, I can create a public league and become its administrator	5
ST-17	As a user, I can create a private league and become its administrator	5
ST-18	As a user, I can enter and leave public leagues	4
ST-19	As a league admin, I can set the league rules	4
ST-20	As a league admin, I can invite other users to my private league	7
ST-21	As a user, I am unable to join private leagues without invitation	6
ST-22	As a league admin, I can remove users from my league	4
ST-23	As a registered user, I can login to the web application using my username and password	7
ST-24	As a site administrator, I can modify leagues, access all database information, and modify the front page.	9

2.c. On Screen Requirements

Figures 1 and 2 below show the preliminary templates for the on screen requirements for the login and home page. On the login page (Figure 1), where the user will first land, there is a login section that asks for the username and password. For new users, there is an option to sign up and register for a new account. For registered users who forgot their password, there is a password recovery option. Once the user has logged in, they will enter the home page (Figure 2), and will see their portfolio value, asset allocation, and recent stock prices. On the that page, there will be seven tabs that consist of home, dashboard, trade, watchlist, my leagues, leaderboard, and sign out. From the home page, the user can then choose to either trade stocks, research stock prices, enter and create leagues, and more.



Figure 1 - Login Page



Figure 2 - Home Page

Identifier	Requirement	Weight
OSR-1	The login page should contain a place for entering a username and password to login.	5
OSR-2	The login page should contain a place for new user registration and password recovery.	3
OSR-3	Once logged in, all pages should contain tabs at the top to redirect user to other features/pages.	4
OSR-4	The webpage should be optimized for all browsers, including desktop and mobile.	4
OSR-5	All unknown URLs and error pages should show a 404 not found or error page.	2

3. Functional Requirements Specification

3.a. Stakeholders

The TTT Stock Market League is a great application for many people and organizations. The application acts as a training to enter a market that has an infinite upside if the user has experience and makes the right decisions. Therefore the application's target base consists of individuals who are curious about the market, students and educators who have aspirations of understanding and trading in the market, along with corporations that want to train their staff without the downside of losing capital. As the user base of TTT Stock Market League grows, there will be more data that will lead to the development of more complicated and essential analysis tools, better market data and indicators, along with more exposure, which will in turn lead to the acquisition of higher skilled traders who want to practice or apply their skills in order to perfect algorithms and try new ideas without using capital.

The software will be accessible for all users with no cost. Members of the group do intend on including advertisements eventually as the league grows, but ultimately will not affect the usage of the users. The point of this is to make sure the TTT Stock Market League grows successfully, and gain enough users before adding advertisements. This will eventually bring in revenue to the stock market league. The main target for this league is for all users willing to learn how to trade stocks or simply just enhance their experience with trading stocks, whether that would be students or professional stock investors. The software should give the users a greater understanding of the stock market world, and is a perfect place to start practicing investing before entering the market.

3.b. Actors and Goals

Role	Type	Goal
Player	Initiating, Participating	Join leagues, buy and sell stocks, view stock information, view leaderboard(s), view portfolio, export portfolio information to Google Sheets
League Manager	Initiating, Participating	Create league(s) both public and private, set league rules, invite users to join private leagues, remove users from leagues
Site Administrator	Initiating	Maintain proper working order of website, handle advertisements
Finance API	Participating	Retrieve stock market information
Database	Participating	Store user info, league info

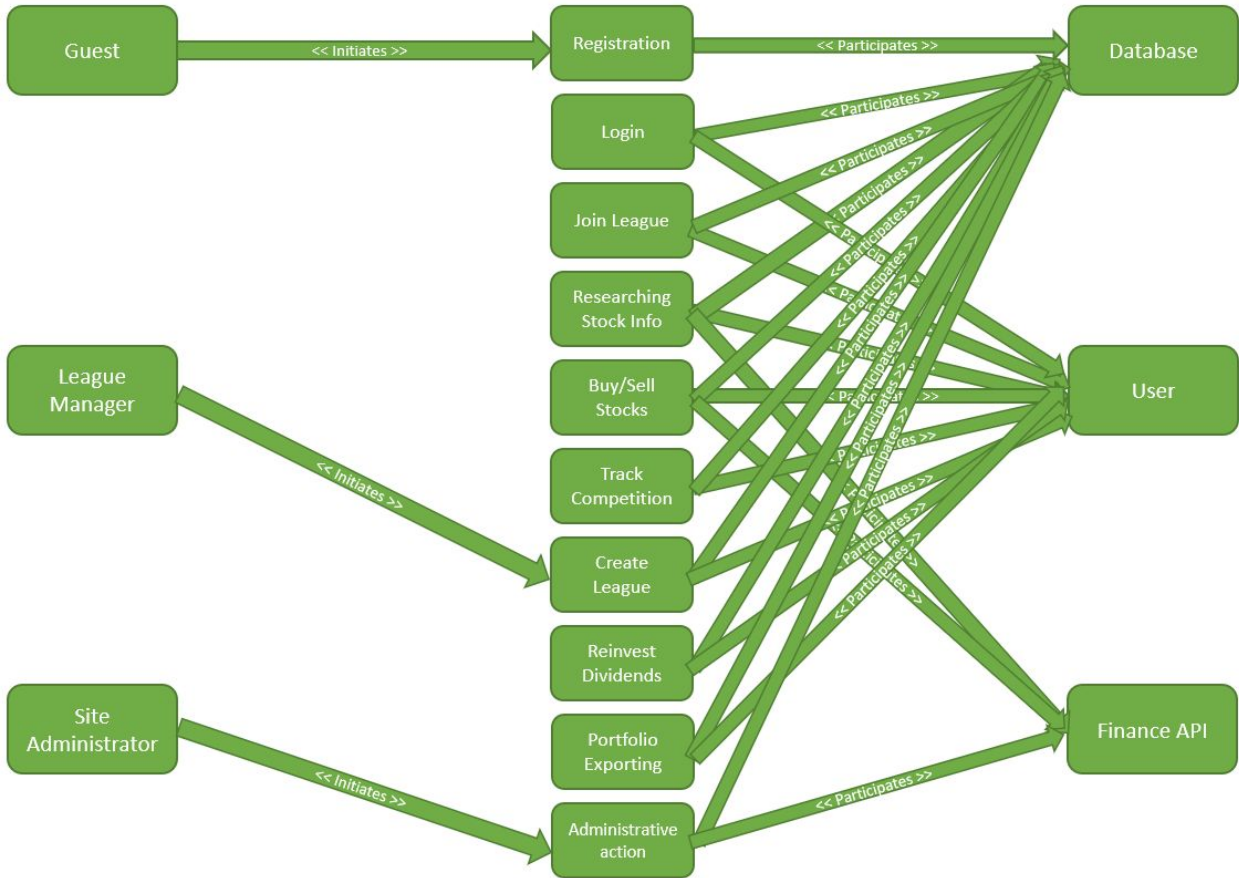
3.c. Use Cases

I. Casual description

Use case identifier	Description	Related Requirement
UC-1: Registration	A non-registered user can create a TTT user account by providing an email, username, and password. Upon registration, the user will be provided with a brief tutorial on the features of the application.	ST-4, ST-15
UC-2: Login	A registered user can login to the TTT web application by providing their username and password	ST-23
UC-3: Join League	A registered user can search through public leagues, viewing their rulesets, and joining any	ST-14, ST-18

	number of leagues	
UC-4: Researching stock info	A user can search for stocks by name or symbol. They can view relevant information such as current stock price and past performance	ST-1, ST-2, ST-3
UC-5: Buy/sell stocks	A user, that is a league member, can purchase stocks to their portfolio as well as sell stocks that they hold	ST-6, ST-7, ST-8
UC-6: Track competition	A member of a league can view current league standings and statistics through a leaderboard	ST-12
UC-7: Create league	A user can create a league. Leagues can either be public or private. Private league managers can invite users to participate in their league. League managers will be able to establish a ruleset upon creating their league	ST-13, ST-16, ST-17, ST-19, ST-20 ST-21, ST-22
UC-8: Reinvest dividends	A user can choose to reinvest the dividends of a stock in his/her portfolio. At the closing price of the next trading session after the payment day for the dividend, the maximum number of additional shares will be added to his/her portfolio. Otherwise, the remaining dividends will be deposited into the user's account as cash.	ST-5, ST-6, ST-10, ST-11
UC-9: Portfolio exporting	A user can export their portfolio information to an external Google Sheets document. The information that can be exported include stock ticker, stock price, number of shares, market capitalization, P/E ratio, dividend yield, 52-wk high, and 52-wk low.	ST-5, ST-9
UC:10: Administrative Actions	A site administrator can perform administrative actions to maintain the proper working order of the site. All database information can be changed by the administrator.	ST-24

II. Use Case Diagram



III. Traceability Matrix

[illegible]

ST-10	4								X		
ST-11	4								X		
ST-12	5						X				
ST-13	10							X			
ST-14	8			X							
ST-15	4	X									
ST-16	5							X			
ST-17	5							X			
ST-18	4			X							
ST-19	4							X			
ST-20	7							X			
ST-21	6							X			
ST-22	4							X			
ST-23	7		X								
ST-24	9										X
Max PW		10	7	8	10	10	5	10	10	9	9
Total PW		14	7	12	28	30	5	41	27	14	9

IV. Fully Dressed Description

Use Case	UC-3: Join League
Related Requirements	ST-14, ST-18
Initiating Actor	Player
Actor's Goals	Search through available leagues, find one that is desirable and join it as a member
Participating Actors	League Manager, Database
Preconditions	Player is a registered user and there are public Leagues available
Postconditions	Player is a member of a league. They have a portfolio and a wallet associated with them
Flow of events for Main success scenario	<p>→ 1. Player initiates search for available leagues ← 2. System provides them with a list of available leagues → 3. Player chooses a league that is desirable to them → 4. User selects a join league button ← 5. Database adds user to league ← 6. Player is added to League Managers list of members → 7. Player is given some starting capital (based on ruleset) and is able to start participating in purchases and sales of stocks</p>
Flow of events for extensions	<p>→ 1. A League Manager of a private league sends an invitation to a registered user ← 2. The Player will receive a notification either in the application or through an email → 3. The Player may accept or decline ← 4. Upon acceptance of invitation, Player will be added to the league database, as well as the League Managers list of members → 5. Player is given some starting capital and is able to start participating in the league</p>

Use Case	UC-4: Researching stock information
Related Requirements	ST-1, ST-2, ST-3
Initiating Actor	Player
Actor's Goals	Research the latest information on a stock.
Participating Actors	Finance API, Database
Preconditions	Player is on the trade page.
Postconditions	Player has gained information on a stock.
Flow of events for Main success scenario	<p>→ 1. Player searches up a stock by ticker or name.</p> <p>← 2. The system signals the Finance API to retrieve information on the stock.</p> <p>→ 3. The Finance API returns with information on the stock.</p> <p>← 4. The system displays the information to the player.</p> <p>→ 5. The player interacts with the charting and the systems updates the charting.</p> <p>→ 6. The player clicks on a news hyperlink.</p> <p>← 7. The system opens up the new article on a pop-up window.</p> <p>→ 8. The player clicks close on the pop-up window.</p> <p>→ 9. The system closes the pop-up window.</p> <p>← 10. The player adds the stock to his/her watchlist.</p> <p>→ 11. The systems adds the request to the database and turns the watchlist indicator on.</p>

Use Case	UC-5: Buy/Sell stocks
Related Requirements	ST-6, ST-7, ST-8
Initiating Actor	Player
Actor's Goals	Purchase stocks to their portfolio and sell stocks from their portfolio

Participating Actors	Finance API, Database
Preconditions	Player is on the trade page.
Postconditions	Player has submitted a buy or sell order.
Flow of events for Main success scenario	→ 1. Player searches up a stock by ticker or name. ← 2. The system signals the Finance API to retrieve information on the stock. → 3. The Finance API returns with information on the stock. ← 4. The system displays the information to the player. → 5. The player chooses the number of shares or amount to buy or sell. ← 6. The system prompts the user for type of order (day order, limit order, market order, or stop limit order). → 7. The player chooses the type of order. ← 8. The system provides information on the request. → 9. The player confirms the order. ← 10. The system adds the order to the Database.
Flow of events for extensions	8a. The players has insufficient cash or shares for the request. ← 1. The system displays that the user has insufficient resources for the order and returns to trade page.

Use Case	UC-7: Create League
Related Requirements	ST-13, ST-16, ST-17, ST-19, ST-20, ST-21, ST-22
Initiating Actor	League Manager
Actor's Goals	To setup a league for players to join and partake in
Participating Actors	Database

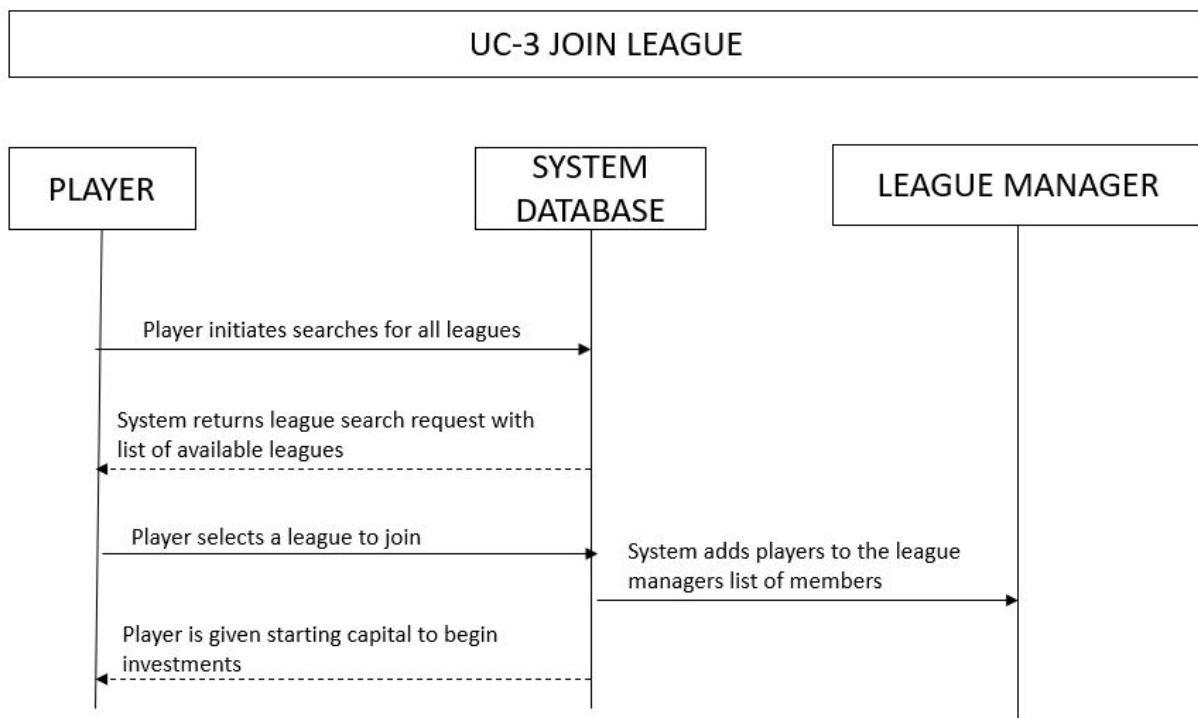
Preconditions	The league manager is a registered user and is on the create a league page
Postconditions	The league manager has created a league for other users to join
Flow of events for main success scenario	→ 1. The league manager clicks on create a league. ← 2. The database shows all of the available options for the league. → 3. The league manager chooses their preferred options and creates the league. ← 4. The database adds the league to the list of leagues. → 5. The league manager is sent to the created league's main page
Flow of events for extensions	3a. The league name is already taken ← The database tells the league manager the name is already taken and to try a different name.

Use Case	UC-8: Reinvest dividends
Related Requirements	ST-5, ST-6, ST-10, ST-11
Initiating Actor	Player
Actor's Goals	To setup reinvestment of dividends for a particular stock in the portfolio
Participating Actors	Finance API, Database
Preconditions	The player is on the dashboard page and has shares of stocks in his/her portfolio.
Postconditions	The player has setup reinvestment of dividends for a particular stock.
Flow of events for Main success scenario	→ 1. The player clicks on a particular stock in his/her portfolio. ← 2. The system signals the Finance API to retrieve information on the stock. → 3. The Finance API returns with

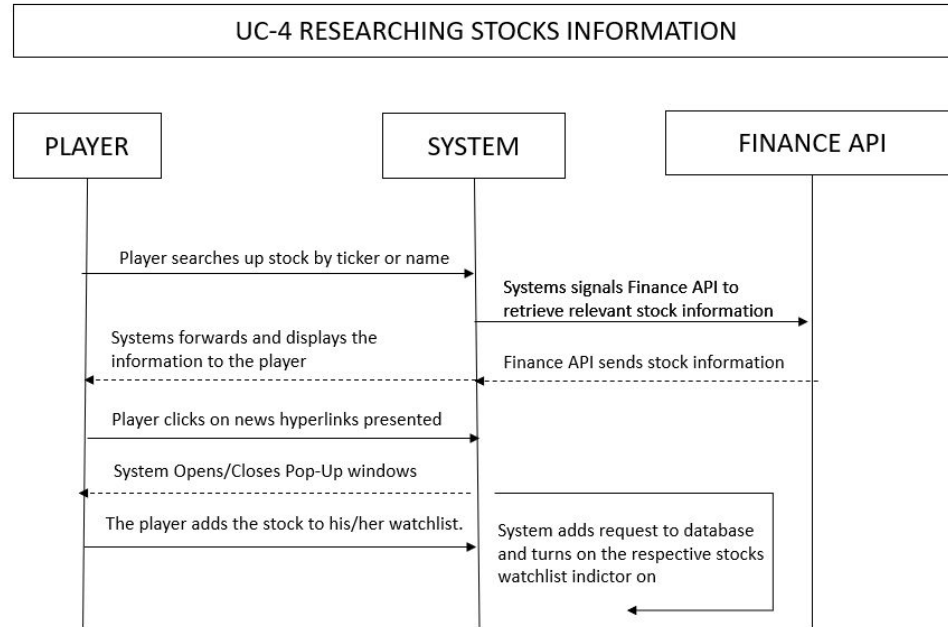
	<p>information on the stock.</p> <p>← 4. The system displays the information to the player.</p> <p>→ 5. The player clicks on the reinvestment option.</p> <p>← 6. The system provides information on the player's request.</p> <p>→ 7. The player confirms the request.</p> <p>← 8. The system adds the request to the database and changes the reinvestment indicator to on.</p>
Flow of events for extensions	<p>5a. Reinvestment was already turned on and the players wants to turn it off. Same flow of events, except the reinvestment indicator is turned off.</p>

3.d System Sequence Diagrams

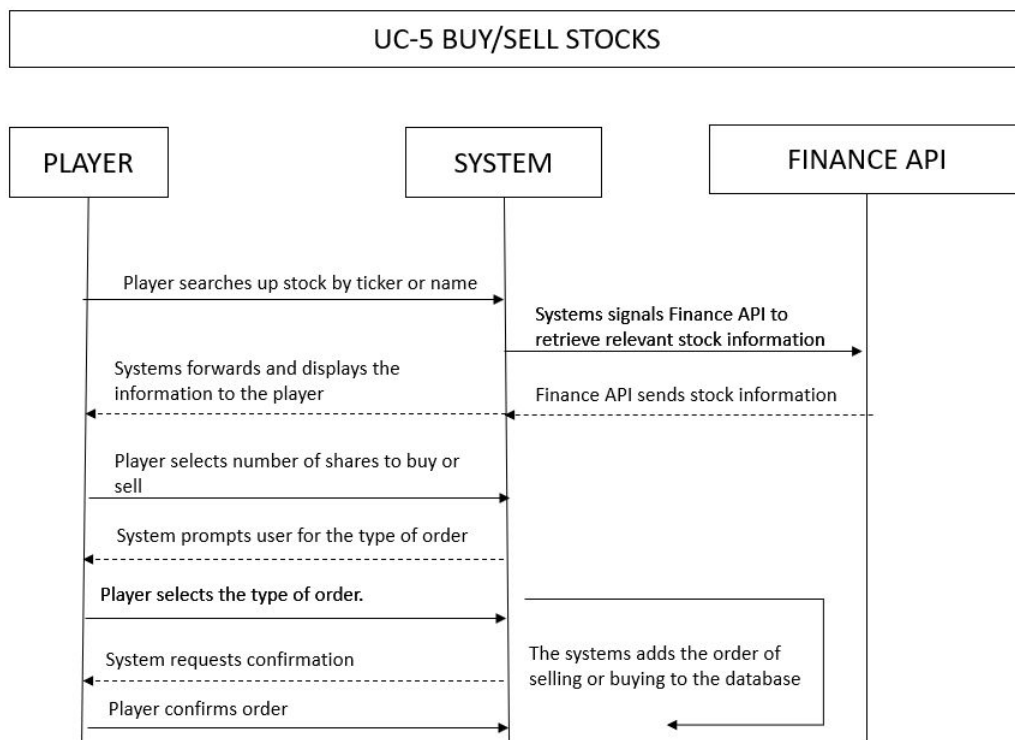
UC-3 JOIN LEAGUE



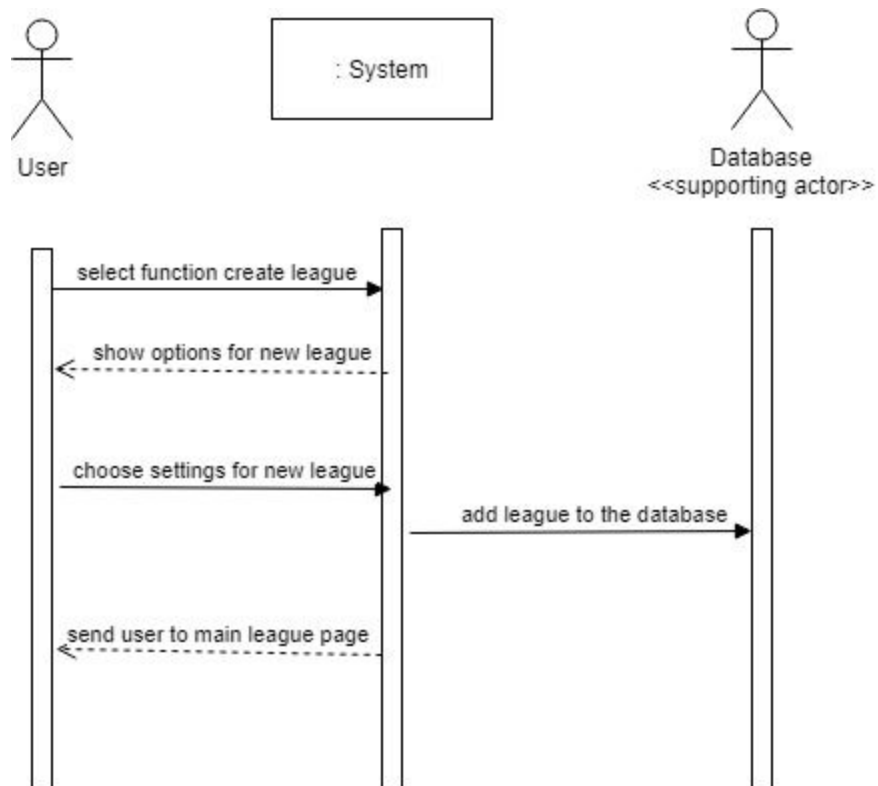
UC-4 RESEARCHING STOCK INFORMATION



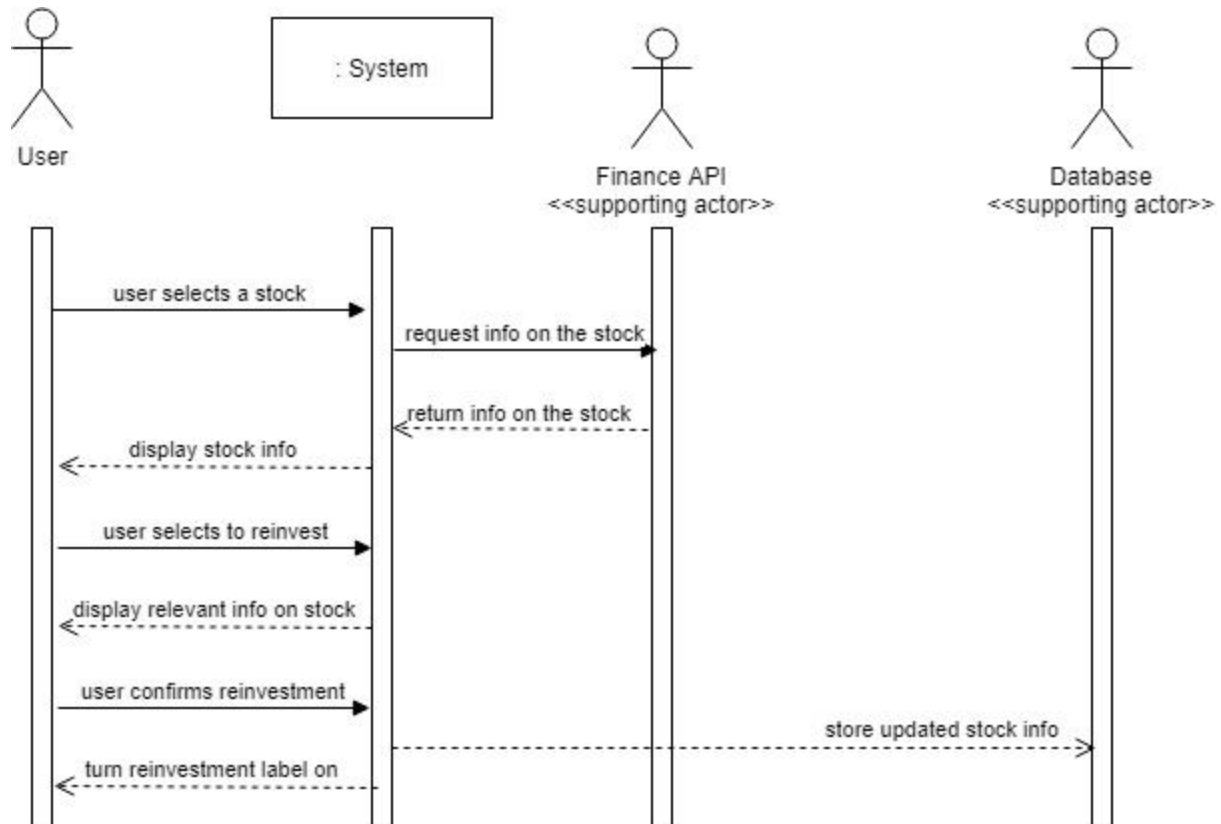
UC-5 BUY/SELL STOCKS



UC-7 CREATE LEAGUE



UC-8 REINVEST DIVIDENDS



4. User Interface Specification

4.a. Preliminary Design

The TTT Stock Market League user interface will act as the main navigation method for using the application. The simple and intuitive design of the user interface will help the users easily navigate through different pages, and conveniently execute multiple actions. The user is able to trade, research, join and manage leagues, as well as review past trades and account overview. As the user enters the website, they are able to sign in or make an account.

Main Login Page (Figure 1)

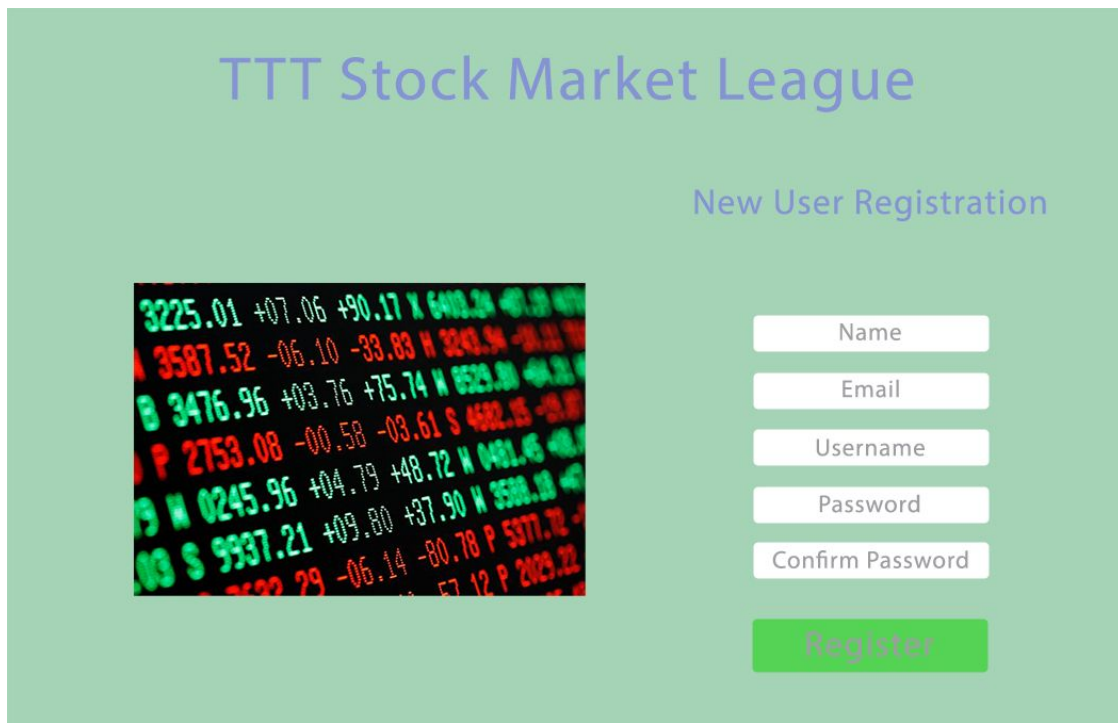
The main login page will be presented to all visitors/users that enter the website. If the user already has registered for an account, then there is a username and password field that will sign in the user. If the user has not yet registered, then there is a button under the sign in button that will redirect the user to the registration page. Under the register button, there is also a forgot password button that will direct the user to the password recovery system.



Figure 1- Main Landing Page

Registration Page (Figure 2)

The new user registration page will consist of five fields, the name, email, username, password and confirm password. Once the user has filled out all of the required fields, they can then click the register button to register their account. The registration page is very simple and very easy to use, so that users can easily register for an account and start trading as soon as possible.



TTT Stock Market League

New User Registration

3225.01 +07.06 +90.17 X 6403.24 -47.37 -47.37
A 3587.52 -06.10 -33.83 H 3243.94 -21.11 78
B 3476.96 +03.76 +75.74 H 6523.20 -44.21 1
P 2753.08 -00.58 -03.61 S 4682.15 -21.07
9 H 0245.96 +04.79 +48.72 H 0481.45 -48.7
03 S 9937.21 +09.80 +37.90 H 3588.18 -4
7522 29 -06.14 -80.78 P 5377.72 -
57 12 P 2029.22

Name

Email

Username

Password

Confirm Password

Register

Figure 2 - New User Sign up

Home Page (Figure 3)

Once the user has logged into their account, they will be greeted with home page. The home page has basic account information like their portfolio balance, an asset allocation pie chart, and latest stock prices for their current holdings. The home page has been kept simple to give the user important information regarding their account, without making it too complicated and hard to navigate. From the home page, and all other pages, the user has a navigation bar at the top of the page to navigate to other important pages where they can choose to see their dashboard, trade and research stocks, see their watchlist, manage their leagues, see the leaderboards, and sign out.



Figure 3 - Home Page (Post Login)

Dashboard (Figure 4)

Once the user clicks on the dashboard in the navigation bar, they are able to see different stats for their portfolio. Users are able to track their portfolio value over time using a line graph. There are also pie charts that show the different sectors that they have invested in and the distribution of their portfolio and how much is allocated to stocks, cash and cryptocurrencies.



Figure 4 - Dashboard

Trade (Figure 5)

The trade page will allow the user to research and execute buy and sell transactions. There is a field at the top of the page that takes an input for the ticker or stock name, which then returns information about the stock. The user is able to see stock charts, news, historical prices, and market cap information. If the user chooses to buy or sell the chosen stock, there is a field for the number of shares and sell execution or buy execution button. There is also a “Add to Watchlist” button that will add the stock to the users watchlist, so they can track the stocks progress and quickly make a move on the stock.

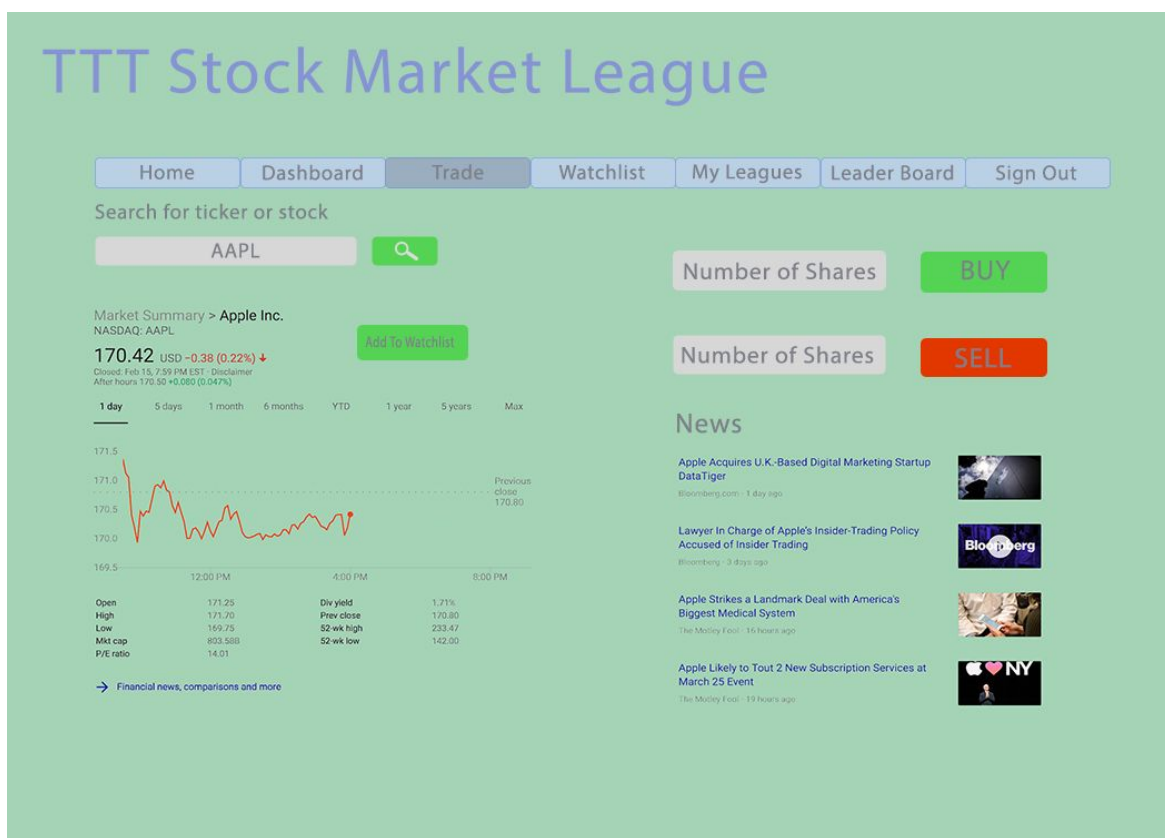


Figure 5 - Trade

Watchlist (Figure 6)

The watchlist is a great feature that lets the user track the stocks that they are interested in. The user is able to see the % change, current price, and the market cap for each stock. The stocks which have increased in price are green and stocks that have decreased in price are red. This makes it easier and faster for the user to decide if their strategy is doing well or not. There is also a button trade, which allows the user to move to the trade page with the current stock already loaded. There is also a remove button if the user decides that they would like to take the specific stock off of their watchlist.

Ticker	Name	% Change	Current Price	Market Cap		
AAPL	Apple Inc.	-0.22%	\$170.42	\$803.6B	Trade	Remove
GOOG	Alphabet Inc.	-0.72%	\$1,113.65	\$776.7B	Trade	Remove
NKE	Nike, Inc.	+0.83%	\$85.38	\$134.4B	Trade	Remove
COKE	Coca-Cola	-0.57%	\$225.18	\$2.106B	Trade	Remove
FB	Facebook, Inc.	-0.88%	\$162.50	\$463.8B	Trade	Remove
BAC	Bank of America Corp	+2.54%	\$29.11	\$281.5B	Trade	Remove
GS	Goldman Sachs	+3.10%	\$198.50	\$75.61B	Trade	Remove
AMZN	Amazon.com, Inc.	-0.91%	\$1,607.95	\$789.8B	Trade	Remove
XOM	Exxon Mobil Corp.	+1.89%	\$77.71	\$329.3B	Trade	Remove
MS	Morgan Stanley	+3.12%	\$41.99	\$71.38B	Trade	Remove
PCG	PG&E Corp.	+0.06%	\$15.48	\$8.029B	Trade	Remove

Figure 6 - Watchlist

My Leagues (Figure 7)

The My Leagues page is where the user will be able to manage their leagues and create new ones. The layout of the page is quite simple, as there is a list of current leagues the user is in, where they can check their ranking in the league, starting balance, and current balance. Users can also click the view league button to get a more detailed view on the league where they can make invite other users, make trades, and more. If the user has not yet joined a league, there is a field where the user can enter the league's name and join the league if it is private. There is also an option for joining a random league if the league name field is left blank. Lastly users can create their own league by entering the league name, starting balance, and whether it is private or public, and create a league.

TTT Stock Market League

[Home](#) [Dashboard](#) [Trade](#) [Watchlist](#) [My Leagues](#) [Leader Board](#) [Sign Out](#)

My Leagues

League A	Starting Balance : \$15,000 Rank: 6	Balance : \$16,873	View League
League B	Starting Balance : \$100,000 Rank: 11	Balance : \$98,873	View League
League C	Starting Balance : \$500,000 Rank: 1	Balance : \$639,873	View League

Join a League

[Join League!](#)

Create League

[Public](#) [Private](#)

[Create League!](#)

Figure 7 - My Leagues

Leaderboard (Figure 8)

The leaderboard page allows users to see how much the top earners have made, along with their balance. Users can choose to see the default global leaderboard, however, if the user is involved in a league, they can also see the leaderboard for that league, and see where they stand in comparison with others.



Figure 8 - Leaderboard

4.b. User Effort Estimation

Usage Scenario	Clicks	Keystrokes
Login and Register	2-3	0-1
Buy and sell shares of stock	4-6	2-12
Join a stock league via invite or public	3-4	0-50
Create a new private or public league	6-7	11-100
Analyze stocks	2	2-5
View current league leaderboard	2	0

Creating new profile:

When a user is new to the stock market league, they will be prompted to create a new profile, unless they have already created a username and password previously.

Navigation:

1. Once webpage is opened up, user must click “Sign up” option
2. User will be prompted to create username and password
3. Hit enter or click register

Login:

If user already has an account created, user can simply type in username and password and click “Login.”

Navigation:

1. Open up homepage (login screen should be on home screen, if not logged in already)
2. Type in username and password
3. Press enter or click “Sign in”

Buying or selling shares:

Once user has logged in, they may place an order on any stock as they would like. They must type in the name of the stock, and type in how much they would like to spend on the stock or how much they would like to sell.

Navigation:

1. From home page, user must select “Trade”, found on the toolbar on the top of the page.

Data Entry:

1. Click textbox to enter stock name, 1 click
2. Typing name of stock, 1-5 keystrokes
3. Click textbox to enter number of shares, 1 click
4. Enter number of shares to buy or sell, 1-7 keystrokes
5. Click “Buy” or “Sell”, 1 click

Join a League:

When a user creates an account, they will be asked whether they would like to join a public or private league.

Navigation:

1. From homepage, user clicks on “My Leagues” on the toolbar found on the top of the webpage.

Data Entry:

1. Click “Enter League Name”, 1 Click
2. Type in name of league user would wish to join, 5-20 keystrokes
3. Click “Join League”, 1 Click

Creating a new League:

Once user creates account they could create their own league to get started.

Navigation:

1. From homepage, user clicks on “My Leagues” on the toolbar found on the top of the webpage.

Data Entry:

1. Select either “Public” or “Private” League, 1-2 Clicks
2. Click on “Enter League Name” Text box, 1 Click

3. Type name of league name, 5-20 Keystrokes
4. Click on “Enter Starting Balance” text box, 1 Click
5. Enter starting balance user would like invitees would like to start with, 7-10 Keystrokes
6. Click “Create League”, 1 Click

Analyze Stock:

When an existing user buys stocks, they may view the status of all of their owned stocks. Users will be able to view the percent change, current price, and current market cap of the stocks.

Navigation:

1. From homepage, user clicks on “Watchlist” on the toolbar found on the top of the webpage.

View Leaderboard:

Once user has signed into TTT Stock Market League and have successfully joined a public or private league, they will be able to view the standings of that league.

Navigation:

1. From homepage, user clicks on “View Leaderboard” on the toolbar found on the top of the webpage.

5. Domain Analysis

A. Domain Model

i. Concept Definitions

Responsibility Description	Type	Concept Name
Rs. 1 Allow users to see initial page for login or creating an account	K	Login View
Rs. 2 Allow users to see the summary of their accounts, such as portfolio balance, asset allocation, and stock prices of their holdings.	K	Home View
Rs. 3 Allow new users to register and create an account to be able to make trades and get full functionality from the web application	D	Account Controller
Rs. 4 Allow registered users to login to their account with their unique username and password combination to use the application	D	Account Controller
Rs. 5 Fetch real time stock and cryptocurrency information for users to trade and research based off current information	K	Alpha Vantage API Adapter
Rs. 6 Allow users to see stock and cryptocurrency data	K	Trade View
Rs. 7 Allow users to trade stocks and cryptocurrencies with their account balance	D	Trade Controller
Rs. 8 Allow users to see their portfolio and dashboard with balance and stock information	K	Dashboard View
Rs. 9 Allow users to see league information	K	League View
Rs. 10 Allow users to create leagues with custom options and rules	D	League Controller
Rs. 11 Allow users to enter and join public leagues or receive invites for private leagues	D	League Controller
Rs. 12 Send league data (new player, new league, etc.) to the league database	D	Database Connection
Rs. 13 Allow users to see leaderboards for individual leagues, as well as global leaderboards	K	Leaderboard

Account Controller (DM-1)

The account controller is the controller that will manage user accounts. This means that the account controller will make it possible for new users to register for an account, returning users to login to their account, and it will store all of the account information into the database.

Alpha Vantage API Adapter (DM-2)

Alpha Vantage is a free online API, which provides real time stock and cryptocurrency data that is required for making trades. The adapter will assist in making the JSON/CSV file formatted so that it can be used in the application. Alpha Vantage not only provide prices, but also provide technical indicators, sector performance, and other very useful information that assists in analysis and decision making.

Dashboard View (DM-3)

The Dashboard View is where the client can review and analyze their orders, along with track their portfolio value overtime.

Database Connection (DM-4)

The Database Connections purpose is to make it simpler to access a central database that could work with all classes and functions. The database connection creates a standard method for accessing data from the database.

Home View (DM-5)

The Home View is where the user is redirected after successful login. The page provides a summary of the user's current account. The user can learn information on portfolio value, asset allocation, and stock prices. The users can also access other pages/views from the Home View.

Leaderboard (DM-6)

The leaderboard provides global and league rankings for the users including information on balance and recent changes.

League Controller (DM-7)

The League Controller is the main system that controls everything regarding leagues. The league controller is able to make a new leagues, add players to a league, modify current leagues. The League Controller also connects with the database to store league information as well as to retrieve data.

League View (DM-8)

The League View is another important user interface, as clients will use it as the main interaction with managing leagues. Whenever an action is taken regarding a leagues, there will

be a request sent to the League Controller, which executes any creation, addition, modification of a league.

Login View (DM-9)

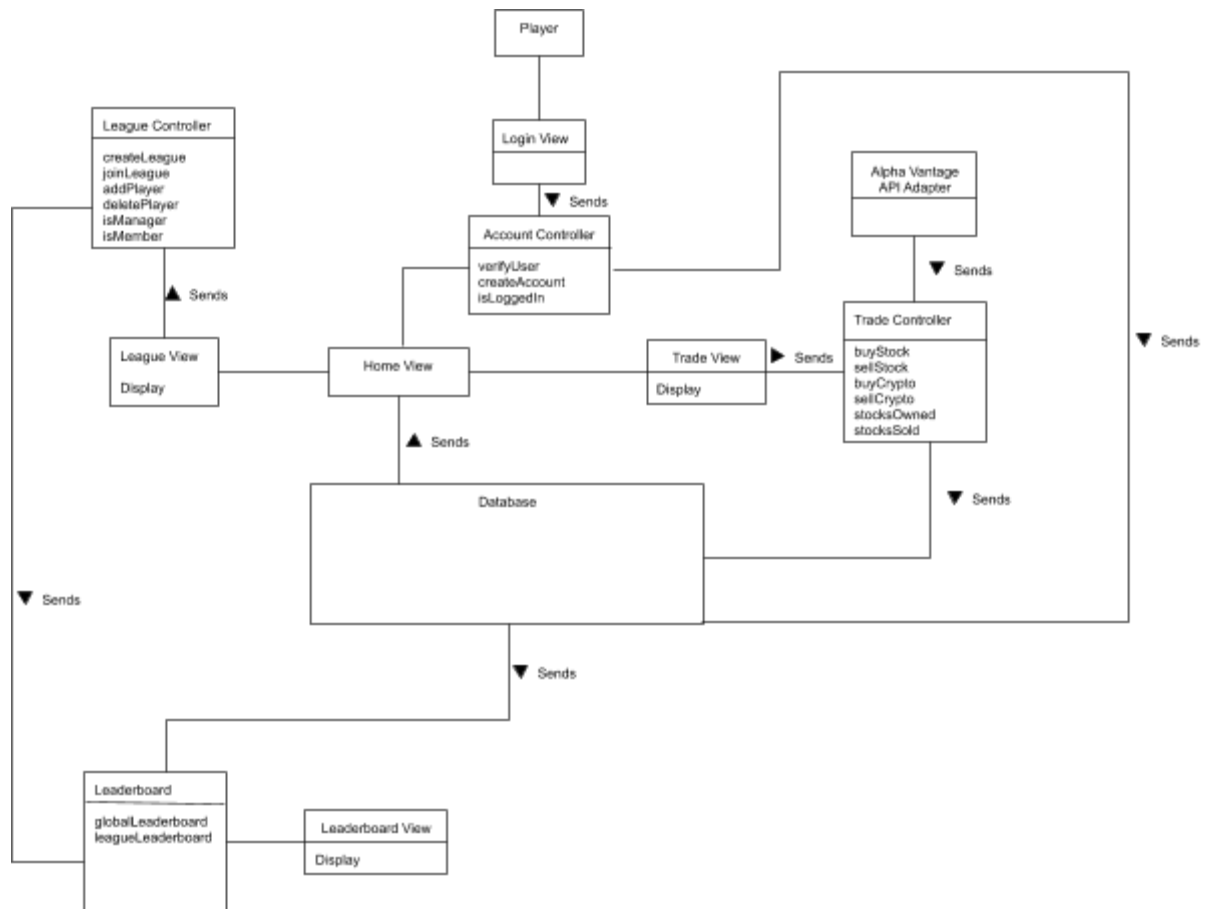
The Login View is the page that all visitors to the website are presented. The page provides options for an user to login, sign up, or recover password.

Trade Controller (DM-10)

The Trade Controller is the controller that will manage and execute all buy and sell orders. The Trade Controller will multiply the number of shares with the current price and that number will be either added or subtracted to the account balance based on if it is a buy or sell order. The Alpha Vantage API Adapter will provide the trade controller with the most recent stock prices for the controller to execute trades.

Trade View (DM-11)

The trade view is the user interface that the client will interact with. The trade view is one of the most essential pages in the application, as all buy and sell orders will be executed from there. Whenever there is a trade executed, it will send a request to the Trade Controller and it will be executed from there.



ii. Association Definitions

Concept Pair	Association Description	Association Name
Account Controller <-> Login View	The Login View sends a login request or new registration information to the Account Controller for verification or storage.	Requests login
Home View <-> Account Controller	The Home View requests the Account controller for information on the account.	Requests account
League View <-> Home View	The Home View can send the user to the League View.	Redirects
League Controller <-> League View	The League View requests the League Controller to modify leagues.	Requests modifications of leagues

Leaderboard <-> League Controller	The League Controller sends league data to the Leaderboard.	Provides league
Leaderboard View <-> Leaderboard	The Leaderboard View requests the Leaderboard for information on rankings.	Requests rankings
Leaderboard <-> Database	The Database provides the Leaderboard with rankings information.	Provides rankings
Home View <-> Database	The Database provides the Home View with portfolio summary information.	Provides portfolio summary
Account Controller <-> Database Connection	The account controller sends a database a request to verify login credential, or stores new information for a new registration.	Sends & verifies
Trade Controller <-> Database	The Database provides the Trade Controller with the user's current portfolio holdings and pending orders.	Provides portfolio holdings and pending orders
Trade View <-> Trade Controller	The Trade View requests the Trade Controller for buy and sell orders.	Requests trade
Trade Controller <-> Alpha Vantage API Adapter	The Alpha Vantage API Adapter provides the Trade Controller on real-time financial information.	Provides financial information

iii. Attribute Definitions

Responsibility	Attribute	Concept
Rs 14. Used to determine if a user is logged in	isLoggedIn	Account Controller
Rs 15. A record of stocks sold by the user	stocksSold	Trade Controller

Rs 16. List of stocks owned by the user including quantity of each stock	stocksOwned	Trade Controller
Rs 17. Used to verify if initiating actor is the league manager	isManager	League Controller
Rs 18. Used to verify if initiating actor is a league member	isMember	League Controller
Rs 19. Used to verify if league is private	isPrivate	League Controller
Rs 20. A unique ID associated with a League	LeagueID	League Controller
Rs 21. A list of all users sorted by their ranking	globalLeaderboard	LeaderBoard
Rs 23. A list of all users in a league sorted by their ranking	leagueLeaderBoard	LeaderBoard
Rs 24. Unique username associated with a Player	username	Player

IV. Traceability Matrix

UC	PW	DM-1	DM-2	DM-3	DM-4	DM-5	DM-6	DM-7	DM-8	DM-9	DM-10	DM-11
UC-1	14	X			X					X		
UC-2	7	X			X	X				X		
UC-3	12				X			X		X		
UC-4	28		X		X						X	X
UC-5	30		X		X						X	X

UC-6	5				X		X	X				
UC-7	41				X			X	X			
UC-8	27		X	X	X						X	
UC-9	14		X	X	X							
UC-10	9	X			X							

B. System Operation Contracts

UC - 3: Join League

Preconditions:

- The user must be registered to the TTT Stock Market League
- The user must be invited to a league or there must be a league available to join

Postconditions:

- The user has joined a league
- The database is updated with this information
- The user can see information about the league and the other users

UC - 4: Researching Stock Information

Preconditions:

- The user must be logged in to the TTT Stock Market League
- The user must search the stock symbol in the stock information search bar

Postconditions:

- The stock information is displayed to the user

UC-5: Buy/Sell stocks

Preconditions:

- The user must be logged into the TTT Stock Market League
- The user must have sufficient currency to be able to purchase the stock and amount of stock

Postconditions:

- The user's portfolio is updated in the database
- The user's virtual wallet is updated in the database
- The stock information is displayed to the user

UC-7: Create league

Preconditions:

- The user must be logged into the TTT Stock Market League

Postconditions:

- The league information is added to the database
- The league page is accessible to all members

UC-8: Reinvest dividends

Preconditions:

- The user must be logged into the TTT Stock Market League
- The user must have invested in a stock

Postconditions:

- The user's portfolio is updated in the database
- The reinvestment indicator will be shown on the stock
- The dividends from the stock will be reinvested into more of the same stock

6. Project Size Estimation

Use-Case Complexity:

To estimate the size of our project, the metric we will use is Use-Cases Points (UCP). The primary concerns of each of our use case points will be the complexity of the use cases, falling under simple, average, or complex and then we will factor in the complexity of the technical complexity surrounding these use case points. To determine what complexity each use case falls under, we will count the number of transactions it goes throw. We may consider a transaction a “step” in the Use-Case. Using these transactions for each use case we are able determine what we will consider simple, average, or complex. For this report, we will only utilize our fully dressed Use-Cases. The following table provides the detailed description for transactions, weight and complexity of our fully dressed use cases. These steps counted can all be founded in our fully dressed Use-Case tables in addition to the System Sequence Diagrams. The metric used to define what category a Use-Case falls under is illustrated as follows:

Use-Case Complexity	Number of Transactions	Use-Case Weight
Simple	≤ 3	5
Average	4 to 7	10
Complex	> 7	15

With this table as a reference, our resulting complexity for our use cases are:

Use case identifier	Transactions (Steps)	Weight	Complexity
UC-3: Join League	7	10	Average
UC-4: Researching stock info	11	15	Complex
UC-5: Buy/sell stocks	10	15	Complex
UC-7: Create league	5	10	Average
UC-8: Reinvest dividends	8	15	Complex

With this data we can now calculate the Unadjusted Use-Case Weight (UUCW). The calculation would simply be the sum of our weight for the fully dressed use-cases.

$$10 \text{ (UC-3)} + 15 \text{ (UC-4)} + 15 \text{ (UC-5)} + 10 \text{ (UC-7)} + 15 \text{ (UC-8)} = 65 \text{ (UUCW)}$$

Since we now have the Unadjusted Use-Case Weight, we must now calculate the Unadjusted Actor Weight. Since this is not simply based on the number of steps or transactions, the explanation and justifications will be more concise for each Use-Case.

Actor Complexity:

Since we now have the Unadjusted Use-Case Weight, we must now calculate the Unadjusted Actor Weight. Since this is not simply based on the number of steps or transactions, the explanation and justifications will be more concise for each Use-Case. The following table is utilized as the metric for deciding the Actor Weight for each individual part:

Actor Complexity	Example	Actor Weight
Simple	A System with defined API	1
Average	A System interacting through a Protocol	2
Complex	A User interacting through GUI	3

UC-3:

- The user will interact with the software through a graphical user interface to search for a league. This would be classified under an actor complexity of “complex” (Weight 3)
- The system utilizes a searching protocol to return a list of leagues to the user's search request. This is under the actor complexity of “average”. (Weight 2)

- The database itself is a supporting actor and is a system with a defined API. This is under the complexity of “simple”. (Weight 1)
- The League Manager is a supporting actor and a defined API component of the software. (Weight 1)

The total Actor Weight for UC-3 is $3+2+1+1 = 7$.

UC-4:

- The User will interact with the GUI to search up a stock by a ticker or name (Weight 3)
- The system communicates with the defined Finance API to retrieve relevant stock information. (Weight 1)
- The system sends all requested watchlist stocks to the database API (Weight 1)
- The system is communicating with the both the finance API and Database API through defined protocol (Weight 2) Pittsburgh, Pennsylvania

The total Actor Weight for UC-4 is $3+ 1+ 1 + 2 = 7$.

UC-5:

- The User will interact with the GUI to search up a stock by a ticker or name (Weight 3)
- The system communicates with the defined Finance API to retrieve relevant stock information. (Weight 1)
- The User will select the number of shares of the GUI to buy or sell (Weight 3)
- The system will add the orders to the existing database API (Weight 1)
- The system is communicating with the both the finance API and Database API through defined protocol (Weight 2)

The total Actor Weight for UC-5 is $3+1+3+1+2 = 10$

UC-7:

- The User will interact with GUI to create the league (Weight 3)
- The system will add the league to the database API (Weight 1)
- The systems interact with both the user and database using defined protocol (Weight 2)

The total actor weight for UC-7 is $3+1+2 = 6$

UC-8:

- The User will interact with the GUI to select a stock (Weight 3)
- The finance API is a system with a defined API (Weight 1)
- The database is a system with a defined API (Weight 1)
- The User will select to reinvest in stock using the GUI (Weight 3)
- The system communicates with the finance API, database, and user using existing protocol (Weight 2)

The total actor weight for UC-8 is $3+1+1+3+2 = 10$

This data can be compiled into the resulting table:

Use Case	Weight
UC-3	7
UC-4	7
UC-5	10
UC-7	6
UC-8	10

With this data we can calculate the Unadjusted Actor weight which is the sum of all the Use Case Actor weights. This would be $7 + 7 + 10 + 6 + 10 = 40$.

To calculate the Unadjusted Use Case Points we will simply add the UUCW and UAW.

	Weight
UUCW	65
UAW	40
UUCP (Total)	105

With the UUCP calculated, we must now adjust this number for the technical complexity of our project based.

Technical Complexity:

To calculate technical complexity, we will utilize the following tables weights. Rated value refers to the importance of a technical factor ranging from irrelevant(0) to very important(5).

Use Case 3 – Join League

Factor	Description	Weight (W)	Rated Value (0 to 5) (RV)	Impact (I = $W \times RV$)
T1	Distributed System	2.0	0	0
T2	Response time or throughput performance objectives	1.0	3 (search speed must not be slow)	3

T3	End user efficiency	1.0	3 (Minimize clicks and typing)	3
T4	Complex internal processing	1.0	0	0
T5	Code must be reusable	1.0	1 (Use in league management code)	1
T6	Easy to install	.5	0	0
T7	Easy to use	.5	5 (Provide Optimal user experience)	2.5
T8	Portable	2.0	0	0
T9	Easy to change	1.0	2 (must be adaptable)	2
T10	Concurrent	1.0	5 (league operation happening in background)	5
T11	Includes special security objectives	1.0	0	0
T12	Provides direct access for third parties	1.0	0	0
T13	Special user training facilities are required	1.0	0	0
Total Technical Factor (TFactor)				16.5

Use Case 4 – Researching Stock Information

Factor	Description	Weight (W)	Rated Value (0 to 5) (RV)	Impact (I = W × RV)
T1	Distributed System	2.0	0	0
T2	Response time or throughput performance objectives	1.0	3 (search speed must not be slow)	3

T3	End user efficiency	1.0	3 (Minimize clicks and typing)	3
T4	Complex internal processing	1.0	0	0
T5	Code must be reusable	1.0	0	0
T6	Easy to install	.5	0	0
T7	Easy to use	.5	5 (Provide Optimal user experience)	2.5
T8	Portable	2.0	0	0
T9	Easy to change	1.0	1 (must be adaptable)	1
T10	Concurrent	1.0	5 (league operation happening in background)	5
T11	Includes special security objectives	1.0	0	0
T12	Provides direct access for third parties	1.0	0	0
T13	Special user training facilities are required	1.0	0	0
Total Technical Factor (TFactor)				14.5

Use Case 5 - Buy/Sell stocks

Factor	Description	Weight (W)	Rated Value (0 to 5) (RV)	Impact (I = W × RV)
T1	Distributed System	2.0	0	0
T2	Response time or throughput performance objectives	1.0	3 (search speed must not be slow)	3
T3	End user efficiency	1.0	3 (Minimize clicks and typing)	3

T4	Complex internal processing	1.0	2(Calculations Involved in transactions)	2
T5	Code must be reusable	1.0	3 (Code must be reusable for stock reinvestment and management)	3
T6	Easy to install	.5	0	0
T7	Easy to use	.5	5 (Provide Optimal user experience)	2.5
T8	Portable	2.0	0	0
T9	Easy to change	1.0	1 (must be adaptable)	1
T10	Concurrent	1.0	5 (league operation happening in background)	5
T11	Includes special security objectives	1.0	0	0
T12	Provides direct access for third parties	1.0	0	0
T13	Special user training facilities are required	1.0	0	0
Total Technical Factor (TFactor)				19.5

Use Case 7 – Create League

Factor	Description	Weight (W)	Rated Value (0 to 5) (RV)	Impact (I = W × RV)
T1	Distributed System	2.0	0	0

T2	Response time or throughput performance objectives	1.0	1 (Speed is nice but not required as this is not an often function)	1
T3	End user efficiency	1.0	2 (Minimize clicks)	2
T4	Complex internal processing	1.0	0	0
T5	Code must be reusable	1.0	0	0
T6	Easy to install	.5	0	0
T7	Easy to use	.5	5 (Provide Optimal user experience)	2.5
T8	Portable	2.0	0	0
T9	Easy to change	1.0	3 (must be adaptable to changes in league infrastructure)	3
T10	Concurrent	1.0	5 (league operation happening in background)	5
T11	Includes special security objectives	1.0	0	0
T12	Provides direct access for third parties	1.0	0	0
T13	Special user training facilities are required	1.0	0	0
Total Technical Factor (TFactor)				11

Use Case 8 – Reinvest Dividends

Factor	Description	Weight (W)	Rated Value (0 to 5) (RV)	Impact (I = $W \times RV$)
T1	Distributed System	2.0	0	0

T2	Response time or throughput performance objectives	1.0	0	0
T3	End user efficiency	1.0	2(End user only has to select this option once to enable and or disable so efficiency is not a high priority)	2
T4	Complex internal processing	1.0	5 (Reinvestment is an automatic process happening in the background so it will utilize cyclic protocols to reinvest assets. This is why speed and end user efficiency is not that important)	5
T5	Code must be reusable	1.0	0	0
T6	Easy to install	.5	0	0
T7	Easy to use	.5	3 (Provide Optimal user experience but is a background process)	1.5
T8	Portable	2.0	0	0
T9	Easy to change	1.0	3 (must be adaptable)	3
T10	Concurrent	1.0	5 (league operation happening in background)	5
T11	Includes special security objectives	1.0	0	0
T12	Provides direct access for third parties	1.0	0	0

T13	Special user training facilities are required	1.0	0	0
Total Technical Factor (TFactor)				16.5

With all the data accumulated in the technical complexity tables, we can calculate the Unadjusted Use- Case Technical Complexity Factor (TCF)

USE CASE	TFactor
UC-3	16.5
UC-4	14.5
UC-5	19.5
UC-7	11
UC-8	16.5
TCF = $0.6 + (0.01 * \text{TFactors})$	1.38

Adjusted Use Case Point Calculation:

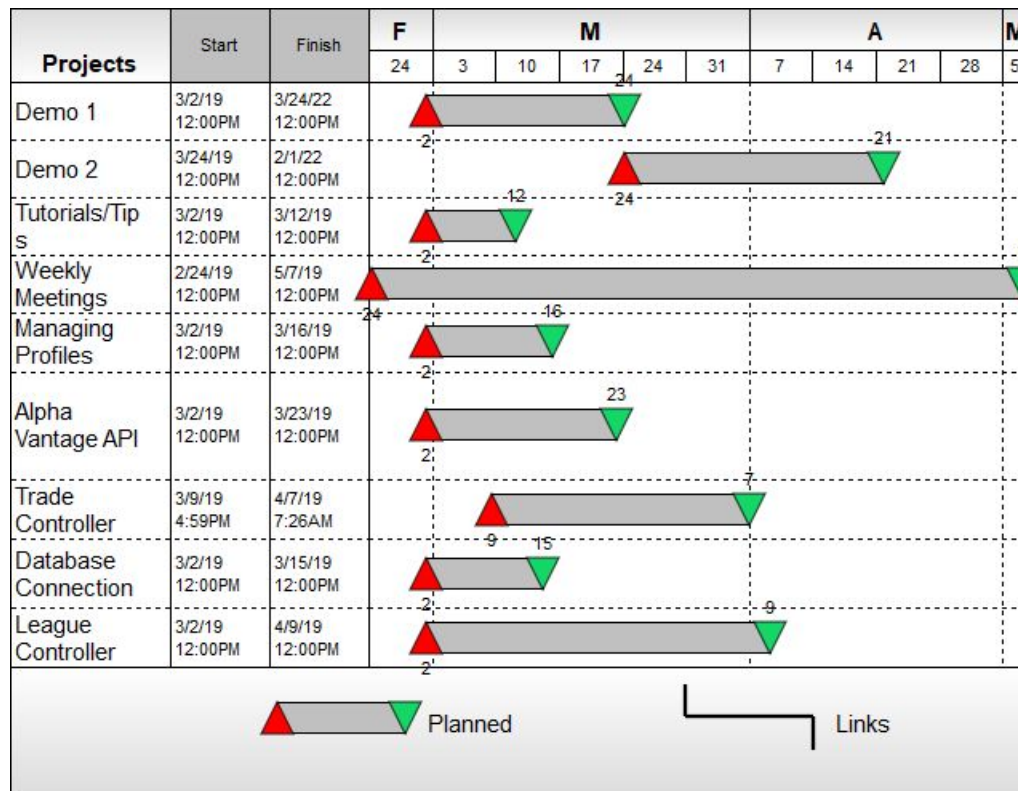
The final adjusted Use-Case Point size is done by the formula:

$$UCP = UUCP * TCF$$

$$UCP = 105 * 1.38 = 144.9$$

With this we can say that the result of our Use Case Point Size Estimation is fairly large at 144.9 (Subject to final review and editing over the next 5 days).

7. Plan of Work



Gantt Chart for TTT Stock Market League

Goals for Demo 1:

- **Website Navigation:** The website for our fantasy league should be ~90% accessible.
- **Database and Website Assimilation:** Website should be able to recognize most key features such as managing profile, stock information, league management, and database.
- **Alpha Vantage API:** Website should be capable of pulling information of stocks, and integrate it to user managed profiles.
- **Email System:** User's will be able to use their email to receive notifications pertaining to their bought/sold stocks and other interactions
- **Profile Registration:** User's will have the ability to create and edit their profiles on the TTT stock market website.

Breakdown of Responsibilities:

During the brainstorming phase of the TTT Stock Market League, the group decided to split up the work to learn multiple aspects of the project. Each member of the team decided to work on the area that they felt least comfortable with to improve their overall skill set and to

better accustom themselves with their weakness. Through this method, we will be able to create a sense of uniformity within the group regarding expertise and allow everyone to be knowledgeable on all aspects of the project.

Currently, the group is planning on how they will start each section that they are focused on. Our expected future contributions can be seen under product ownership.

Projected Milestones:

Since beginning the semester, our group has brainstormed plenty of ideas to create a fantasy stock league. Our group's main goal is to develop a website that will simulate the stock market, and will be educational to all users. Each week, members of the group have met at least once to speak about goals and weekly updates on ways to improve the project.

- **User Interface**
 - Members of the group will create a UI that would enable users to access any of the features that our project will have available.
- **Profile managing**
 - Users will be able to manage their profile fully, controlling what they can do on the website, and viewing their current progress.
- **Alpha Vantage API**
 - The website will be able to pull the stocks' information onto the website and integrate it fully to the users.
- **Email Notification**
 - Users will be able to receive notifications based on their settings to their emails.

Product Ownership

Account Registration

Ajeet Malhotra

Danny Lee

Spreadsheet Exporting

Albert Joshua Capistrano

Antoni Chrobot

Daily Stock Tracking

Antoni Chrobot

Raffay Khan

Active Stock Market Trading

Albert Joshua Capistrano

Danny Lee

Dividend

Ping Lin

Aryeh Ness

Peer Comparisons

Danny Lee

Raffay Khan

Education

Aryeh Ness

Chris Young

Stock Recommendations

Ping Lin

Ajeet Malhotra

Cryptocurrency Integration

Chris Young

Aryeh Ness

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