Pitfail Report 1

An Online Financial Engineering Game

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Software Engineering I, Group 3
https://github.com/pitfail/pitfail-reports/wiki

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2 Customer Statement of Requirements

Investors today are seeking more effective financial tools that not only motivates them to invest in the stock market and improve their decision making skills but also an application that is interesting enough to keep using. Our goal is to build a system that is less focused on simulation than on playing a game. Existing trading simulations mimic the inconveniences of trading stocks on real markets; while this might help future traders to practice, it is out of place for the typical internet user. In contrast with the existing alternatives, Pitfail offers number of differentiating features: while the core program centers around buying and selling of liquid assets (stocks, options; anything with available market prices), PitFail aims eventually to users to trade directly with each other in non-liquid assets such as derivatives. To acheive a low-threshold for getting in to the game, PitFail may be played using users' existing accounts (such as Twitter, smart phones or Facebook) with essentially no setup.

Pitfail simulates a virtual stock world, creating a network of stock investors, through which they trade real-world stocks without the risk of losing real money. Unlike existing trading simulations, Pitfail does not require the players to go through a time consuming registration process. Players can login to the system using their existing e-mail addresses and the system remembers the players for their next use. As Pitfail requires essentially no commitment it is easy for players to try it out. Initially, the player is given a fixed amount of startup funds. The player uses these funds to virtually buy the stocks.

There are many options for a player to choose from once he/she logs in:

1. Player can join a team (a small group of already registered players). Once player joins a team ,the player will buy/sell/compete with other players/teams using collective portfolio of the team.

2. Player can join a league (a small group of already registered players) where the members of a league compete with each other using their individual portfolio.

3. Player can play with 'Pitfail Universe' which includes all players.

When the player trades and builds a portfolio, the system should have access to real-time stock information and should adjust the value of a player's investments based on this real time stock info. Pitfail retrieves actual stock prices from a third-party source Yahoo! that monitors stock exchanges and maintains up-to-date (though delayed) stock prices. If the corresponding actual stock loses value on a real-world stock exchange, the player's virtual investment loses value equally. Likewise, if the corresponding actual stock gains value, the player's virtual investment grows equally.

As a game, a crucial part of the application is maintaining player portfolio. The application provides every player with portfolio to view/modify his/her history i.e. list of securities owned(stocks/derivatives). In addition to the securities currently owned by the player, the player is able to view his or her historical performance as measure by net worth. To add a flavor of a game, players can monitor each other's progress by viewing a feed of recent activity and browsing leader boards. Pitfail also offers aggregate feeds of recent activity. This allows a group of people to keep abreast of their friends' or enemies' activities. Pitfail provides the players with the ability to comments on other's trades when browsing recent activity or viewing another user's portfolio. These comments make players feel involved and part of a larger community. One additional feature Pitfail provides is the ability for players to "upvote" and "downvote" trades based on their opinion of trade. Pitfail can then rank users and assign status symbols (e.g. badges) to users with the strongest ability to vote predictively. This type of ranking appears to be unique to Pitfail. Another feature that appears to be unique to Pitfail is that it allows users to design their own securities (i.e futures or options) , thus creating new financial products. Even without a court system to enforce complex contracts, custom securities allow Pitfail's users to a new financial environment.

As mentioned, Pitfail can be accessed via a website, twitter, Facebook and android interface. Each of these methods have their own purposes. As financial trades are compact and atomic and that they can be expressed through small messages, Pitfail provides a twitter and Facebook interfaces where players can buy/sell securities by tweeting to a particular account/ writing post on Facebook account wall . Twitter and Facebook provide a familiar interfaces to use the system. Also, as no registration is required which makes it easy to use. Pitfail can also be accessed via a website that offers additional set of features (In addition to all of the functionality provided by the Twitter interfaces): like view portfolio, design custom securities, interact socially with other users and play against or in co-operation (teams/leagues) with other users. Also, website helps to generate some advertising revenue. Therefore making it desirable to attract users to the Pitfail website by offering features that are not possible via Twitter/Facebook. Android interface provides features that are similar to that of the website, with the addition of notifications to the user when some event occurs within Pitfail.

The motivation for implementing teams/leagues comes from the apparent fact that most (perhaps all) trading games target students and teachers as their principal user base, suggesting this accounts for most of the people who actually play these games. While PitFail is mostly seeking a different niche -- the casual online player -- the classroom market is too big to ignore completely, hence a feature that makes it possible for students to play against each other in a league.

Below is the list of customer requirements:

1. **REQ-1** Stock Market Simulator Website: Investors are looking for a effective tool that allows users to invest and learn without having to invest real money and also allows them to interact with other users more effectively to make the game really enjoyable.

2. **REQ-2** Android Application: Mobile users who like having native applications can use such system with quick access very easily.

3. **REQ-3** Access via Twitter/Facebook: Users who heavily use social networks like Facebook/Twitter can connect to Pitfail easily.
4. **REQ-4** Simple User Interface: Users are looking for simple interface that welcomes new users and guides the new user through portfolio management.
5. **REQ-5** Updated Stock Information: Application should present stock symbols, company names, stock history, updated stock values and prices amongst other details.
6. **REQ-6** Player Portfolio: Each player must have separate portfolio that gives him/her option to buy/sell new securities, view currently owned securities.
7. **REQ-7** Evaluate Portfolios: Securities owned by each player should be periodically evaluated and should be updated to their current value.
8. **REQ-8** Advertisements: The website must contain appropriate and interesting advertisements relating to finance and stock

9) **REQ-9** Administrators for help/supervision: An administrator must be available to answer questions and to supervise the game.

3 Glossary of Terms

Asset These show up on a users balance sheet, as things that they own. An asset is anything which may someday be converted co cash.

Coordinator Pitfail user responsible for administering a textit{league}. See Actors and Goals for more information.

Game The trading of securities given a particular set of rules with the object to increase the value of one's portfolio.

Invite-Only League Restricted league where becoming a *member* requires approval by a *coordinator*.

League An instance of the *game* having particular rules associated with it. A *coordinator* may create a league for *players* to join.

Member *Player* who has a portfolio associated with a specific league. Members of a league compete against each other.

OAuth Protocol used for authenticating users and sharing information with Pitfail on their behalf. See (`http://oauth.net/`).

OpenID Protocol used for authenticating users using their existing accounts. See (`http://openid.net/`).

OpenID Provider Third-party service that provides an OpenID identity for users; e.g. Google.

Player Pitfail user participating in one or more *leagues*. See Actors and Goals for more information.

Portfolio Collection of *securities* associated with a specific user and league. Each user aims to maximize the value of his or her own portfolio.

Public League Open league where users can choose to become *members* with no approval.

Security Financial asset having a cash value. This includes *stocks*, bonds, and *derivatives*.

Stock Claim on the earnings of a company. To Pitfail players, a stock is an opaque asset with fluctuating value.

Ticker Short string which uniquely identifies a stock.

4 Functional Requirements Specification

4.1 Stakeholders

- *Advertisers* who purchase ads on the website
- *Spectators* interested in finance who do not wish to invest in the real market
- *Teachers* of economics courses and their *students*

4.2 Actors and Goals

- A *Player* is one who participates by buying and selling securities.
  - Wants to increase the value of their portfolio, thereby proving competency at security trading.
  - Competes with other players for higher ranks in leagues.
- A *Web Player* is a *player* who is interacting with the *game* via the web browser interface. This actor contains all use cases of the *player*. It also shares the goal of the *player*.
- A *Twitter Player* is a *player* who is interacting with the *game* via the twitter interface. This actor contains all use cases of the *player*. It also shares the goal of the *player*.
- A *Coordinator* is responsible for administering a *league*.
  - Wants to effectively administer the tournament to provide either a learning experience to the *players*, or, alternately, an enjoyable experience to the *players*.
  - Desires a construct in which to effectively challenge others interested in security trading.
- The *database* is the store for all persistent data on interactions with the *system*. It stores data regarding all user portfolios and the association of authentications with users.
- *Yahoo!* is the source for all real market data which determines the actual effect of purchasing and selling securities.
- A *stock information provider* is a supplier of stock pricing data for the present (within the margin of some minutes). They are queried for all data regarding actual market numbers. Currently, *Yahoo* is the *stock information provider*.
- *Authentication providers* allow us to uniquely identify users and associate some stored state with their unique identification.
- *Twitter* is utilized both as a authentication provider (for all *players* as well as a portion of the interface to the service.
- *Yahoo* is the source for all real market data which determines the actual effect of purchasing and selling securities.

4.3 Casual Use-Case Description

The system is designed such that customization and setup by a *player* is minimized. As such, league joining is unneeded by new players. In fact, to be a new *twitter player*, one can simply send a *commanding tweet* and the Pitfail system will automatically initialize the required backing data.

Account creation is omitted from the use case listing because account creation is always accomplished implicitly. Third party services are used for authorization, and all other setup is accomplished with defaults that may be changed at another point it time by the *player* as requested (UC-7).

Actor	Description	Short Name	UC#
Player	Purchases a security from the market at the price the *stock price source* indicates is the market price for that security.	Buy	UC-1
Player	Sells a held security at the price indicated by the *stock price source*.	Sell	UC-2
Player	Indicates that they wish to begin participating in a particular league. Does not remove them from any league. Also note that leaveing a league is omitted to prevent people from gaming the system by joining a league, doing poorly, and leaving to essentially have a "clean record".	Join League	UC-3
WebPlayer	Examine the contrents of his or her portfolio, displaying information regarding their current assets and liabilities as well as how they have been progressing over time	View Portfolio	UC-4
WebPlayer	Examines details of a particular security.	Get Security Details	UC-5
WebPlayer	Checks league statistics. Provide a clear view of the leaderboard as well as changes over time.	View League Stats	UC-6
WebPlayer	Changes some settings regarding their Player	Player Settings	UC-7
WebPlayer	Changes some settings regarding a portfolio/league they are a member of.	Portfolio Settings	UC-8
TwitterPlayer	Query portfolio value & other details.	Portfolio Info	UC-9
TwitterPlayer	Changes his or her current (default) league. The default league is the league which UC-1(Buy) and UC-2(Sell) requests are sent to when a league is not specified in the command string.	Change Default League	UC-10
Coordinator	Creates a league.	Make League	UC-11
Coordinator	Modifies a league's settings. A coordinator will need to manage a league via changing settings regarding the league.	League Settings	UC-12
Coordinator	Add an additional Coordinator to a league.	Add Coordinator	UC-13
Coordinator	Remove a coordinator from the league.	Remove Coordinator	UC-14
Coordinator	Delete a league.	Delete League	UC-15
Coordinator	Accept or decline requests to join a league.	Manage League	UC-16
Coordinator	Invite players to a league.	Invite to League	UC-17
Player	Authenticates with the system.	Authentication	UC-18
Player	Has their initial account (portfolio tracking) created.	Create User	UC-19

4.4 Fully Dressed Use Cases

4.4.1 UC-1: Buy

Related Requirements:

- REQ1: Stock Market Simulator Website
- REQ2: Android Application
- REQ3: Access via Twitter/Facebook
- REQ5: Updated Stock Information
- REQ6: Player Portfolio

Initiating Actor: Any of: Player, Webplayer, TwitterPlayer

Actor's Goal: To purchase a security from the market, to add it to his portfolio, and see his updated portfolio.

Participating Actors: Database, Securities, Stock Price Source, Yahoo!

Preconditions: The user should have created an account, be in a league with settings that allows the "BUY", and have enough money to perform the BUY of the security.

Postconditions: The user needs to be able to see his purchased security in his portfolio and track the progress of the security in his portfolio until he "SELLS" it.

Flow of Events for Successful Buy:

1. → The *Player, Webplayer, or TwitterPlayer* determines a *Security* and how much of it to "BUY".
2. ← *System* signals the *Stock Price Source* for the price of the security.
3. ← *Stock Price Source* sends the price of the *Security* to the *System.*
4. ← *System* signals the *Database* for the amount of money the *Player* has.
5. ← *Database* sends the amount of money for the *Player* to the System.
6. ← *System* checks that there is enough money for compelete the transcation.
7. ← *System* signals the *Database* to complete the transcation for a *Player*, *Security*, and the quantity.
8. ← *Database* signals the *System* the transcation is complete.
9. ← *System* signals to the *Player* "Transcation Completed."

Flow of Events for Unsuccessful Buy:

1. → The *Player, Webplayer, or TwitterPlayer* determines a *Security* and how much of it to "BUY".
2. ← *System* signals the *Stock Price Source* for the price of the security.
3. ← *Stock Price Source* sends the price of the *Security* to the *System.*
4. ← *System* signals the *Database* for the amount of money the *Player* has.
5. ← *Database* sends the amount of money for the *Player* to the System.
6. ← *System* checks that there is enough money for compelete the transcation.
7. ← There is not enough money. *System* signals to the *Player* "Transcation Not Completed: Insufficient Funds."

4.4.2 UC-2: Sell

Related Requirements:

- REQ1: Stock Market Simulator Website
- REQ2: Android Application
- REQ3: Access via Twitter/Facebook
- REQ5: Updated Stock Information
- REQ6: Player Portfolio

Initiating Actor: Any of: Player, Webplayer, TwitterPlayer

Actor's Goal: To purchase a security from the market, to add it to his portfolio, and see the updated portfolio

Participating Actors: Database, Securities, Stock Price Source, Yahoo!

Preconditions:

- User is logged in
- Contain in his portfolio at least the quantity of securities his is requesting to sell.

Postconditions:

- The user's portfolio will reflect the quantity of securities sold.

Flow of Events for Successful Sell:

1. → The *Player, Webplayer, or TwitterPlayer* determines a *Security* and how much of it to "SELL".
2. ← *System* signals the *Stock Price Source* for the price of the security.
3. ← *Stock Price Source* sends the price of the *Security* to the *System.*
4. ← *System* signals the *Database* for the amount of the *Security* the *Player* has.
5. ← *Database* sends the amount of the *Security* the *Player* has to the System.
6. ← *System* checks that there is enough *Securities* to complete the transaction.
7. ← *System* signals the *Database* to complete the transcation for a *Player*, *Security*, and the quantity.
8. ← *Database* signals the *System* the transaction is complete.
9. ← *System* signals to the *Player* "Transaction Completed."

Flow of Events for Unsuccessful Sell:

1. → The *Player, Webplayer, or TwitterPlayer* determines a *Security* and how much of it to "SELL".
2. ← *System* signals the *Stock Price Source* for the price of the security.
3. ← *Stock Price Source* sends the price of the *Security* to the *System.*
4. ← *System* signals the *Database* for the amount of the *Security* the *Player* has.
5. ← *Database* sends the amount of the *Security* the *Player* has to the System.
6. ← *System* checks that there is enough *Securities* to complete the transaction. There is not.
7. ← *System* signals to the *Player* "Transaction Not Completed: Insufficient Securities."

4.4.3 UC-4: View Portfolio

Related Requrements:

- REQ1: Stock Market Simulator Website
- REQ4: Simple User Interface
- REQ5: Updated Stock Information
- REQ6: Player Portfolio

Initiating Actor: Only *WebPlayer*, the similar UC-9 is provided for the *twitter player.*

Actor's Goal: To view information regarding their portfolio. This information includes the currently owned securities, minimal statistics regarding those securities (as they relate to the current and past value of the portfolio), current avaliable capital (and similar minimal information regarding its change), and the overall value of the portfolio (also with some statistical information regarding changes over time). The actor desires this information to make decisions regarding what their next interaction with the system should be. They use this info to decide to sell stock they have or buy an increased number of shares of stock they have).

Participating Actors: *Stock information provider*, *Database*

Preconditions: None, note that authentication & account creation are handled within this use case.

Postcondions: None, this is a stateless action. Information is displayed to the user but no internal actions are taken.

Flow of Events for Main Success Scenario:

1. → *Web player* browses to a page which will display his portfolio.
2. ← *System* checks for authentication and when it does not exsist (a) runs the authentication (UC-18). Checks for a associated *user* in the system and when there is none runs (b) user creation (UC-19).
3. ← *System* requests the information about the user's portfolio for this particular league from the *Database*.
4. → *Database* returns the information regarding the portfolio.
5. ← *System* forms a query regarding all the currently held securities within the portfolio and dispatches it to the *stock info provider*.
6. → *Stock info provider* returns the requested data.
7. ← *System* forms a web view of the portfolio information and returns it to the *web player*

Additional Notes: When this use case is running the other contained use cases (UC-18 and UC-19), each of these perform their own sequence of interactions with the user. In the case of a failure in one of the included use cases, the users remains in the control of that included use case until the failure is resolved or another use case is initiated.

4.4.4 UC-5: View League Statistics

Related Requirements:

- REQ-1: Shock Market Simulator Website

Initiating Actor: WebPlayer

Actor's Goal: To view the performance of his or her portfolio relative to other league members. For a teacher, this may also be used to verify that his or her students are actively participating in the game.

Participating Actors: Database

Preconditions: The league that is being viewed exists and the league is either public or the user is a member.

Postconditions: None; this is a stateless action.

Flow of Events for Main Success Scenario:

1. → *Player* requests to view league performance.

2. ← *System* signals the *Database* for authentication and the league's leaderboard.
3. ← *Database* authenticates the user's ability to view the statistics and returns the league's leaderboard.
4. ← *System* returns a leaderboard of all league members.

Flow of Events for league does not exist:

1. → *Player* requests the league statistics page.
2. ← *System* signals the *Database* for authentication and the league's leaderboard.
3. ← *Database* signals the *System* that the league does not exist.
4. ← *System* returns "page not found" error.

Flow of Events for league is invite-only and the user is not a member:

1. → *Player* requests the league statistics page.
2. ← *System* signals the *Database* for authentication and the league's leaderboard.
3. ← *Database* signals the *System* that the league is invite-only and the *Player* is not a member.
4. ← *System* returns "access denied" error.

4.4.5 UC-6: Modify League Settings

Related Requirements:

- REQ-1: Stock Market Simulator Website
- REQ-9: Coordinators for Supervision

Initiating Actor: Coordinator

Actor's Goal: To modify settings for the coordinator's league. This includes modifying the league's name, nickname, starting funds, and security settings.

Participating Actors: Database

Preconditions:

- League that is being modified exists
- Initiating actor is a coordinator of the league that he or she is modifying

Postconditions:

- League name is still unique
- League nickname is still unique
- Starting funds is positive

Flow of Events for Main Success Scenario:

1. → *Coordinator* requests to view league settings page.
2. ← *System* signals the *Database* for authentication and the league's settings page.
3. ← *Database* authenticates the user's ability to modify the league settings and returns the league settings page.
4. ← *System* returns a league setting page populated with the current settings.
5. → *Coordinator* submits updated league settings.

6. ← *System* Validate new league settings
7. ← *System* sends updated settings to the *database.*
8. ← *Database* signals the *System* that the settings have been updated.
9. ← *System* signals the *Coordinator* "Settings have been updated."

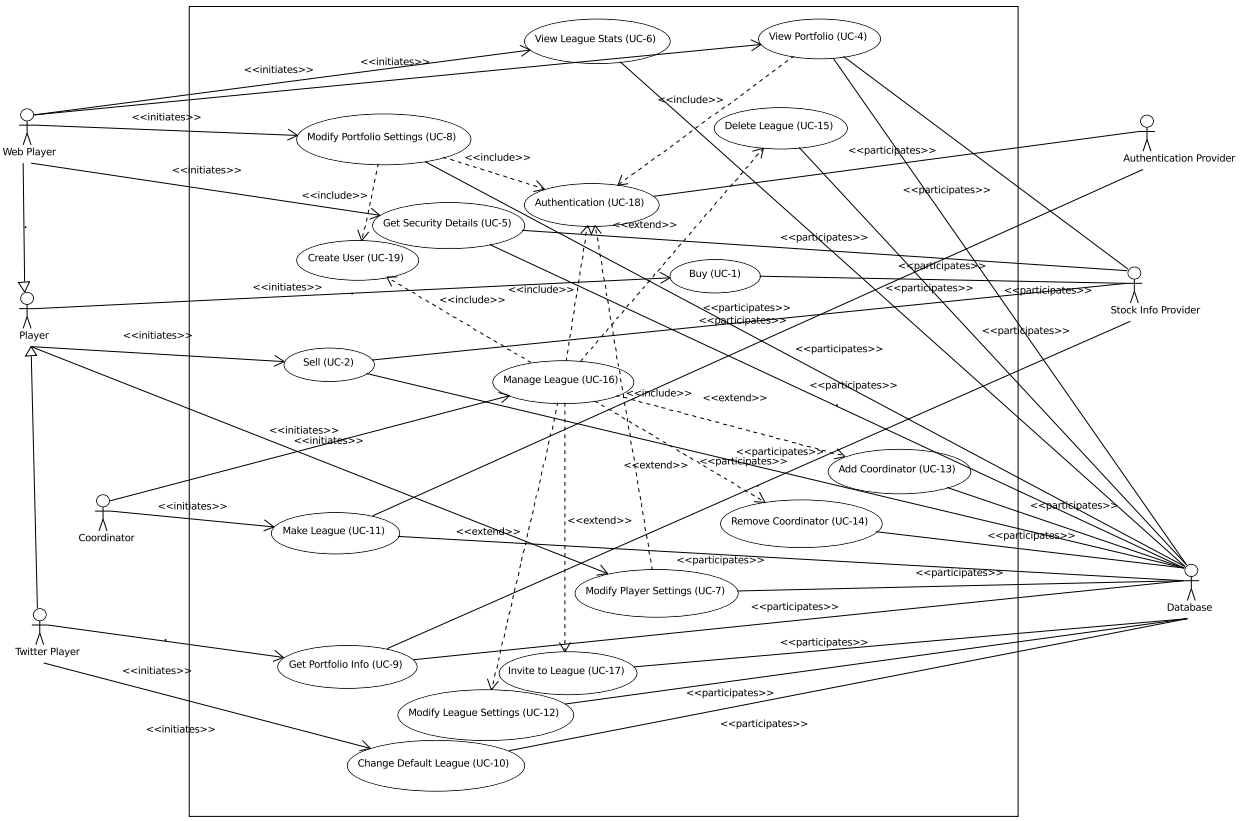
Flow of Events for league does not exist:

1. → *Player* requests the league settings page.
2. ← *System* signals the *Database* for authentication and the league's settings page.
3. ← *Database* signals the *System* that the league does not exist.
4. ← *System* returns "page not found" error.

Flow of Events for user is not a coordinator of the league:

1. → *Player* requests the league settings page.
2. ← *System* signals the *Database* for authentication and the league's settings page.
3. ← *Database* signals the *System* that the league is invite-only and the *Player* is not a member.
4. ← *System* returns "access denied" error.

4.5 Use Case Diagram

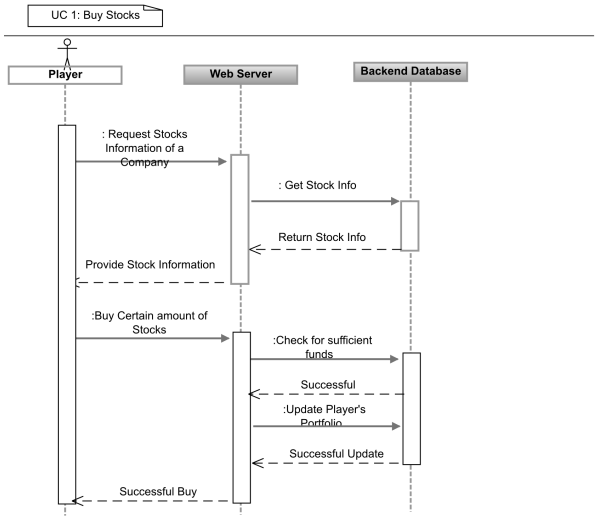


4.6 Use Case Tracability Matrix

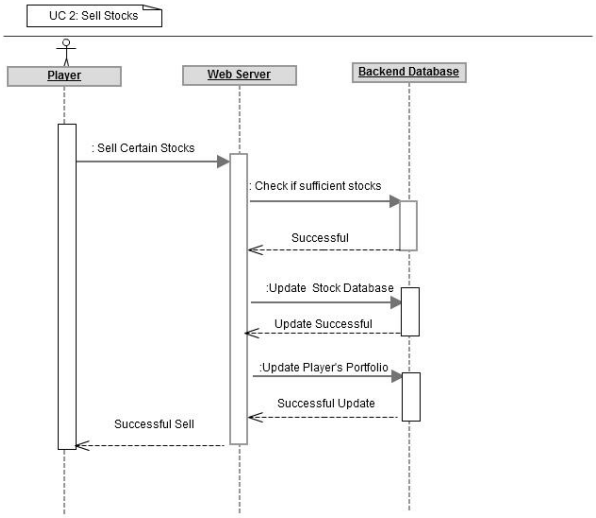
.	REQ-1	REQ-2	REQ-3	REQ-4	REQ-5	REQ-6	REQ-7	REQ-8	REQ-9
UC-1		x	x			x			
UC-2		x	x			x			
UC-3		x						x	x
UC-4	x			x		x	x	x	
UC-5	x			x	x				
UC-6	x			x			x	x	
UC-7	x			x				x	
UC-8	x			x				x	x
UC-9			x		x	x	x		
UC-10			x	x		x			
UC-11	x							x	x
UC-12	x							x	x
UC-13	x							x	x
UC-14	x							x	x
UC-15	x							x	x
UC-16	x							x	x
UC-17	x					x		x	x
UC-18	x	x	x		x				
UC-19	x	x	x	x					

4.7 System Sequence Diagrams

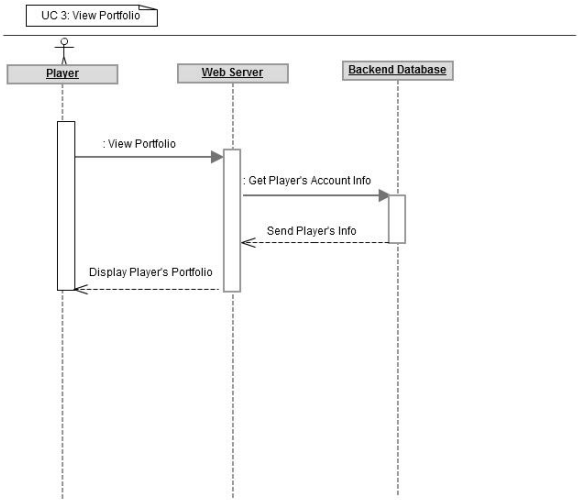
UC-1: Buy Stocks (Scenario: Successful operation)



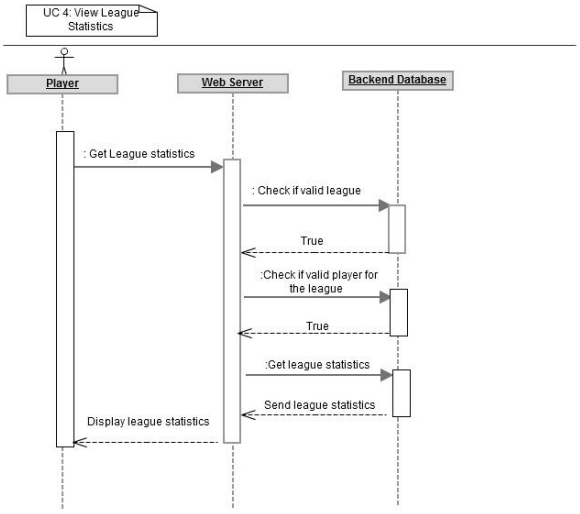
UC-2: Sell Stocks (Scenario: Successful Operation)



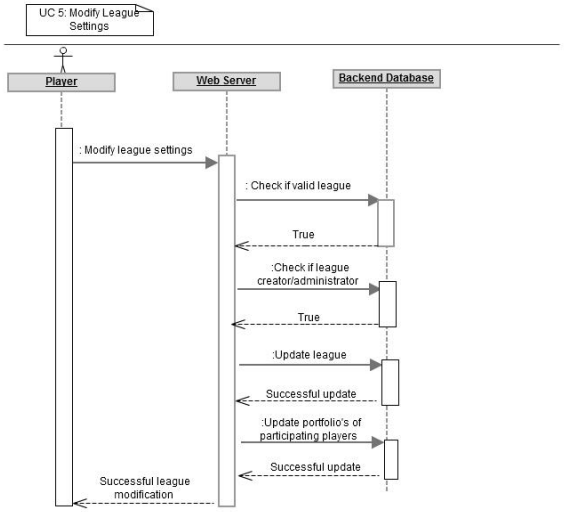
UC-3: View Portfolio (Scenario: Successful Operation)



UC-4 View League Statistics (Scenario: Successful Operation)



UC-5 Modify League settings (Scenario: Successful Operation)



5 Nonfunctional Requirements

5.1 Usability

The website should be easy to navigate irrespective of the type of user. It should have an appealing user interface which is pleasant to the eyes. A through consideration should be given for its aesthetic design in order to make it easily navigable and to have a good readability. The key focus should be on making the user interface as interactive as possible.

5.2 Performance

In order to have a great performance, the website should be as lightweight as possible by keeping minimum hardware demands. For it to be efficient, any task initiated by the user should be completed in a timely

manner. The web server should be able to serve multiple requests and when a large number of users are logged in.

5.3 Reliability

In case of Internet failure, the user's portfolios should be brought back to a consistent state when user logs in the system again after the failed internet connection. The system should keep a backup of user's data in case of server failure. A proper care should be taken to handle a situation where a particular stock source is not available (i.e. Yahoo).

5.4 Security

The system should be secure enough such that user's privacy is maintained. The system should have a login process irrespective of the application i.e via Website, Mobile or twitter interface.

5.5 Supportability/Extensibility

It should be feasible to extend any server components and include improved versions of modules which can be installed only by administrators. For future purposes of handling the load, it should be easier to include more number of servers to achieve load balancing. The system should be platform independent so that it is easy to move to newer technologies or the next versions of web server.

5.6 Maintainability

The system should be easy to maintain for the administrator. The administrator should be provided with an interface to interact with the entire system to make changes and to recover from any failure manually as well. The interface should give the administrator enough capability to perform future maintenance.

5.7 Testability

The system should be flexible enough to allow creating test databases and fake players so that feature test does not need to manipulate the actual database. This would ensure that it has great testability which can be used to build a more robust

5.8 Consistency

It should be ensured that the application is consistent throughout irrespective of what interface the player is using i.e whether website, mobile application or twitter interface. Functionality might be limited on these different interfaces but it should not difficult for the user to shift from one application to another to access the system. Buzz words used should be same throughout and on all the interfaces to avoid confusion.

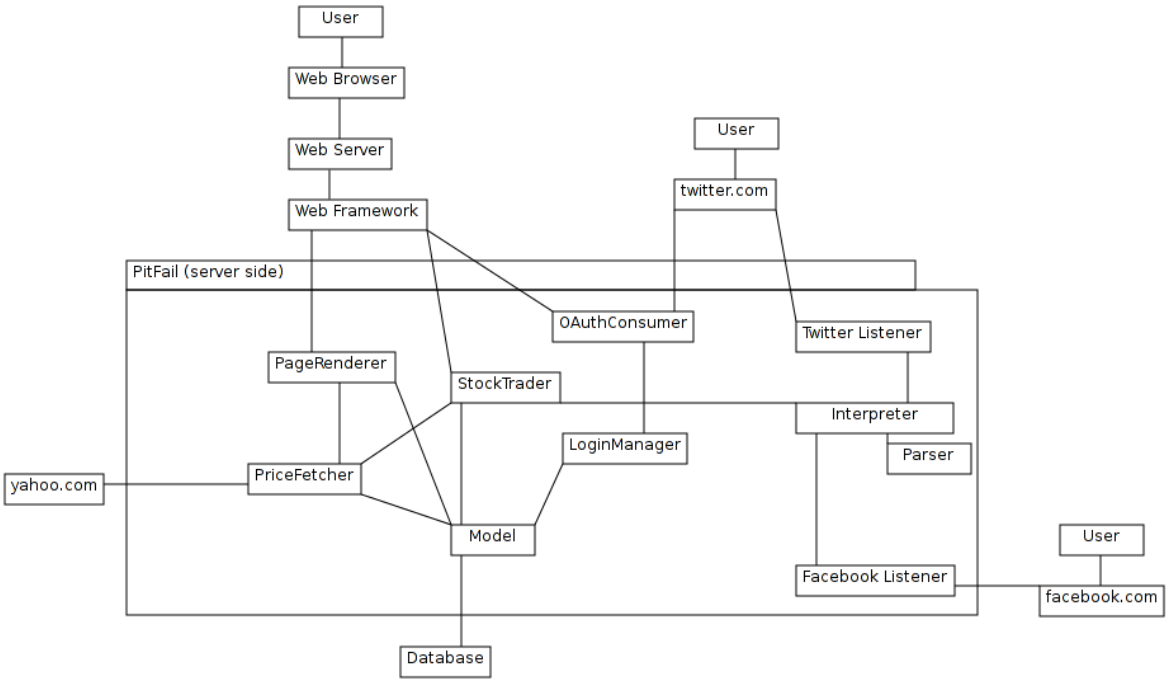
5.9 Documentation

The website should have enough material in the form of tutorial which can help the user to understand the rules and policies of the Stock fantasy league game and how it works.

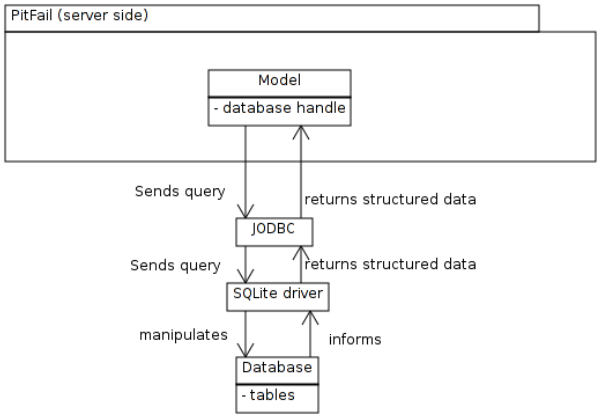
6 Domain Analysis

6.1 Domain Model

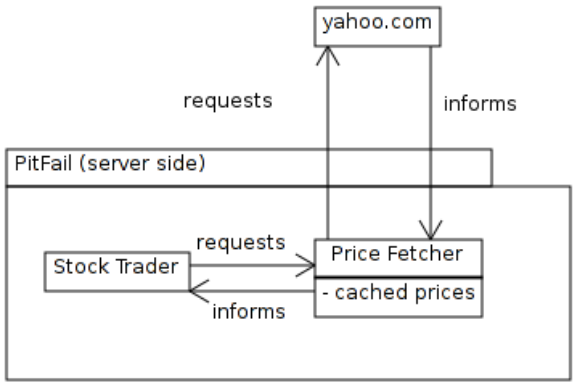
A sparse overview of the Domain Model looks like



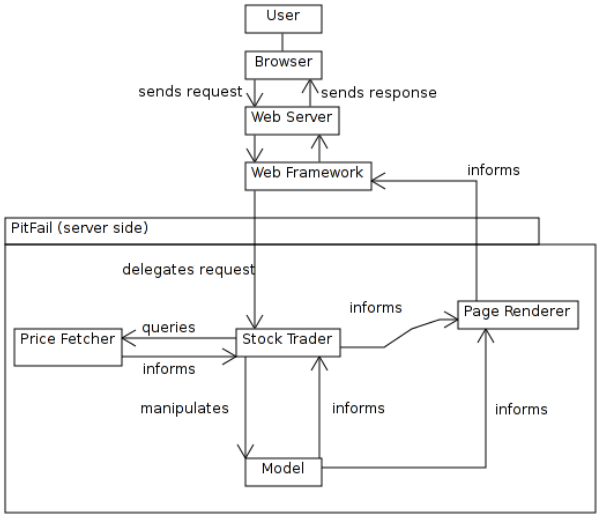
We can zoom in on the various parts to add attributes and associations:
The Model is the backend persistent storage:



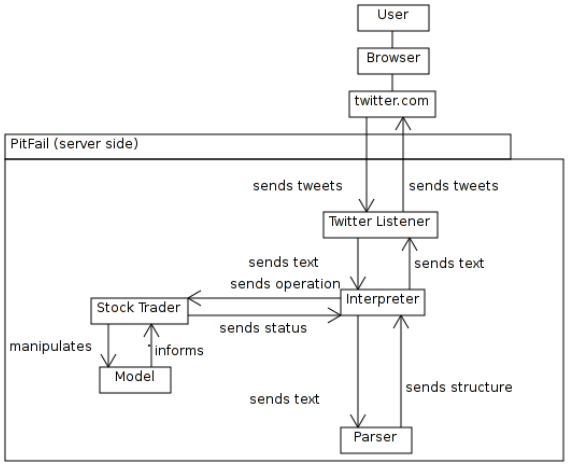
The Price Fetcher:



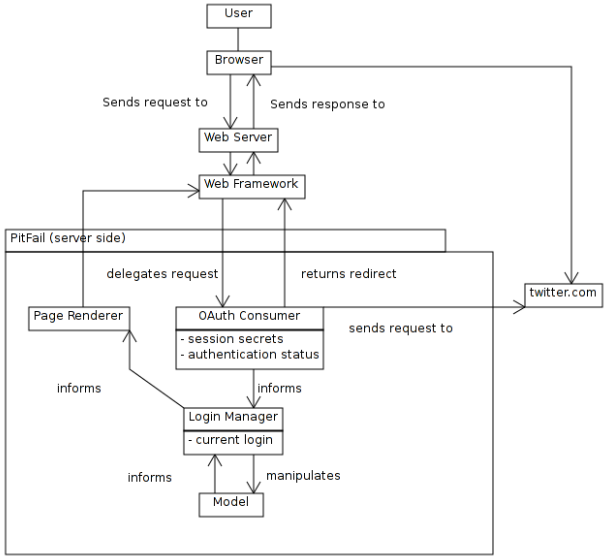
The Web trading front-end:



The Twitter trading front-end:



And the login process:



6.1.1 Concept Definitions

The concepts from the model are:

User
Definition: A human being playing the Pitfail game.
Web Browser
Definition: The User's browser, running on the User's computer.
Responsibilities:

- Take input from User
- Send requests to Web Server
- Receive responses from Web Server
- Render page content

Android Client
Definition: The Android application: Pitfail, running on the User's Android phone.
Responsibilities:

- Listen to user input via touch
- Send request to Web Server, receive response from web server
- Display appropriate screen with response action

Web Server
Definition: HTTP web server, running on Pitfail's server.
Responsibilities

- Receive requests from Web Browser
- Delegate requests to Web Framework
- Receive responses from Web Framework
- Send Responses to Web Browser

Web Framework
Definition: Web framework APIs.
Responsibilities

- Receive requests from Web Server
- Convert requests to structured data and delegate to appropriate handlers
- Receive rendered pages in the form of structured data and convert to markup
- Send responses to Web Server

Page Renderer
Definition: Creates a presentation aimed at the User in the form of structured data.
Responsibilities:

- Decide what information should be rendered
- Convert prices/balance sheets/news to human-readable form
- Send rendered pages to the Web Framework

OAuthConsumer
Definition: Takes the role of the "consumer" in the OAuth protocol.
Responsibilities:

- Receive requests from Web Framework
- Send requests for authentication to twitter.com
- Receive + store session secrets from twitter.com
- Inform Login Manager of new logins

Stock Trader
Definition: Is in change of the logic of making trades.
Responsibilities:

- Receive requests from Web Framework
- Interpret requests and translate them into operations on the Model
- Decide of a request makes sense and is legal for the current user
- Inform the Page Renderer of recent actions so that they may be report to the user
- Manipulate the Model to reflect the result of trades

Price Fetcher
Definition: Gets real-world stock prices.
Responsibilities:

- Receive requests for price information from various components
- Request new price information from yahoo.com
- Receive price information from yahoo.com
- Maintain a cache of recent price quotes

Login Manager
Definition: Handles the current user login.
Responsibilities:

- Receive new login information from OAuthConsumer
- Store current login information for the session

- Query the Model to check for existing user information
- Update the Model to reflect new user information

Twitter Listener
Definition: Provides an interface for users to play Pitfail via Twitter.
Responsibilities:

- Maintains a connection with twitter.com and listens for tweets
- Delegates tweets to the Interpreter
- Receives responses from the interpreter and sends them as tweets

Facebook Listener
Definition: Provides an interface for users to interact with Pitfail via Facebook.
Responsibilities:

- Listens to wall posts on Pitfail Page and maintains a connection with Facebook.com
- Delegates the wall posts with requests to buy/sell to the interpreter
- Receives responses from the interpreter and sends them as a response to the Wall posts as comments.

Interpreter
Definition: Interprets text-based trading commands.
Responsibilities:

- Receive text commands from Twitter Listener and Facebook Listener
- Delegate commands to the Parser and receive a structured representation
- Send structured commands to the Stock Trader and receive a response
- Convert response to text and send back to the corresponding Listener

Parser
Definition: Converts human-entered text to structured trading commands.
Responsibilities:

- Receive text commands from the Interpreter
- Convert commands to structured from

Model
Definition: Handles persistent data.
Responsibilities:

- Create and maintain a database handle
- Convert high-level model operations to database queries

6.1.2 Attribute Definitions

Because it is primarily web-based, the Pitfail program is mostly stateless. Persistent data is almost entirely stored in a database, the schema for which is described later.

A few attributes related to sessions and volatile information are stored within the program itself. These are described here.

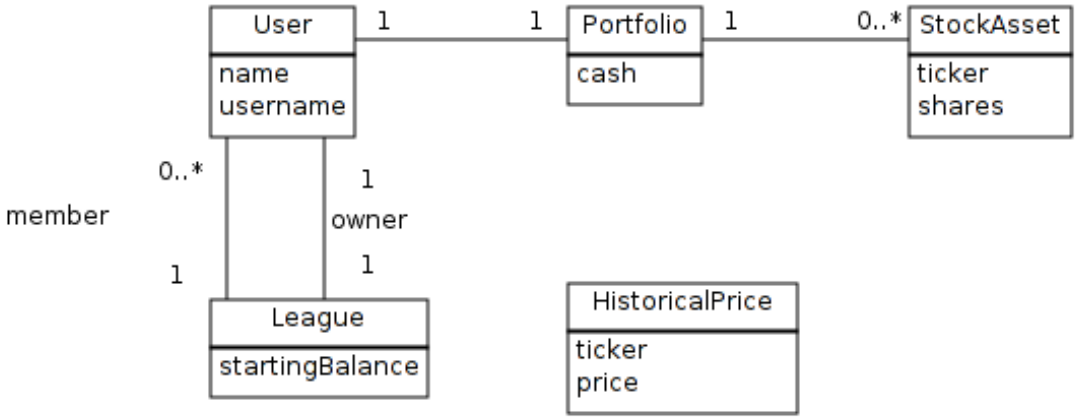
Concept	Attribute	Meaning
Model	database handle	Allows communication with the database.
Database	tables	Relational tables. Schema described elsewhere.
Price Fetcher	cached prices	Stores recently retrieved prices to avoid DOSing yahoo
OAuthConsumer	session secrets	OAuth authentication secrets
OAuthConsumer	auth status	Whether authenticated, and if so as whom
Login Manager	current login	Currently logged in user

6.1.3 Association Definitions

Subject	Verb	Object	Meaning
Browser	sends request to	Web Server	The user has followed a link or performed at action
Login Manager	informs	Page Renderer	Reports login status so it can be displayed on page
Login Manager	manipulates	Model	When a new user logs in, remember them in database
Model	informs	Login Manager	Tells is this a new user and who are they
OAuth Consumer	informs	Login Manager	Tells about new authentications
Model	sends query	JODBC	Sends SQL to be performed on the database
JODBC	returns strc. data	Model	Results of query
Stock Trader	requests	Price Fetcher	Requests price data for a ticker symbol
Price Fetcher	informs	Stock Trader	Returns requested data
Price Fetcher	requests	yahoo.com	Requests price for ticker
yahoo.com	informs	Price Fetcher	Tells price for ticker
Stock Trader	manipulates	Model	To perform a trade
Model	informs	Stock Trader	Current status of portfolios
Interpreter	sends text	Parser	Human-written command to be parsed
Parser	sends structure	Interpreter	Interpretation (or failure)
Interpreter	sends operation	Stock Trader	Trade to be performed
Stock Trader	sends status	Interpreter	did it perform correctly
twitter.com	sends tweets	Twitter Listener	Live stream of user's tweets
Twitter Listener	sends tweets	twitter.com	Response to users
Web Framework	delegates request	Stock Trader	User performed a trade in browser
Stock Trader	informs	Page Renderer	Reports status of trade back to user
Page Renderer	informs	Web Framework	How to render the new page
Model	informs	Page Renderer	Current status of portfolios

6.1.4 Attributes Stored Persistently in Database

Because this constitutes the majority of the state of PitFail, it is worth giving a rough schema for the database, even though this will never be visible to the user, because it indicates what data is expected to persist across sessions.



6.2 System Operation Contracts

6.2.1 UC 1: Buy Security

Preconditions:

- Verify user entry into the system
- Verify funds of the user
- Verify availability of security in desired quantity (or even more)

Post conditions:

- Update user portfolio
- Update database of system with the latest value of available security

6.2.2 UC 2: Sell Security

Preconditions:

- Verify the number of securities with the user (should be sufficient enough to sell security)

Post conditions:

- Update database with an increase in the number of available securities
- Update user profile

6.2.3 UC 3: View Portfolio

Pre conditions:

- Valid and updated values of user's account

Post conditions:

- Display of information is in a format readable and understandable by the requester

6.2.4 UC 4: View League Statistics

Pre conditions:

- Existence of Valid League
- Participation of valid users into the league

Post conditions:

- Display of information is in a format readable and understandable by the requester
- Display of statistics should be according to the access rights of the requester

6.2.5 UC 5: Modify League Settings

Pre conditions:

- Existence of Valid League
- Access of the League to its issuer

Post conditions:

- Update the League information according to the new changes
- Reflect the changes to the users participating in the league

7 User Interface Design

Pitfail's website satisfies the requirements that the other interfaces cannot: enabling social interaction, providing a rich user interface, and coordinating leagues. Providing a rich set of features above what is available via Twitter is crucial for drawing existing users to the website. On balance, the website must have a simple interface that welcomes new users and guides the new user through the registration process. This starkly contrasts with many exiting trading simulations, such as the Stock Market Game's seven page registration procedure that requires a large amount of personal information.

7.1 Preliminary Design

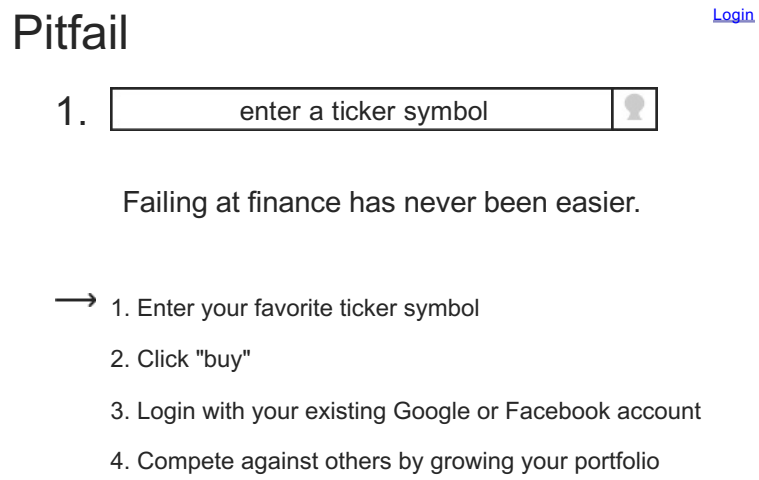
Simplifying the registration procedure starts with the welcome page. Instead of welcomes the logged-out user with a registration page, Pitfail presents him or her with a simple four-step guide to purchasing his or her first stock. Existing users can bypass this guided process at any time by following the "login" link that is in the top-right corner of ever page. This intentionally mimics the login method on popular websites such as Facebook, Google, and Reddit.

7.1.1 Welcome Page for New User

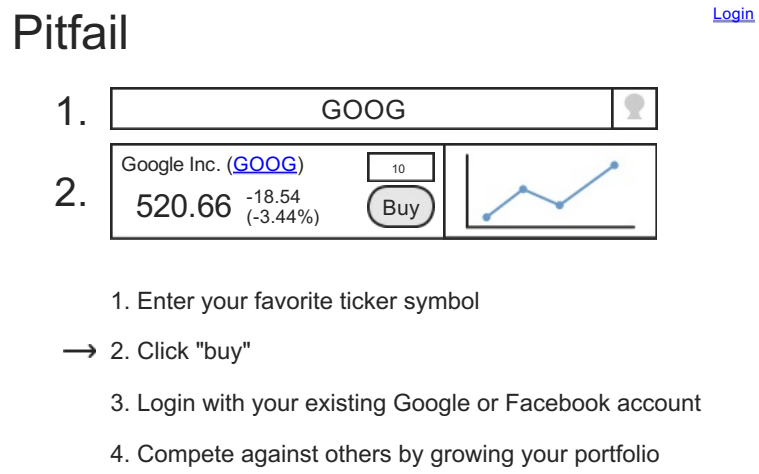
If the user is logged out, he or she is assumed to be a new user and is presented with a guided login process. Existing users can skip the account registration by using the OpenID "login" link in the upper-right corner of the page. This design intentionally designed to mimic the behavior of popular websites such as Facebook, Google, and Reddit.

New users, on the other hand, are guided through the process of purchasing their first security. Guiding new users through their first purchase helps the new users gain familiarity with Pitfail's user interface before confronting the full complexity of portfolio management.

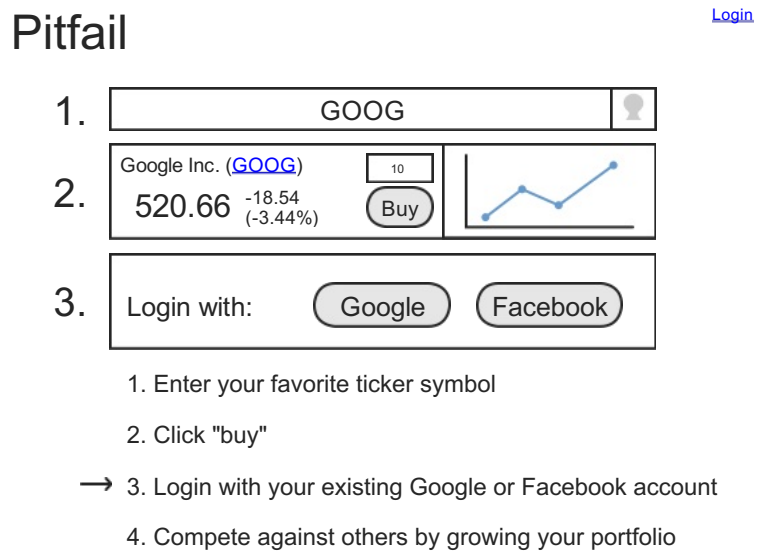
First, the user is asked to enter a stock ticker symbol into the search box to request a quote:



Assuming the ticker symbol exists, the Pitfail slogan is replaced with a stock quote that indicates the stock's market value. The user then chooses how many shares he or she wishes to purchase and clicks the "buy" button to confirm the purchase (this process of purchasing a stock is described in more detail when discussing the portfolio page):



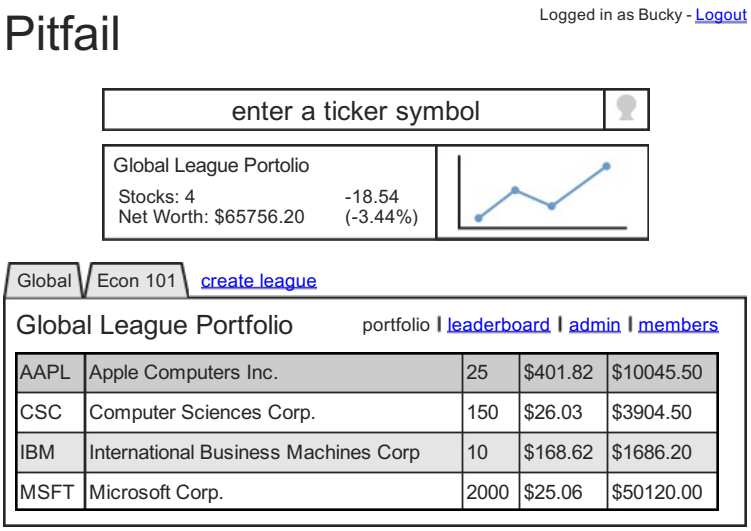
After the user clicks "buy" he or she is prompted to login using OAuth, OpenID, or Facebook Connect. Single-click login buttons are provided for most common providers, such as Facebook, Google, and Twitter:



Once authentication is complete the user's Pitfail account has been initialized and the stock has been purchased. This account creation is completely transparent to the user and no personal information is required to complete the login process. From this point forward, new users and returning users are treated identically.

7.1.2 Portfolio Management

Now logged in, the user is redirected to his or her Global League portfolio page. The portfolio page is the heart of the Pitfail website and serves as a portal to the rest of the website and is split into three sections: (1) controls to buy/sell securities, (2) league controls, and (3) an overview of the securities in the current portfolio:



Much like when completing the guided account creation process, users can purchase shares of a stock at market price by entering a ticker symbol in the large search box near the top of the page. This displays a stock quote for the requested company and displays the fields necessary to purchase the stock:

Pitfail

Logged in as Bucky - Logout

GOOG

Google Inc. (GOOG)

520.66 -18.54 (-3.44%)

10

Buy

Global | Econ 101 | create league

Global League Portfolio

portfolio | leaderboard | admin | members

AAPL	Apple Computers Inc.	25	$401.82	$10045.50
CSC	Computer Sciences Corp.	150	$26.03	$3904.50
IBM	International Business Machines Corp	10	$168.62	$1686.20
MSFT	Microsoft Corp.	2000	$25.06	$50120.00

The user completes the purchase by entering a number of shares or dollar amount into the text field and clicking the "buy" button. Similarly, the user can sell shares at market price by using the same input technique in the table row that corresponds to the stock that he or she wishes to sell (not pictured due to space constraints).

Users that are members of multiple portfolios (e.g. students, teachers) can switch between their portfolios using the tabs near the top of the page. All actions, including buying/selling securities, only apply to the currently selected portfolio. Besides managing his or her own portfolio, each user can also view the current league's leader board:

Pitfail

Logged in as Bucky - Logout

Global | Econ 101 | create league

Leaderboard

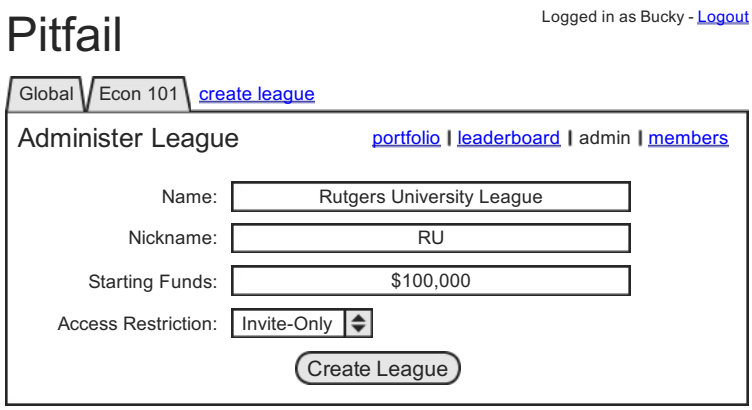
portfolio | leaderboard | admin | members

1	Bucky	$100232.53
2	Cody	$95012.33
3	Satchel	$87216.39
4	Bert	$73195.23
5	Ernie	$52000.12
6	Jordan	$25120.00
7	Austin	$22770.54
8	Jennifer	$19430.13
9	Jeff	$15000.00
10	John	$1.00

The leader board shows a list of all users in the current league ranked by the current net worth of their portfolios. This encourages friendly competition and a provides a natural portal for the addition of social features in future versions.

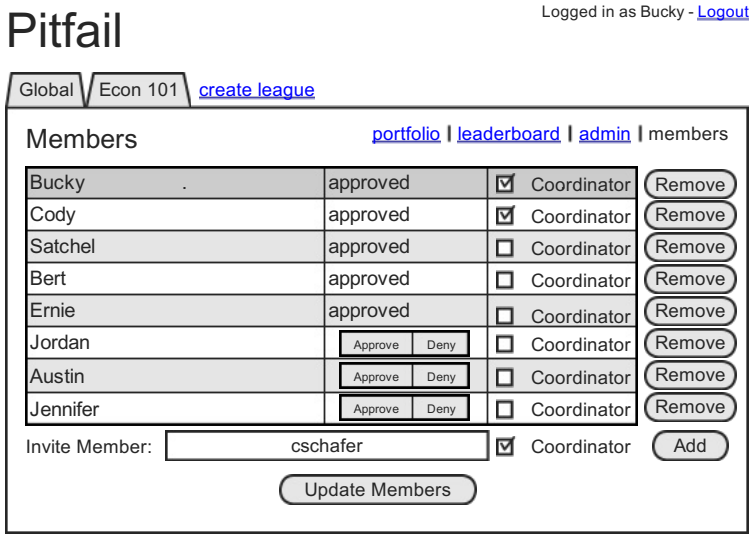
7.1.3 League Coordination

Besides the league-dependent "portfolio" and "leader board" links, there are two contextual links that are only visible to league coordinators. First, the league administration page allows league coordinators to change league-wide preferences:



These preferences include the league's name, nickname (used in places where the full name would be too long), starting funds, and access restriction preferences. An identical form is used for league creation.

Second, the league coordinator has access to tools necessary to manage the league's members. This includes inviting new members, removing members, and promoting existing members to league coordinator status:



This page is particularly important for invite-only leagues, such as those used by teachers. League coordinators are presented with a comprehensive list of current members and a queue of pending join requests that are awaiting approval.

7.2 User Effort Estimation

Several of the most common usage scenarios for the Pitfail website are evaluated below. In particular, note that common scenarios (e.g. buying a stock) are much easier to perform than rare scenarios (e.g. creating a new league):

Usage Scenario	**Clicks**	**Keystrokes**
purchase a stock	5	7
sell a stock	5	2
create a new league	4	19
modify an existing league	5	4
invite a user to a league	6	5

These usage scenarios are discussed in detail below.

7.2.1 Purchase a Stock

Assume the user wishes to purchase 10 shares of Google stock in his or her Global League portfolio. The user must:

- **Navigation:** total of three clicks, as follows
  1. Click on "login".
  2. Click on the "Global League" tab.
  3. Click on "portfolio".
- **Data Entry:** total of two clicks and seven keystrokes, as follows
  1. Click on the "enter a ticker symbol" text field.
  2. Press the keys "G", "O", "O", and "G".
  3. Present "enter" to load the quote.
  4. Press the keys "1" and "0" to specify 10 shares.
  5. Click the "buy" button to confirm the purchase.

Note that the user could press "enter" instead of clicking the "buy" button.

7.2.2 Sell a Stock

Assume the user wishes to sell 10 shares of Google stock from his or her Global League. The user must:

- **Navigation:** total of three clicks, as follows
  1. Click on "login".
  2. Click on the "Global League" tab.
  3. Click on the "portfolio" tab.
- **Data Entry:** total of 2 clicks and 2 keystrokes, as follows
  1. Click on the text input in the row corresponding to Google.
  2. Press the keys "1" and "0" to specify 10 shares.
  3. Click the "sell" button to confirm the purchase.

Note that the user could press "enter" instead of clicking the "sell" button.

7.2.3 Create a New League

Assume the user wishes to create a new league named "Rutgers" with the nickname "RU", $100,000 starting funds, and allow public access. The user must:

- **Navigation:** total of two clicks, as follows:
  1. Click on "login".
  2. Click on "create league"
- **Data Entry:** total of two clicks and 19 keystrokes, as follows
  1. Click on the "name" field.
  2. Press the keys "R", "u", "t", "g", "e", "r", and "s" to enter the name.
  3. Press the tab key to move to the "nickname" field.
  4. Press the keys "R" and "U" to enter the nickname.
  5. Press the tab key to move to the "starting funds" field.
  6. Press the keys "1", "0", "0", "0", "0", and "0" to enter $100,000.
  7. Press the tab key to move to the "access restriction" field.
  8. Press the down-arrow key to select "public".
  9. Click the "create league" button.

Note that the user could have selected "public" using the mouse and/or pressed "enter" instead of clicking the "create league" button.

7.2.4 Modify an Existing League

Assume a coordinator of the "Rutgers" league wishes to change the league's nickname from "RU" to "RU1", which he or she is a coordinator of. The user must:

- **Navigation:** total of three clicks, as follows:
  1. Click on "login".
  2. Click on the "Rutgers" tab.
  3. Click on the "admin" link.
- **Data Entry:** total of two clicks and four keystrokes, as follows
  1. Click on the "nickname" field.
  2. Press the "backspace" key to clear the field's contents.
  3. Press the keys, "R", "U", and "1" to enter the new nickname.
  4. Click on the "update field" button.

Note that the user could have pressed "enter" instead of clicking the "create league" button.

7.2.5 Invite User to a League

Assume a coordinator of the "Rutgers" league wishes to add the "Bucky" user as a coordinator of the "Rutgers" league. The user must:

- **Navigation:** total of three clicks, as follows:

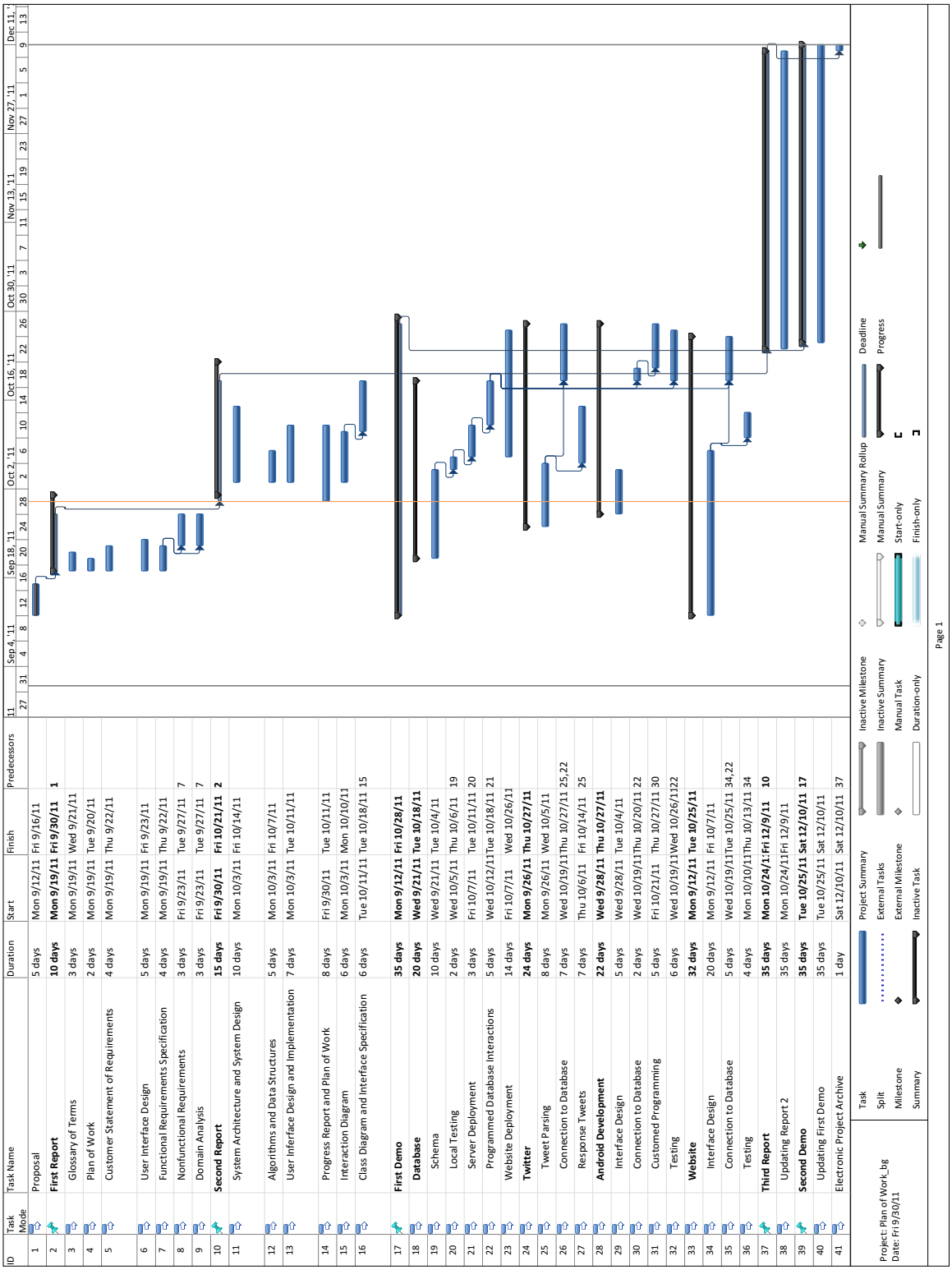
  1. Click on "login".
  2. Click on the "Rutgers" tab.
  3. Click on the "members" link.

- **Data Entry:** total of three clicks and five keystrokes, as follows

  1. Click on the "invite member" text field.
  2. Press the keys "B", "u", "c", "k", and "y" to enter the user name.
  3. Click on the "coordinator" checkbox.
  4. Click on the "add" button.

  Note that the user could have pressed "enter" instead of clicking the "add" button:

8 Plan of Work



9 References

Miles, Russ and Kim Hamilton. Learning UML 2.0. Ed. Eric McLaughlin and Mary O'Brien. Sebastopol: O'Reilly, 2006.