

Using a Web-enabled Database to Facilitate Social Interaction: The Case of the WPI Investment Club

An Interactive Qualifying Project Report
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Michael L. Diamant

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Approved:

Dr. Huong Higgins, Advisor
Associate Professor
Worcester Polytechnic Institute
Management Department
100 Institute Road
Worcester MA 01609
United States
Hhiggins@wpi.edu

Abstract

In this project, I apply database technology to facilitate social interaction, specifically by building an online operational base for the WPI investment club. The goals of this project are to develop a web-enabled database with that facilitates social interaction in the context of investment education, to create the structure of an investment club on-campus to bring together interested students, and to propose a technology enabled solution investor information overload.

Executive Summary

In this project, I apply database technology to facilitate social interaction, specifically by building an online operational base for the Worcester Polytechnic Institute (WPI) investment club. The goals of this project are driven by personal interests in investing and technology, and how these elements can be combined to benefit others. The project seeks to develop a web-enabled database that promotes social interaction through a focus on investing. The project also seeks to research and to understand information overload and its effects on the individual investor, and how a web-enabled database can be used to reduce the negative effects of information overload. The project engages the WPI student community by developing the framework for an investment club on-campus that will allow students to exchange investing ideas.

Research targets the technologies and concepts used in the development of a web-enabled database and the concepts that tie together social issues and investing. The technology review overviews the elements and concepts necessary to construct the online operational base, including MySQL, PHP, and Web 2.0. MySQL is a popular open source database that serves as the web-enabled database in this project. PHP is an open source programming language that is used to develop dynamic websites and to interact with web-enabled databases, like MySQL. Web 2.0 is a conceptual framework that is used to drive the design of investment club. Research from a social perspective details information overload, its effects on individual investors, and how a web-enabled database, like the online operational base, can be used to reduce these malignant effects. The Motley Fool CAPS, which is an existing online service that provides a web-enabled database with investing applications, is studied to provide insight into the development of this project. Also, existing university investments clubs and an online investment research firm are profiled to better understand the strengths and weaknesses of existing university investment clubs and to understand how to generate objective investment research.

During the course of the project, the web-enabled database and frontend website were implemented, allowing users several functionalities. Users can rate and comment on stocks covered by the WPI investment club and the performance of their picks is subsequently tracked by applying market data. Over time, the database generates feedback for the user, in the form of a score that benchmarks user performance. Additionally, users have the opportunity to maintain a blog and to comment on other blogs, and the chance to vote in community polls and investment club stock pitches. These features provide website users with an online community that facilitates social interaction and promotes investment education.

Research into information overload was completed in parallel with web development to devise a potential solution to reduce investor's information overload. The potential solution is a system that interfaces with the web-enabled database and scans financial news to find keywords that indicate the news article's sentiment, and then quantifies the sentiment through a scoring formula. The system incorporates users by allowing users to submit keywords, or tags that indicate article sentiment. Following the user submission of tags, the system automatically scans

incoming financial news for user submitted tags, and then generates a score representing the article sentiment. This approach quantifies the intangible news article sentiment in a form that is highly summarized and can be quickly used to make an informed investment decision. By providing information in a quantified and summarized format, it is possible to reduce the effects of information overload.

This project also creates the framework for a new on-campus organization, the WPI investment club. This project proposes a leadership structure and club activities to provide students the opportunity to exchange investment ideas. During the course of the project, students were selected to help lead the club and an information session was held on-campus to promote awareness of the investment club. The investment club will continue to run after the completion of the project and seeks to become an integral part of student life at WPI.

This project is open-ended, leaving room for future projects to be conducted. Future project ideas include the creation of the envisioned information overload reduction system, the study of how information layout affects information overload, the study of how to align incentives of decision makers as to increase information processing capacity, and the development of similar web-based databases at other educational institutions, such as high schools.

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I. Introduction

I.1 Project Motivation

I.1.1 Fulfillment of IQP Requirements

In this project, I apply database technology to facilitate social interaction, specifically by building an online operational base for the WPI investment club. This project focuses on the application of technology promoting social interaction in the context of the WPI investment club. The goal of the online operational base, which consists of a web-enabled database and a website, is to incorporate new and existing ideas to create an online community that enables students to interact and to share investing ideas. The creation of the WPI investment club represents the start of an organization that is entirely new to WPI and helps to bring together students interested in investing.

Fundamentally, the project exists to fulfill the requirements of the Interactive Qualifying Project (IQP). From a technical perspective, developing the interactive and web-database enabled website provides a challenge. The website requires designing a complex relational database to power interactive features and an attractive visual interface for user interaction. The database is the backend of the website, that is, the database enables user functionality on the website, but the user does not directly interact with the database. Instead, the user interacts with the frontend of the database, which is the website. A successful website interface design allows the user easy access to the database's functions without needing technical knowledge to manipulate the database.

From a social perspective, this project serves to provide a structured environment, in the form of an investment club, to allow WPI students to exchange ideas about investing. The creation of an investment club on-campus provides a formal outlet for students to stimulate their interest in investing by interacting with other students. This project also looks to the use of web-enabled databases to promote social interaction among students in the form of the WPI investment club website.

I.1.2 Fulfillment of Personal Goals

My first personal goal is to create an environment that benefits students seeking to invest in the stock market. To reach this goal, an investment club will be formed on-campus to facilitate the interaction and the exchange of investment ideas among students. The eclectic WPI student body is ideal for generating new and innovative investment ideas because WPI students study a variety of fields that create pools of domain knowledge. The investment club provides an opportunity for WPI to leverage its diverse campus background to develop new investment ideas. My personal motivation exists because learning to invest alone was a difficult process and if I had the support of a structured environment, learning to invest would have been a simpler and a more interactive process.

My second personal motivation is derived from the first. Once students have learned how to approach investing and begin utilizing their newly learned skills, in combination with their domain knowledge from their majors, new investment ideas will be formed. The most gratifying moment will occur when club members are able to come up with innovative and informed investment ideas. It is the ability to generate well-thought out ideas that is most interesting to me. WPI students are certainly capable of producing original ideas, but not all students understand investing fundamentals. Without teaching students how to properly invest, it

is impossible to expect students to generate informed ideas. My second personal motivation is to provide students with an online platform, in the form of the investment club website, to help students develop investing ideas and knowledge.

My third personal motivation is to help the WPI investment club stand apart from other university investment clubs by building a fully-featured, interactive website. The website will reflect many of the investment club's activities. The website will emphasize new approaches to website design that focus on user interaction to build an online community that emphasizes student research and interaction. The ultimate goal of the website is for it to serve as a base for club operations and to help integrate users into one community.

Fulfilling the requirements of the IQP and achieving all three personal motivations will result in an investment club that acts as a resource to students wishing to develop their investing skills. The club will become a model for other university investment clubs to follow due to its highly interactive nature. On a broader scale, the success of the investment club will make a positive addition to WPI student life.

1.2 Project Goals

The project motivation explains the ultimate goal of this project, the formation of an on-campus investment club and the creation of an online operational base, and how achieving this goal fulfills the requirements of an IQP. However, the project motivation does not explain research and tasks that must be accomplished along the way to completing the ultimate goal. Listed below are tasks and research that must also be accomplished.

- Research existing university investment clubs
- Research existing online investment research firms and how they function
- Research Web 2.0 website design principles
- Define information overload and study how to reduce information overload in an investing environment
- Design and develop investment club website
- Develop scoring algorithm to rank and to benchmark club member financial performance
- Develop framework for on-campus investment club
- Plan for future projects

Researching existing school investment clubs as well as existing investment research firms provides perspective on how to organize the WPI investment club. The goal is to determine what activities, tasks, and services existing organizations do well so that they can be incorporated into the WPI investment club, and also to discover areas of weakness that the WPI investment club can use to differentiate itself from existing organizations. The investment club website will be designed around Web 2.0 principles, which focuses on having users generate the website content. Researching Web 2.0 principles will help create a website that most benefits the users, that is, WPI investment club members. Researching information overload provides insight into how decision makers perform when presented with too much information and explains possible methods to reduce information overload for investors.

Programming the website entails frontend website design, which is what website visitors see, and designing the website database, which website visitors interact with but do not see. The website requires the design of a user login system that allows for user functionality. The website must also support the streaming of financial data to track user stock pick performance. Additionally, a scoring algorithm must be devised to benchmark user performance. Creating this algorithm requires research into the average commission cost per trade because commission cost

will be used as a proxy for gauging performance. The scoring algorithm will compensate for the lack of commission charges when a user makes stock pick by incorporating a commission factor into the scoring algorithm.

Developing the framework of the on-campus investment club entails several tasks. Necessary paperwork for forming an on-campus club must be created to recognize the investment club as an organization. Examples of necessary paperwork include a constitution and a letter of intent describing the club purpose. Second, students must be recruited into the organization to help drive leadership. Third, an on-campus information session must be held to increase awareness of the organization. Last, it is necessary to create investment literature in the form of stock pitches to serve as a model for investment club members. Creating a model stock pitch provides a starting point for devising further investment literature.

The last project goal is to plan for future projects. This is the first project of its kind and it is important that the project remain open ended so that future groups can build upon the work accomplished during this project. Future work can be done to expand upon the information overload research or to study how a web-enabled database, like the one created for the project, can be further developed or deployed in other learning environments.

1.3 Investment Club Structure

One of the goals of the IQP is to develop an investment club on-campus. Figure 1 displays the investment club structure. There is an emphasis on the online operational base that is provided through the website and database created during this project.

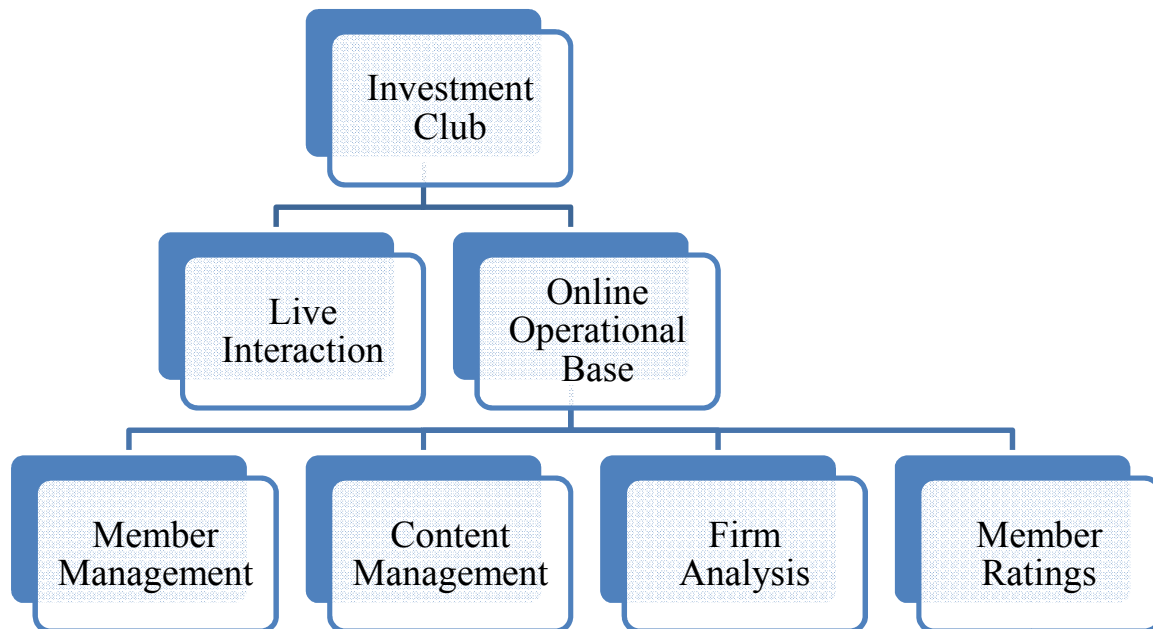


Figure 1 - Investment Club Structure

The investment club structure is composed of two main branches: (1) live interaction and (2) online operational base. Live interaction is composed of the activities the investment club plans to pursue. Example activities include weekly stock pitches, fictitious investing simulation challenges, and a year-long educational series that teaches basic principles of investment

management. The focus of this project is an online operational base. This project focuses on the development of a relational database in combination with a frontend website to manage investment club operations

The four main areas that the operational base covers are member management, content management, firm analysis, and member ratings. The relational database provides support for the management of user accounts. User accounts allow feedback to be given to club members. Content management deals with the need to store financial data from an external source in the database and to manage the descriptions of firms covered by the investment club. The relational database provides the capabilities necessary to handle a flow of financial data and to handle member descriptions of investment club covered firms. Financial analysis refers to the submission of documents analyzing a firm's financial and business health to determine if the underlying stock should be bought or sold. Financial analysis relies on member expertise for document content and on the database to manage storage and retrieval of the analysis. Last, member ratings are calculated using a custom algorithm to provide feedback to members through their user accounts.

1.4 Database Usage Overview

The investment club's online operational base depends upon the user's interaction with the database. The online system operates by providing the user with a frontend website that acts as the medium through which the user interacts with the database. Figure 2 shows how information flows from the user to the database and then back to the user.

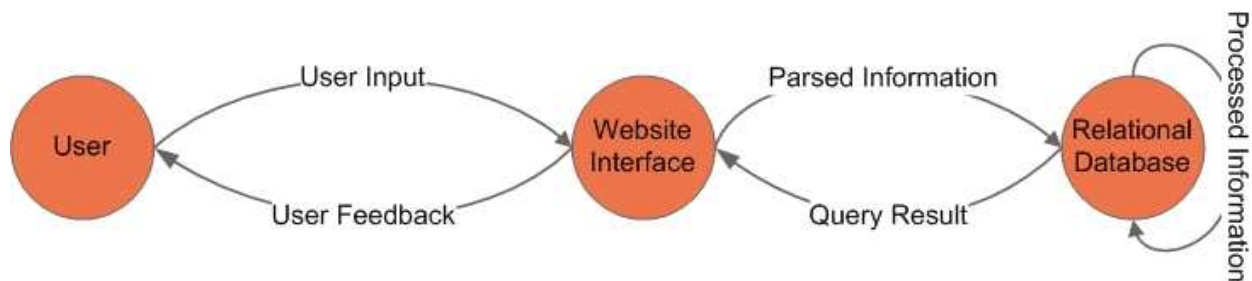


Figure 2 - Website Information Flow

The user does not directly interact with the database. Instead, the user interfaces with the website, which in turn submits information to the database for processing. The following example illustrates how this process functions. A user logs in to his/her account and rates a particular stock a "buy". The user does this by pointing and clicking on the "buy" option and clicking submit on a form.

After clicking submit, the website parses the user's input, the buy recommendation, into a format readable by the database and acquires other data needed to complete data storage in the database. In this example, financial data must be accessed to store the current stock price to later benchmark user performance. Once this information is acquired and parsed into a format that is database readable, it is transmitted to the database to be stored.

Next, the database processes stored information. The database, for example, can update each member's score on a daily basis. To do this, the database obtains current financial data to

compare the current stock price with the stock price at the time of stock pick. Then, by applying a scoring algorithm, a user's score is calculated and stored in the database. The database performs processes transparently to the user.

To obtain feedback or other information from the database, the user browses the website, which results in queries to the database. Again, this process is transparent to the user. The user simply sees the results of a query formatted by the website interface. To continue the example, let us say that the user who made a stock pick the previous day, returns to the website the next day. The user browses to the page where the stock pick was made. Here, the user sees an updated score reflecting the previous day's stock performance. This is a result of the automatic daily information processing the database does to update the score and the result of a query to display the updated information to the user. In this example, the user's score provides feedback about the user's stock picking abilities. This exemplifies how the database transparently aides the user's investment skill development.

II Project Overview

The end deliverable of the project is a fully functional online operational base for the WPI investment club by the end of April 2008. The operational base consists of a functional website frontend to facilitate user interaction and a relational database to manage data storage and processing. The project focuses on three goals: (1) creating the online operational base, (2) developing a possible solution to investor information overload in the context of the online operational base, and (3) creating the structure of the WPI investment club to facilitate student involvement.

- Build online operational base for WPI investment club
 - Research existing web-enabled databases that are used to facilitate social interaction in a financial context.
 - Study and choose technologies best suited for the development of the online operational base.
 - Determine requirements of web-enabled database.
 - Create scoring algorithm to provide users with investing performance feedback.
 - Design and develop web-enabled database and frontend website.
 - Perform testing to ensure online operational base functions as specified.
- Develop possible solution to reduce investor information overload.
 - Research information overload from an investor's point of view.
 - Examine information management in the context of information overload.
 - Study existing technologies used to combat information overload.
 - Propose a method to create a new product that combats investor information overload by applying existing technologies in new ways.
 - Propose information overload related ideas to be studied by future groups.
- Create WPI investment club structure
 - Research existing university investment clubs.
 - Research existing online investment research firms.
 - Develop investment club officer structure, club events, and club goals.
 - Develop sample investment analysis literature to be later used as a model.
 - Recruit interested students to drive club leadership.

- Hold on-campus information session to promote club awareness.

II.1 Investment Club Online Operational Base

Building an online operational base for the WPI investment club represents one of the main goals of this project. The web-enabled database and website serve as the online operational base for the investment club because it provides a way to manage users, manage content, and to provide feedback to users. The investment club operational base is a significant database development project that involves several steps.

II.1.1 Research

Before any development work can occur, research into existing web-enabled databases with a financial application and existing development technologies must be completed. Finding an existing web-enabled database that facilitates social interaction in a financial context provides a model for development. The model website is one that brings users together to form a community environment where users can share their opinions about the stock market and then be scored on their financial performance. The model website is one that enables users to improve their investing knowledge through constant performance feedback. The online operational base will mimic many of the features of the model website, but will be adapted to fit the needs of the WPI investment club.

In addition to finding a model for development, existing technologies must be researched to find the technologies most applicable to the development effort. A database technology that is web-enabled and that can handle the storage, retrieval, and update of data must be found. The ideal database technology is open-source, meaning that it is free to use, and is able to interface or interact with existing web-programming languages to develop the website. The database selection is an important component of the development effort because once implemented, it is difficult and costly to change the database management system.

The second technology research component is to find a web programming language suitable for interaction with the database technology that is able to present information to the user on the website. The web programming language must act as an intermediary between the database and the user, facilitating information exchange. Like the ideal database technology, the ideal web programming language is one that is open source so that costs are avoided. Also similar to the chosen database technology is that once a web programming language is chosen, it becomes extremely difficult to change it once the development process begins.

The final development technology is actually a framework, rather than a tangible product. It is necessary to model website design around a framework that views user participation and interaction as the main purpose of the website. Such a framework is flexible and dynamic so that it can meet the needs of the users. The ideal framework will encourage users to act as co-developers in contributing website content to drive social interaction. The ideal framework pulls together the chosen web-enabled database and web programming language to create a true online community.

II.1.2 Requirements

Once the technologies to be used have been determined, the requirements for the database must be developed. The requirements are similar to the blueprints of a home; they are the instructions that drive database development. The requirements are written from an end user

perspective to capture business rules and requirements. The requirements are later translated into a technical language when the database schema or database structure is created.

For this project, requirements are gathered from several sources. The model website that demonstrates functionality that the WPI investment club seeks to capture will be a source of requirements. By analyzing features in the ideal website, functional requirements can be generated. A second source for requirements comes from brainstorming sessions that help develop new functions that should be reflected in the investment club online operational base. A third source for requirements is to study existing university investment clubs to see which processes utilize the power of the Web, and which processes do not utilize the Web. For example, if a university investment club fails to store member information online, one database requirement can be to store member information in the form of a member profile.

II.1.2 Development

After the project requirements are formally established, development begins. Development entails creating the database schema, loading sample data into the database, and developing the frontend website. Figure 3 shows the iterative development process that will be applied.

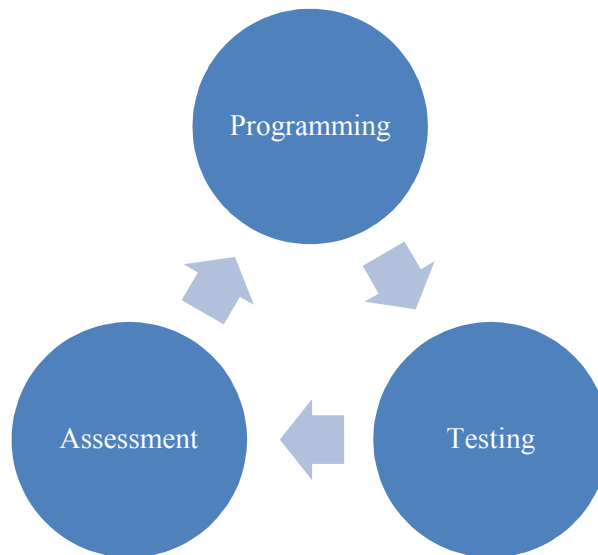


Figure 3 - Development Process

This is a large scale development project and in order to be successful, there must be a framework or approach to the development work. In this project, the process will be to code or to program a small segment of code, test the code for quality and completeness, and evaluate the success of that block of code. This iterative process ensures that each time a new functionality is added to the system, it is tested and it is ensured that it works properly. Using a preventative approach minimizes the risk that late in the project, an extreme malfunction will be discovered.

In addition to constant testing, development work will be carried out in a segmented process. Development work will be completed in a modular fashion. For example, users may have certain functions that do not involve stock interaction, such as user profiles and user blogs. These features are independent of user opinions about stocks, which require work to develop stock functionality. Thus, all user functionality not involving stocks would be programmed first. Next, stock functionality not involving users would be programmed, and last, stock functionality

that incorporates the users would be programmed. This logical approach helps to segment tasks into smaller sections that allow development to finish sooner.

II.1.3 Testing

The final step in the creation of the online operational base is to perform additional testing. Once the entire database and website have been completed, testing can take place on a broader scale. Rather than testing specific functions, testing is now applied to the entire system. For example, testing can include studying performance of various functions when multiple test users are introduced to the system. By performing additional testing, the risk that the system will fail once it goes live is minimized.

II.2 Information Overload

II.2.1 Purpose

Information overload is a concept that is prevalent in many industries. The aim of the research done in this project is to define information overload and to understand how information overload affects the individual investor. The investment club's online operational base strives to facilitate social interaction and secondarily, it also aims to manage information. The management of information can be seen as an attempt to reduce information overload. By studying information overload from the context of the individual investor, it is possible to better understand how too much information affects investing decisions and how technology can be used to reduce this malicious effect.

II.2.2 Research Approach

The concept of information overload will be researched through academic journals and reputable technology news sources. The academic journals will provide insight into information overload theory and also present formal studies conducted on information overload. Technology news sources will provide practical examples of how technology has been applied to reduce information overload in a broad number of industries. By approaching to research this issue from two different perspectives, it is hoped that it is possible to innovate a solution to information overload.

II.2.2 Goal

The goal of information overload research is to be able to propose a method to combat information overload for individual investors by applying existing technologies in a new way. By understanding the theory gathered from academic journals and the technical understanding from technology sources, the chance that a solution can be devised is maximized. Once the notion is synthesized and documented, it can be the start of a future project. The ideal solution will incorporate ideas and findings from academic journals and will employ existing technologies in a way that can be interfaced with the online operational base. The integration of this information overload reducing system into the online operational base will increase the value of the online operational base because it is better able to help users make investment decisions.

II.3 WPI Investment Club

II.3.1 Research

To create an investment club on-campus, it is necessary to research existing organizations to understand strengths and weaknesses in current models of operation. This assessment enables the WPI investment club to reflect existing strengths and to improve upon existing weaknesses. By identifying and improving upon existing weaknesses, the WPI investment club can differentiate itself from existing organizations.

Research will consist of studying existing university investment clubs and online investment research firms. Similar to the website and database development, it is necessary to find a model for development for the investment club structure. To do this, existing university investment clubs will be analyzed. The analysis will focus on how well these organizations utilize the Internet to create an online operational base to assist club functions as well as the type and the wealth of information provided to club members online. The goal of the assessment is to identify the strengths of existing organizations that must be reflected in the structure of the WPI investment club and to identify the weaknesses of existing organizations that must be improved upon in the WPI investment club.

The study of online investment research firms is secondary to the research of existing university investment clubs. The emphasis of this research is to better understand how a typical online investment research firm produces investment research. It is important for the WPI investment club to understand how investment research is produced because one of the goals of the investment club is to become a producer of investment research material as a way to display the application of its club members' financial knowledge.

II.3.2 Goals

There are several goals to be accomplished during this project relative to investment club development. The first goal is to act upon the research completed to create the structure of the investment club. The structure includes:

- Definition of club leadership
- Definition of club operations
- Examples of club activities

Once the structure of the organization is developed, it is necessary to attract other interested students to help lead the organization. Other students will be sought after through personal connections and they will be evaluated on their investment knowledge, their desire to learn more about investing, and their commitment level to club leadership. After finding club leadership, the next goal is to promote the organization on-campus to develop a member base. Promotion of the organization will be accomplished by holding an information session to explain to potential members the goals of the club and how they will be accomplished.

By the completion of this project, the investment club will have the structure, leadership, activities, and member base in place to begin club operations in A-term 2008. The investment club will use the database developed during this project to drive operations management and to better help club members improve their investing skills.

III Literature Review

III.1 Technology

This project makes use of several technologies and concepts to create the WPI investment club website. Below are descriptions of the technologies and concepts applied in this project to help the reader understand the significance of each technology and concept.

III.1.1 MySQL

MySQL is the open source database management system (DBMS) used in this project to create a web-enabled database. MySQL is based upon the relational database model, which stores data in two-dimensional tables called relations and that allows users to interact with the database using high-level queries. Queries in the relational model are expressed in a high-level language called SQL (Structured Query Language) (Ullman & Widom, 2008, p. 3). For additional relational database resources, please reference *A First Course in Database Systems* by Jeffrey Ullman and Jennifer Widom.

MySQL is one example of a database system that implements the relational model. MySQL is open source, meaning it is freely available. The first public release of MySQL came in early 1998 and subsequent releases have been made to improve availability of features (MySQL AB, 2008). MySQL is an excellent choice for a DBMS because it has been deployed globally and it has been deployed in many high volume websites, such as Wikipedia and Facebook. Additionally, MySQL is the recipient of many awards, including, “Best Open Source Software: Database” in 2007 from InfoWorld and “Developer.com Product of the Year: Best DBMS or Related Technology of the Year” in 2004 (MySQL AB, 2007). The popularity of MySQL is also visible through its market share. MySQL has gained 25% market share in overall database usage by developers in the last two years and a 2004 SD Times (Software Development Times) reader’s poll found MySQL to be the third most deployed database, behind only SQL Server and Oracle (MySQL AB).

III.1.2 PHP

PHP represents the recursive acronym, PHP Hypertext Processor, which is an HTML-embedded scripting language. HTML stands for HyperText Markup Language, which is the markup language most often used to write basic websites. PHP works in conjunction with HTML markup to allow web developers to write “dynamically generated pages quickly” (The PHP Group, 2007). Similar to MySQL, PHP is open source and was first released in 1995 and has since experienced explosive growth. As of April 2007, PHP was running on over 20 million servers worldwide (The PHP Group, 2007). PHP, like MySQL, is also run on the popular Web 2.0 websites, Wikipedia and Facebook.

PHP represents a good choice of programming language to interact with the MySQL database for several reasons. First, PHP is open source, which means there are no licensing fees. Second, PHP remains a popular and current technology and is readily used to develop Web 2.0 websites. Last, PHP easily integrates and works with MySQL, which ensures that development will proceed smoothly.

III.1.3 Web 2.0

The use of Web 2.0 principles has been mentioned in the Project Motivation section. To better understand how the investment club website will be designed, it is necessary to understand the underlying concepts behind Web 2.0 and how they will be applied throughout the design of the website. Web 2.0 is a technical terminology that represents a conceptual framework for how to approach website design. Web2.0 websites focus on building a community through user involvement, which generates a network effect. A network effect occurs when increased usage of a service results in greater utility. For example, the more people that use Napster or any file sharing program, the more useful it becomes to other users.

Web 2.0 websites have the following characteristics: (1) provide a scalable service, (2) trust users as co-developers, and (3) harness collective intelligence, (O'Reilly, 2005). Web 2.0 websites, such as Facebook, the social networking website, heavily rely on the network effect because as more users join and contribute to the website, the website becomes more useful to other users. In this sense, the service is scalable. By treating the users as co-developers and using everyone's ideas to help develop content on the website, the website will be driven by users, not developers. With users driving content generation, user interaction and participation is encouraged.

The WPI investment club website will seek to emphasize Web 2.0 website design principles. By leveraging Web 2.0 design principles, the club website can become an active resource for club members. The investment club website will become an active resource by enabling club members to perform many actions, including rating stocks as a buy or sell, commenting on stocks, and keeping a personal investing blog. Utilizing Web 2.0 design principles will allow the WPI investment club to stand apart from other university investment clubs who do not embrace their users as active contributors.

II.2 Social and Investing Issues

Technology alone cannot drive the success of this project. The use of the technology must have an application that will promote social interaction and learning among individuals. The issues discussed below provide a context for how to apply technology to this project and the discussion also investigates investing related issues and their implications for this project.

III.2.1 Information Overload

Information overload is a phenomenon with far reaching implications, especially for investors. Decision makers are typically tasked with making decisions based upon information cues. Initially, additional information cues enhance the ability of the decision maker. However, people have a limited ability to process information and once the information processing limit has been reached, additional information degrades the ability of a decision maker. Thus, there is an inverse U relationship between information load and information processing (Hwang & Lin, 1998, pp. 213-8). Figure 4 depicts this relationship.

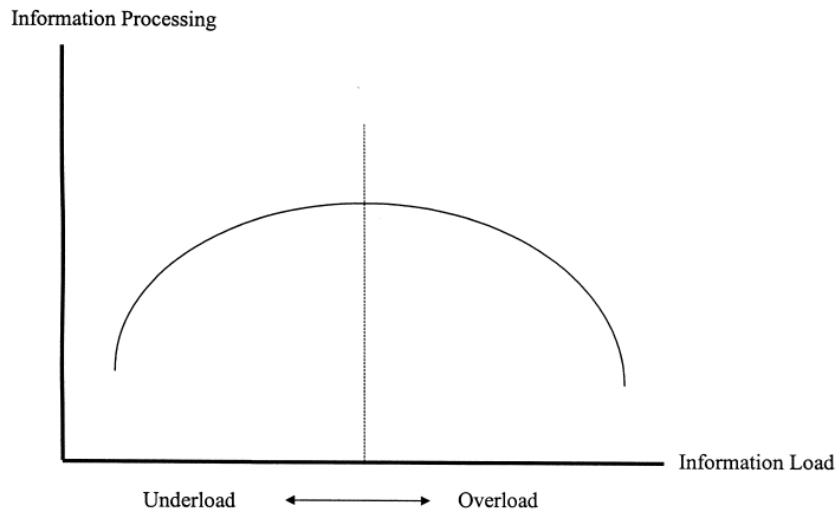


Figure 4 - Information Processing vs. Information Load

The concept of information overload has existed for some time. For example, in 1984, information overload was being studied in the context of consumers. Malhotra believes that consumers can become overloaded when given too much information in too short of a time span. She offers the following example, “this [information overload] could occur when a motivated consumer who is reading the newspaper and watching TV is confronted with a commercial packed with information relevant to an impending decision” (Malhotra, 1984). The same problem is easily translated to the investing paradigm. If a motivated investor were studying a stock and then multiple buy and sell signals appeared in the form of investment research reports, blogs, and TV commentary, the investor could easily become overwhelmed by the available information.

The growth of the Internet has sparked a growth in available financial information that can easily create information overload. This explosion in available information should increase market efficiency, as defined by the efficient market hypothesis (EMH). EMH argues that stocks are traded at a market value equal to that stock’s intrinsic value and although inefficiencies may exist, they are relatively uncommon. EMH is driven by the profit motive of investors, that is, investors seek to profit from the stock market and will become knowledgeable about a particular firm to ensure success. Investors apply their knowledge by buying and selling stock, which indicates investor sentiment. As more individuals gather and analyze this information, incorrectly priced stocks become fewer and fewer (Ross, Westerfield, & Jordan, 2006, pp. 385-7).

Thus, an increase of available information makes the stock market more transparent, meaning that fewer stocks should be incorrectly priced. However, the individual investor may suffer as a result of increased information availability because the individual investor may not have sufficient capabilities to process all of the available information, which leads to impaired decision making. Individual investors are subject to information asymmetry. Information asymmetry is a term from information economics that describes any situation where one party knows more about a particular situation than another party. Environments in which asymmetric

information occurs are readily available. The most common example is the market for lemons. The market for lemons is the used car market, which is subject to asymmetric information because the buyer does not know if a particular car is a bad car, a “lemon”, or if the car works (Varian, 2003, pp. 668-9). The stock market, like the used car market, can have “lemons” as well. For example, a person with insider information about poor company news can sell off the stock to a buyer who is unaware of the forthcoming bad news.

The definition of asymmetric information can be subdivided into two different categories: intentional and unintentional asymmetric information. To return to the market for lemons used car market example, an example of intentional asymmetric information is a car dealer who knowingly sells a “lemon”, a car which will perform poorly, or not at all, without informing the buyer of the defects. Intentional asymmetric information occurs when the party that has one-way access to particular information exploits the uninformed party through their advantage. Unintentional asymmetric information occurs when the car dealer has actually informed potential buyers about the defects through intermediaries, such as flyers and posters. However, because buyers are overloaded by other existing information from other flyers, posters, and various car dealership advertisements, they make the purchase without realizing the existence of this information. In this scenario both parties have access to particular information, but their consumption and reaction rates vary by ability to process information and incentive to respond to information. Fundamentally, this is an example of information overload.

A relevant application of asymmetric information is signaling. Signaling is the idea that one person can reveal private information to an uninformed person. A common example of signaling is a college degree. A college degree signals to employers that the graduate has many capabilities (Mankiw, 2007, pp. 487-8). In the same way, signaling applies to the stock market. For example, if one purchases a stock, this signals that one is optimistic about the future for this stock and if one sells a stock, this signals that one is pessimistic about the future for this stock.

The goal for investors is to decipher signals in the stock market and to deal with information overload. Failure to understand and to interpret the available information can lead to poor decision making. Professors Julie Agnew and Lisa Szykman at The College of William and Mary performed a study to examine if information overload explains why defined contribution plan participants tend to select the default offering, rather than selecting a plan of their choice and if information display can impact information overload. The study separated individuals into two groups, high knowledge and low knowledge as determined by a financial literacy test. The results of the study corroborate the notion that investors become overloaded when presented with a multitude of options. Low knowledge participants reported being overloaded regardless of the number of choices, which is an indication that financial education needs improvement. High knowledge participants reported increasing information overload as the number of choices increased, which supports the notion that individuals are overloaded when presented with too much information. A striking figure is that low knowledge participants were more than four times as likely to select the default allocation as high knowledge participants.

The findings of the study regarding information display show that how the information is display only impacts high knowledge individuals. When asset allocations were presented in a condensed table form, high knowledge individuals reported increased confidence in their decision making and did not suffer from information overload. When asset allocations were presented in booklet form that required participants to look at multiple pages to make a decision,

information overload increased. However, low knowledge participants actually reported less information overload when information was displayed in a booklet instead of a table. These results support the notion that summarized information can help combat information overload only if the decision makers can properly interpret the information. If the decision makers are not knowledgeable, information overload will happen regardless of the countermeasures provided and instead education should be emphasized (Agnew & Szykman, 2005, p. 13).

Like the participants in the Agnew and Szykman study, if individual investors are overloaded with information they will be more likely to choose an overly conservative investment that wastes potential gains or worse, the individual investor will choose an investment that is too risky that results in a loss of capital. To effectively combat information overload, the approach to information management must be changed. Wang, Lee, Pipino, and Strong advocate information must be managed as a product for information consumers (individuals that use the information), rather than a by-product of the systems that produce the information. This approach is framed through four guiding principles.

1. Understand the information needs of the information consumers.
2. Manage information as a product of a well-defined production process.
3. Manage information as a product with a life cycle.
4. Develop governance structures to manage information manufacturing processes and resulting information products.

Understanding the information needs of information consumers (investors) is the most important principle to take away from this paradigm. There are four categories of information quality that address the needs of information consumers.

1. Intrinsic information quality focuses on the quality of the information itself.
2. Contextual information quality considers quality in the context of the user and the task at hand.
3. Representational information quality captures the quality of the information representation.
4. Accessibility information quality emphasizes the role of systems for obtaining and manipulating information (Wang, Lee, Pipino, & Strong, 1998).

Intrinsically, the information must be believable and free-of-error. Error free data builds trust in information consumers that the data are true and can be used in decision making. For investors, this means the sources of information must be believable. Less formal sources, such as blogs and online forums must be filtered to ensure high information quality. Contextual information quality refers to how timely and value-added is information presented to information consumers. Investors require real time data and information to make decisions because that is the pace at which the market moves. To improve contextual information quality, investors must seek sources of automated information, that is, information that is automatically presented to users when updated. Representational information quality refers to the ease of understanding the information collected. Data visualization is one way to approach representational information quality. This issue was also explored in the asset allocation study where participants were presented information in a condensed and summarized format and in a sprawling format. Representational information quality is one area that steps can be explored to counter information overload. Last, accessibility information quality refers to how easy it is to

manipulate information. With respect to investors, information accessibility means that investors should have an easy to use, visual interface to interact with the information presented to them.

Understanding that information must be treated as a product does not directly explain how to combat information overload. However, it does set the right frame of mind that can be used to understand information overload solutions. The next step is to explore ideas for how to reduce information overload in the context of information as a product.

The medical industry also suffers from information overload and the challenge is to organize the information in a way that is easily searchable. John Halamka is the Chief Information Officer (CIO) at Beth Israel Deaconess Medical Center where he oversees the medical libraries. He explains that he has been in the process of replacing his library of books with digital media. Halamka treats information as the product by replacing the libraries with “information commons” and renaming librarians to “information specialists”. Halamka’s efforts increase the value-added or the contextual information quality. For example, Halamka describes the efforts of his information specialists to turn data, in this case, web-enabled Harvard faculty presentations, into knowledge:

“But it's not enough to text-index these materials, because search engines don't match concepts. Our information specialists apply metadata tags using the National Library of Medicine's Medical Subject Heading concept hierarchy. That way, a search for "brain" will bring up a presentation about neurons, even if the word *brain* doesn't appear in the text.” (Halamka, 2008)

Halamka has successfully adapted the mindset to manage information as a product and the result will be to reduce information overload. Halamka makes this point, “I’m optimistic that in 2008, I’ll receive more wisdom and not just more data” (Halamka, 2008). The goal of reorganizing his approach to information management was to improve its contextual information quality, which will ultimately help reduce information overload. Halamka’s approach is to create metadata, or data about data. Metadata helps describe existing data (Boll, Klas, & Sheth, 1998, p. 2). A tagging system is powerful and can potentially help investors reduce information overload.

Tagging is a new approach to metadata creation. One method of presenting tags to users is a tag cloud. A tag cloud is a visualization of word frequency using different font colors, sizes, and boldness to depict which words appear most frequently (Halvey & Keane, 2007). Figure 3 represents a tag cloud created by scanning part of this paper into the tag cloud creator found at TagCrowd, <http://tagcrowd.com/>. Note that words are organized alphabetically and a smaller and lighter font represents a word used less frequently, while a darker colored and larger font represents a word used more frequently. By quickly glancing at the tag cloud it is clear that “information” is the most used word in the underlying document, which again, happens to be this paper. By tagging investment information with descriptive phrases, investors can more quickly discern if a particular piece of information is worth researching further.



Figure 5 - Tag Cloud Example

Another way to innovate information management is to consider RSS (Really Simple Syndication). RSS is an XML-based format for content distribution. Users install an RSS reader that reads an RSS feed. The RSS feed is a source of information and the RSS reader automatically updates content for the user when the RSS feed is updated (The New York Times > RSS, 2008). RSS provides individuals with a way to receive targeted information automatically. Employees at the Union Bank of California NA suffer from information overload because of a steady stream of e-mails, voicemails, and intranet postings. The information overload caused employees to fall behind in learning about the bank's latest offers, which translated into fewer options offered to customers. To combat information overload, the bank is creating targeted RSS feeds so that works receive fewer messages, but the messages that are received are more relevant (Perez Carlos, 2007). The implementation of an RSS knowledge system has improved the contextual information quality because employees now have information that is more relevant, which in turn, is value-added to bank customers who now have more service options.

RSS feeds can be applied to investing by helping investors automatically received the latest financial news. The decision makers, investors, can specify what information is to be delivered, which helps investors filter out useless information, or noise. Figure 4 displays an example RSS news feed from the New York Times World Business section. For each article the title is presented as a link to the full version of the article and a summary of the article is presented along with the date of publication. The RSS reader is the web browser, Mozilla Firefox, which is capable of reading and parsing an RSS feed. Users can subscribe, that is, receive updates from the feed by clicking the "Subscribe Now" button.

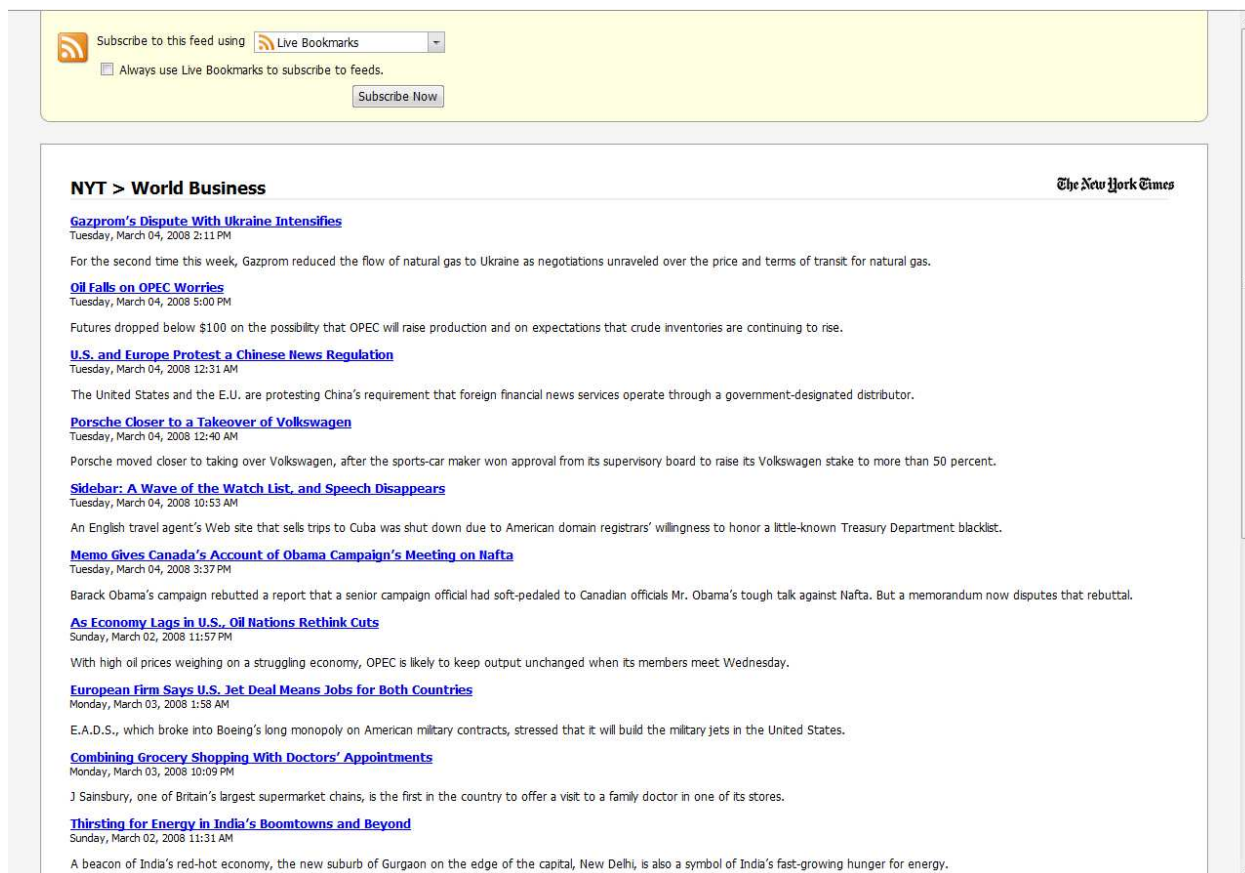


Figure 6 - RSS Feed Example

Combining the benefits of a tagging system with automated information delivery from an RSS feed may lead to the optimal way to combat investor information overload. My proposal to reduce investor overload is to create a tag-based rating system for financial information. The system would consist of a custom built RSS news reader, a database to warehouse information, and access to financial news via RSS feed. The system would work in the following way:

1. The RSS news reader would obtain the latest financial news updates from an RSS feed. Yahoo! Finance currently provides free RSS feeds for industries and individual firms. The RSS news reader would store information about the article, like title and content, in a database, so it can be accessed at a later date.
2. The RSS news reader would display financial news articles to database users. Users would read the article and look for key phrases that indicate the sentiment of the article. Phrases like, “better than expected” typically indicate positive news for a firm. Phrases involving “litigation” typically indicate negative news for a firm. For each article, the user can submit to the database new tags, or one to three word phrases, that indicate article sentiment.
3. For each new article that is stored into the database by the RSS news reader, it is scanned by the system for user-submitted tags that indicate article sentiment. Based upon the number of positive and negative tags contained in an article, an overall sentiment rating can be given to the article. Additionally, users can submit more tags should they come across a previously undocumented phrase.

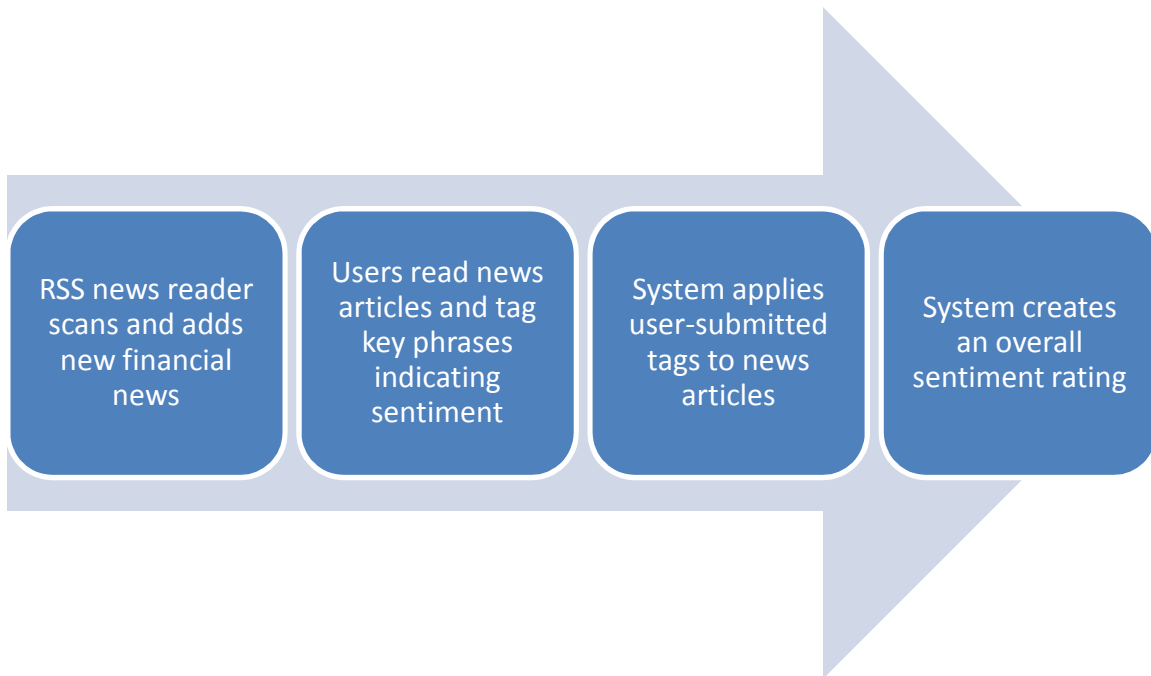


Figure 7 - Tag-based Rating System Process Flow

This system can be implemented in the context of the WPI investment club. The WPI investment club already has the necessary infrastructure, namely a database that contains user accounts. The challenge is to create the RSS news reader and to modify the database to handle news articles and user-submitted tags. The reason this system will work is because user-submitted tags are generic in the sense that the phrase “better than expected” reflects good news for any firm, regardless of industry. By relying on collective intelligence, that is the wisdom of the crowd, the system becomes more intelligent as users submit more tags that help to refine the system. The overall sentiment rating quantifies the information contained in the news article and quickly helps the user decide if the information contained in the news article will either positively or negatively affect an investment decision.

The system has high contextual information quality because the news articles will automatically be added by the RSS news reader. The user does not waste time scanning the Internet for new developments because they are delivered directly to the user. This is a value-added process because time saved from searching for a news article can be spent conducting investment research. The system also has high intrinsic information quality because the information will be delivered from Yahoo! Finance, which aggregates its news from reputable sources, such as the Associated Press. Thus, users can trust that information is free from error and is believable. Building trust between the system and the user helps ensure that users will embrace the system. The system also has high representational information quality because the end result is a numerical quantity that summarizes the entire content of the news article. Theoretically, users will seldom have to read the entire article because the overall sentiment rating should reflect the contents of the article. Lastly, the system has high accessibility information quality because if users find undocumented phrases, they can submit them to the database. In this case the high accessibility information quality helps to make the system more intelligent because as users submit more tags the system learns how to more accurately rate financial information.

The system will create a tag cloud when users actually read through an article. This provides a supplement to the sentiment rating that allows users to easily interpret the article. The tag cloud would display the frequency at which tagged phrases appear in the article. This is similar to the tag cloud example shown earlier, except that in this case the system would use the user-submitted tags that appear in a particular article to create the tag cloud.

The system can also benchmark performance in the following way. Once an article receives a sentiment rating, the stock price at that time can be stored into the database. Then, over time the price of the stock can be tracked to grade the quality of the tags. For example, if an article is suggested to contain very good news and in the following months the stock price plummets without ever increasing, then the user-submitted tags should be examined. Benchmarking will help the system's users easily determine the quality of their tags. If stock price positively correlates with the tags users have submitted, then the intrinsic information quality is high. Users will believe in the tagging system, which in-turn increases user acceptance and usage of the system.

In some situations, an article will not contain any tagged phrases, even after users have been submitting tagged phrases to the database for some time. Those articles containing no tagged phrases receive a neutral rating. It makes sense that not all articles should receive a positive or negative rating because not all news articles will move stock prices. The goal of the system is to find those extreme bits of news that will drastically move the stock price up or down. By quickly informing users of the information sentiment, users can make a more accurate investment decision while expending less time and effort in the research process. The system makes use of two concepts, RSS and tag clouds to deliver and to parse financial information automatically to investors. The investors can in turn, make an informed investment decision by quickly interpreting the quantified overall sentiment rating of a news article. The system reduces information overload by approaching the management of financial news as a product and enables investors to make informed decisions.

III.2.2 The Motley Fool CAPS

The Motley Fool CAPS is a website that acts as an online stock rating universe that also benchmarks the financial performance of its users' stock ratings. The Motley Fool CAPS serves as a model for the development of the online operational base. The Motley Fool is an investment research company that was founded by the Gardner brothers, David and Tom in 1993. By 1997, the recognizable domain name, fool.com, had been registered and content was published online. The Motley Fool provides a stock advisor service for subscribing customers and also runs a discussion board and newsletter for all users.

In October 2006, the Motley Fool launched the Motley Fool CAPS. CAPS is a new online service that utilizes Web 2.0 design principles to allow users to generate all of the content. CAPS is a stock rating universe where users login and are able to rate stocks. A user's pick is tracked against the performance of broader market indices, such as the S&P 500. Users are empowered by CAPS to predict stock movement and access a high volume of investment information. CAPS is the next step in the Motley Fool's mission to make the stock market more transparent and more fair to individual investors (The Motley Fool, 2006). Figure 8 shows a sample stock page for Alcoa, Inc. The user can quickly view community and Wall Street sentiment, as well as the top bull and bear remark. This interface also allows the user to submit his/her own opinion with the "rate this stock" feature.

Alcoa, Inc. (AA)
 CAPS Rating: ★★★★★
 A Producer of primary aluminum, fabricated aluminum, and alumina, and is active in all major aspects of the industry: technology, mining, refining, smelting, fabricating, and recycling.

\$34.68 ↓ -0.94 (-2.63%)
 3/20/2008 4:02 PM

AA SCORE LEADER
 sjsb078
 Rating: 99.31
 AA Score: 47.52

Ya gotta love a solid company with 11.27 Forward P/E, 7.38 Price/EBITDA, and a plan to purchase a total of 25% of itself.

Member Survey
 Help us improve your CAPS experience

Scottrade
 Member FINRA/SIPC
 SWITCH NOW

Most-Rated Stocks

- 1 AAPL ★★★★★
- 2 GOOG ★★★★★
- 3 MSFT ★★★★★
- 4 JNJ ★★★★★
- 5 CSCO ★★★★★
- 6 GE ★★★★★
- 7 SBUX ★★★★★
- 8 MQ ★★★★★
- 9 NFLX ★★★★★
- 10 NUAN ★★★★★

QUOTE | HISTORICAL PRICES | CHART | PROFILE/KEY STATS | EARNINGS | STATEMENTS | GROWTH RATES | RATIOS | SEC FILINGS

YOU AREN'T CURRENTLY RATING AA

Rate This Stock
[Add Stock to Watchlist](#)

ALCOA, INC. AT A GLANCE

Current Price: \$34.68
 Last Trade Time: 3/20/2008 4:02 PM
 Open: \$0.00
 Previous Close: \$35.62
 Daily Range: \$33.80 - \$35.62
 52-Week Range: \$26.69 - \$48.77
 Volume: 23,078,009
 Market Cap: \$29.01B
 P/E Ratio: 11.95
[Compare Our Special Broker Offers](#)

WHAT THE COMMUNITY THINKS [SHARE THIS](#)

Total Players
 1059 Outperforms 93 Underperforms

All-Stars
 292 Outperforms 29 Underperforms

Wall Street
 6 Outperforms 1 Underperforms

Players bullish on AA are also bullish on:

- [Apple, Inc.](#) ★★★★★
- [Johnson & Johnson](#) ★★★★★
- [General Electric Company](#) ★★★★★
- [Exxon Mobil Corp](#) ★★★★★
- [Altria Group, Inc.](#) ★★★★★

Players bearish on AA are also bearish on:

- [General Motors Corp](#) ★★★★★
- [Dell, Inc.](#) ★★★★★
- [Vonage Holdings Corp.](#) ★★★★★
- [Ford Motor Company](#) ★★★★★
- [CitiGroup, Inc.](#) ★★★★★

Ticker Tags
[Large Cap \(487\)](#), [Pittsburgh \(6\)](#), [S&P 500 \(485\)](#), [Pennsylvania \(16\)](#), [Aluminum \(15\)](#), [New York \(30\)](#), [Dow \(30\)](#), [Dividends \(160\)](#)
[Suggest a tag](#)

STOCK TRENDS

STOCK PRICE | CAPS RATING

AA VS S&P 500 (SPY)

Apr Jul Oct Jan

NEWS & DISCUSSION BOARDS

NEWS | FOOL ARTICLES | FOOL BOARDS

Other News Headlines for AA

- [U.S. Justice Department launches probe of Alcoa](#)
 3/21/2008 7:49:51 PM - Reuters
- [Feds Open Alcoa Bribery Probe](#)
 3/21/2008 6:48:39 PM - AP
- [Business Highlights](#)
 3/21/2008 5:54:11 PM - AP
- [More Headlines...](#)

TOP BULL PITCH

Recs: 1
 TokReason (95.61)
 Submitted: 1/21/08 4:58 PM

We're more comfortable in that kind of business. It means we miss a lot of very big winners. But we wouldn't know how to pick them out anyway. It also means we have very few big losers - and that's quite helpful over time. We're perfectly willing to trade away a big payoff for a certain payoff." - 1...[More](#)

TOP BEAR PITCH

Recs: 2
 ganogordon (< 20)
 Submitted: 10/26/07 11:29 PM

housing slumpo make aluminum go glumpo
 Replies: 0 [Reply](#) [Permalink](#)

QUOTE FROM Interactive Data

Figure 8 - Motley Fool CAPS Sample Stock Page

The Motley Fool CAPS leverages collective intelligence to drive better investment decision making. CAPS is exactly the type of technology application that this project seeks to achieve. CAPS serves as inspiration for the design of the WPI investment club website. Like, CAPS, the WPI investment club seeks to leverage the knowledge of its members to develop better investment decision making. The WPI investment club will employ a similar interface design that allows users to generate content and to provide feedback to each other.

III.2.3 Existing University Investment Clubs

Although an investment club is new to WPI, there are numerous other university investment clubs that can be studied as investment club models. Studying existing investment clubs provides ideas for how to develop the WPI investment club. The investment clubs at

Boston College, Dartmouth, University of Florida, and Stanford University have been selected as models to study

Boston College

The Boston College investment club (BCIC) is notable for receiving attention from TheStreet.com, a financial information website. TheStreet.com wrote an article about the 25-year long history of the BCIC in November 2007. The club benefits from a long history and is currently managing a portfolio worth approximately \$360,000 (Krakow, 2007). The BCIC currently holds over 35 stocks in a broad set of sectors that includes basic materials, financials, healthcare, services, technology, industrial, and consumer goods. New stocks are researched by club members and then presented to the entire club. The decision to buy or sell the stock is done by polling club members, which allows the entire club to be involved in the stock selection process. The BCIC is divided into teams of analysts that cover specific sectors that systematically review the portfolio. This approach to portfolio management helps create individuals with domain expertise (Boston College Investment Club).

The BCIC benefits from having a large amount of available capital, which allows the club to hold a large number of positions. Because the BCIC has a long history, the club is well-developed with analyst teams covering a variety of sectors. This directed research effort helps the BCIC maintain positions in favorable stocks, while selling positions in stocks that are no longer expecting price increases. While the BCIC has a solid routine for stock research and coverage, the BCIC website lacks interactive features. The club's website only provides users with information, and does not allow users to contribute information. In this respect, the BCIC is not taking full advantage of the wealth of knowledge possessed by its members. In conclusion, the BCIC presents a solid model from which the WPI investment club should draw from for stock research and coverage. However, it must be stressed that the WPI investment club must strive to include interactive features in the club website to leverage the knowledge of club members.

Dartmouth

The Dartmouth investment club (DIC) acquired their portfolio endowment by a donation from a 1968 alumnus in 1996. Similar to the BCIC, the DIC has regular meetings to hear stock pitches to develop new investment ideas. The DIC expands upon their activities list by also having bi-weekly meetings to discuss macroeconomic trends and to review the club portfolio. The DIC offers mock interviews to club members, which truly fulfills the DIC's goal to prepare club members for careers in the financial services industry. The DIC also provides a fundamental research kit to accelerate learning among club members. Additionally, the club is active in its search to find external events and speakers. Notably, the DIC sponsored a trip to visit Warren Buffet and has sponsored on-campus visits from industry leaders, such as Bill Miller, the Chief Investment Officer of Legg Mason Capital Management, and Jack Byrne, former Chairman of GEICO (Tuck Investment Club, 2006).

The strength of the DIC is the club's ability to provide a wide variety of useful services to club members. The inclusion of mock interviews is an excellent way to prepare interested club members for a career in financial services and demonstrates to employers that DIC members are dedicated to investing. The WPI investment club must also strive to provide similar resources. In particular, preparing a research kit will largely help accomplish the personal motivation of educating club members. Like the BCIC, the DIC lacks a website that is useful to club members

and outsiders. The DIC does not list current holdings or past transactions. Again, the WPI investment club must strive to have a website that includes the users in the development of the website.

University of Florida

The University of Florida investment club (UFIC) offers a vast number of resources for the benefit of club members. Included in the resources are books, websites, brokers, as well as all past presentations. The vast number of available resources ensures that club members are educated. The main activity of the UFIC beyond stock pitches appears to be an externally run stock picking competition. Run through Investopedia, the stock picking competition allows club members to apply investing strategies in a carefree environment. Similar to the BCIC, the UFIC has club members that serve as analysts for a particular sector. This specialization ensures that the UFIC makes informed investment decisions and does not overlook any investment opportunities in any sector (Ratner, 2007).

The UFIC has the strongest set of educational resources available among the investment clubs investigated. However, the UFIC fails to include a transaction list of stock purchases and sales, which hampers the effectiveness of the website. The WPI investment club should look to capitalize on the sector delineated analyst leadership style because it is an effective way to split up the massive number of available stocks. Additionally, the WPI investment club should create a comparable set of resources to best prepare club members for investment management.

Stanford University

The Stanford University investment club (SUIC) is known as the Blyth Fund on-campus and has been active since 1976. The SUIC stands out from other investment clubs because of their strong online presentation of stock transactions. The SUIC includes a list of buys and sells since 2002, and for each decision a downloadable PDF is available that contains a complete stock pitch. The SUIC also includes within its resources section, a series of investing topics for students. The notion behind this series is good, but the SUIC only covers several fundamental concepts without much detail (Najda).

The WPI investment club should approach stock transactions with a level of detail at least as fine as that of the SUIC. In addition to including a fundamental research kit, the WPI investment club should also provide club members with online tutorials similar to that found on the website of the SUIC, but with greater depth and coverage.

Summary of School Investment Clubs

The existing four school investment clubs are a small, but representative sample of existing university investment clubs. The existing investment clubs exhibit strength in their operations. The clubs have consistent member bases that participate in a steady stream of activities, ranging from club meetings and trips to investing simulations. As mentioned, the WPI investment club should include successful ideas, like club trips and stock market simulations, into the operations strategy. Although other investment clubs are well established, there remains room to improve. None of the investment clubs effectively integrate their website into their operational strategy.

The WPI investment club must look to use the online database created for this project as a way to differentiate from other investment clubs. The ability to integrate an online database into the club's operational strategy is significant. The WPI investment club will be the first

investment club to leverage the power of the Internet as a feedback loop to benefit club members. Club members will be able to hone their skills using a website that is administered by club members and can be tweaked to meet the specifications of the club. This tool will help the WPI investment club stand out from the crowd of other investment clubs.

III.2.4 Online Investment Research Firms

In addition to understanding how school investment clubs operate, it is important to understand how investment research firms operate because one of the functions of the WPI investment club is to present investment research. The most easily accessible investment research firm is one that operates online. To better understand how a typical investment research firm functions, Ryan Freund, founder of Freund Investing (<http://freundinvesting.com/>), was interviewed.

Freund is a 2006 Management Information Systems graduate of WPI that created his investment research firm in August 2007. The barrier to entry in the online investment research industry was low for Freund because he possessed the necessary investing knowledge and had website design experience. The low barrier to entry has allowed Freund to turn a hobby into a business. For the WPI investment club, the barrier to entry into investment research is also low because of the substantial amount of financial literature available for free over the Internet.

Similar to other investment research firms, Freund Investing generates its revenue from two sources: (1) advertisements and (2) stock investment newsletter subscriptions. Freund writes a monthly stock investment newsletter called the “Investment Advisor” for a yearly fee of \$149, which at the current time generates more income than advertisements. The Motley Fool, another prominent online investment research firm, also uses the same mixture of revenue sources.

The difficulty resulting from a low barrier to entry is that competition is strong and it is difficult to differentiate from the competition. Freund looks at the intrinsic values of his firm to drive differentiation. Freund founded Freund Investments on the principles of honesty, integrity, and objectivity, and he comments that often, unseen incentives cause other investment research firms to produce biased reports. By remaining objective and honest in his analyses, Freund gains the trust of readers, which helps to differentiate Freund Investing from the competition. Freund’s insights are useful for the investment club. The investment club must strive for unbiased and objective research as a standard to ensure that investment club research reports are well regarded by any external parties that read the reports.

Freund also spoke about the need for individual investors to take more responsibility for their own financial future. As Freund points out, the creation of the WPI investment club comes at an opportune moment.

“I do think that investors are getting sick of the double-speak and the increase in small investment research firms is a testament to the popularity of such firms...The move towards relying more on blogs of individuals than on big investment firms and the media is accelerating and will continue to do so over the foreseeable future” (Freund, 2008).

The WPI investment club serves to empower individual investors, rather than relying on traditional financial institutions to take care of financial planning. Members of the club will be well-positioned to take full advantage of the power an individual investor now wields.

Freund applies a strictly fundamental strategy for stock picking. His strategy is revolves around financial ratios, such as the P/E ratio, but he does not use projected or forecasted ratios and he does not use financial models, such as the discounted cash flow (DCF) model. Freund

only invests in industries that he understands. For example, he does not invest in biotechnology because he does not understand the science behind the products, and he avoids investing in banks because the derivatives market is too opaque. Again, Freund's thoughts should be reflected in the approach of the WPI investment club. The WPI investment club should rely on fundamental analysis to drive investment decision making and should only operate in industries understood by club members. Here, the WPI investment club holds a strong advantage. WPI has an eclectic group of students with many different majors. This helps the investment cover additional industries because there is significant domain knowledge available to the club in multiple industries.

The interview with Freund Investments founder, Ryan Freund, has provided insight into how to approach and how to create investment research and how individual investors are now empowered to take control of their own financial future. The interview shows that the creation of the WPI investment club comes at a fortuitous time and that the investment club must be diligent in pursuing objective investment research as a way to stand out among other investment clubs.

III.2.5 Average Trading Fees

It is necessary to investigate average trading fees associated with trading stocks because the algorithm that determines player accuracy on the investment club's website takes into account trading costs. In reality when one makes a trade, one's trade is not successful unless there is a profit after subtracting commission costs. Although commission costs cannot be explicitly modeled under the current stock pick rating system on the investment club's website, the accuracy rating can take commission costs into account.

It can be stipulated that a stock pick is not an accurate pick unless the pick returns at least a certain positive percentage that takes into account trading fees. In this sense, the accuracy rating acts as a proxy for trading fees. To determine what percentage return to stipulate for accuracy, it is necessary to discover the industry average trading fee. Many brokerage firms offer a variable trading fee that is lowered in accordance with increased trading volume. The coverage of brokerage firms will be largely limited to discount brokerage firms. Discount brokerage firms have lower fees because they typically offer fewer services, such as not advising clients. Given that this system is aimed at college students, it is unlikely that college students would opt for a full-service brokerage firm, like Wells Fargo, when given a lower cost option. Furthermore, it is likely that discount brokerage firms will impose pricing pressure on full-service brokerages. Table 1 summarizes commission costs:

Table 1 – List of Brokers and Commission Costs

Broker Name	Trading Fee (Market Order)
E*Trade	\$12.99
OptionsXpress	\$14.95
Scottrade	\$7.00
ShareBuilder	\$9.95
TD Ameritrade	\$9.99
TradeKing	\$4.95
Zecco	\$4.50

The average trading fee from these seven brokerage firms is \$9.19 per order, which implies that the act of buying and selling stock will cost double or \$18.38. Assuming that the average trade involves \$1,000, then 2% of the trading total is \$20. This approximately matches the average commission cost found from researching discount brokerage firms. Of course, as an

individual invest more capital in one trade, then trading fees become less significant. However, since the target audience is college students, it is likely that students will have little capital to invest. \$1,000 is selected as this has been the average trade I have made in my retirement account that holds approximately \$6,000.

Stipulating that an investor must return at least 2% on his or her investment forces the investor to be more prudent in investment decisions because the investors must now also account for trading costs that would be faced in reality. The accuracy rating, thus, acts as a proxy for accounting for commission costs that helps make the investing simulation more life-like.

IV Investment Club Structure

IV.1 Introduction

The WPI investment club structure is derived from three sources: (1) the structure of existing school investment clubs, (2) the structure of online investment research firms, such as Freund Investing, and (3) the ideas that result from personal brainstorming sessions.

IV.2 Leadership

The WPI investment club requires a set of officers to lead club meetings, research, and innovation. The club will have the following officer positions to form the WPI investment club executive board:

- *President* – The president is in charge of short-term and long-term club strategy. Responsibilities include, but are not limited to setting club goals, meeting dates and reviewing, refining, and approving strategies and plans developed by other officers.
- *Vice-President of Research* – The Vice-President of Research oversees all investment research conducted by club members. Responsibilities include directing individual club member research initiatives and finding new areas of club interest for investment. Additionally, the Vice-President of Research is in charge of creating fictitious investing competitions for club members.
- *Treasurer* – The Treasurer is responsible for handling the club's budget, which will come from the WPI Student Government Association (SGA). The Treasurer is also responsible for executing market orders in the investment club's portfolio, as determined by club voting.
- *Secretary* – The Secretary is responsible for handling external inquiries about the club and for recording discussions during club meetings to create meeting minutes. The Secretary is also tasked with marketing responsibilities, such as the creation of the club newsletter.

The executive board ensures that short-term and long-term club goals are met to drive club growth and to ensure club members are benefitting from their club membership. Beyond the executive board, it would be ideal to have a second set of officers that act as sector experts. Here, the benefit of WPI students studying a broad set of disciplines is visible. For example, a biotechnology major can become the biotechnology sector expert by using domain knowledge to help translate the science into wealth. Examples of sectors that the WPI investment club can cover are technology, biotechnology, financials, emerging markets, and real estate. The Vice-President of Research can direct particular club members to grow their domain knowledge to become sector experts.

IV.2.1 Current Officers

During the course of this project, students interested in leading the development of the investment club were contacted. Officers were selected on the basis of their interest level in investment education, commitment to club leadership, and investment knowledge. These students now serve as the investment club officers and will help to organize the club during the next academic year. The officers include:

- President – Cordell Rogers
- Vice-President – Michael Diamant
- Treasurer – Veselin Iliev
- Secretary – Divya Mathew

The investment club will seek out knowledgeable club members to become sector experts and to advise the investment club in various areas of research.

IV.3 Membership

Membership is available to all students and faculty at WPI. Club members do not necessarily have to have background knowledge. Although it is preferable to find educated club members, the only requirement is that club members have an inclination to learn. Without an inclination to work and to learn new concepts, their ability to contribute to the club will be limited at best. WPI faculty members are also invited to participate in the investment club. Faculty members bring a wealth of outside domain knowledge and their different perspectives provide opportunities for the investment club to innovate in investment research.

There are currently no plans to institute membership dues. The investment club will seek SGA recognition to have an annual budget provided by SGA to providing club funding. SGA recognition enhances the investment club's image as a reputable organization and it greatly enhances the spending power of the club.

Expectations of club members will vary. Not all club members can be expected to become sector experts because not all club members have the same amount of available time and inclination to work. The driving principle of the investment club is to provide as many valuable resources to club members in hopes that club members take the appropriate initiative. Club officers will work closely with individuals that take advantage of club provided resources to become a sector expert. Other club members are expected to attend and to participate in club meetings and to take part in club sponsored activities, such as investing competitions. Participation drives the ability of the club to successfully interpret and analyze the large volume of available information.

IV.4 Meetings

Club meetings are open to all club members and take place twice a month. Public club meetings facilitate interaction among club members, develop new investment ideas, and allow club officers the opportunity to inform club members of project progress. Each meeting begins with an introduction provided by club officers that outlines changes in the club and in the stock market since the last meeting. This is a chance for club members who have not been following market trends to catch up. At some meetings, guest speakers will be invited, and they will speak following the introduction. If no speaker is present, then stock pitches will be heard. Stock pitches are expected to take up a majority of meeting time. It is an opportunity for any club

member to either go long or short on a particular stock. After the presentation, the floor is open to questions and comments regarding the pitch. After each club meeting, members can visit the club website to review the presentation to vote either in favor of a buy or sell for the stock in question.

Although any club member is allowed to present a stock pitch, a rigorous research and presentation style must be adhered to. Club members will be asked to fill out a stock pitch form, shown in Figure 9. The stock pitch form forces the individual to critically think about the stock being recommended and to explain why a purchase (short or long) of this stock will generate wealth.

Submit a Stock

If you have a stock that is currently not covered by the WPI investment club that you think should be - submit it! We ask for several items of information:

1. Basic fundamental information about the stock and its industry
2. Compelling reasons explaining why this stock deserves to be covered
3. Concrete analysis that indicates a buy or sell rating for this stock

Background Information

Company Name

Ticker

Industry

Market Cap

Rating

Company Ratios	Industry Average Ratios
P/E Ratio <input type="text"/>	P/E Ratio <input type="text"/>
Current Ratio <input type="text"/>	Operating Margin (%) <input type="text"/>
ROE (%) <input type="text"/>	
ROA (%) <input type="text"/>	
Operating Margin (%) <input type="text"/>	

Short Response

What makes this company unique? In other words, what is its competitive advantage? For what time period is your rating valid?

Why will this company outperform/underperform companies in the same industry?

After performing fundamental analysis, what aspects of the stock are strongest?

After performing fundamental analysis, what aspects of the stock are weakest?

Figure 9 - Stock Pitch Form

Club members are encouraged to seek out investment opportunities wherever they arise, but club members cannot create a pitch for a penny stock, that is, a stock that trades for less than \$1.00. Certainly, there have been times when penny stocks have resulted in exponential growth, but

these types of stock are the most thinly traded and most speculative. The WPI investment club does not condone penny stock investment because the risk-reward ratio is too high.

IV.5 Educational Series

One of the main goals of the WPI investment club is to provide investment education to club members. To cater to all students, including students with no financial background and those that have invested previously, the investment club will sponsor an educational series that runs in parallel to the monthly meetings. The goal of the educational series is to provide a learning environment to all club members. The beginning of the year will focus on simple investment management topics to provide an entry-level knowledgebase for beginner investors. As the year progresses, more advanced topics will be addressed to help more advanced investors advance their skills.

IV.6 Competitions/Challenges

To stimulate participation and idea development, the investment club will sponsor a variety of investing competitions or challenges. Competitions are directed by the Vice President of Investment Research. Competitions can be for fun, that is, no prizes included or prizes can be added to create additional incentive for club members to fully participate. Stock competition simulations are one example of investment club sponsored competitions. Club members learn valuable investing lessons through a fun trial-and-error process where real money will not be lost and the club benefits from all of the new stock picks and stock picking methodologies that members will generate.

IV.6.1 Example Competitions/Challenges

The following is a brainstormed list of potential competitions and challenges that can be sponsored by the club to encourage new investment ideas. Competitions and challenges that involve trading simulation can be carried out either by using the Virtual Stock Exchange simulator (<http://vse.marketwatch.com/Game/Homepage.aspx>) or the Investopedia simulator (<http://simulator.investopedia.com/>). Below is a list of stock market competitions that can be sponsored by the investment club.

- Run a stock market simulation for the duration of the academic year. The club member with the greatest return is declared the winner.
- Sponsor a stock market simulation for varying time periods. In addition to competing for an entire academic year, club members can compete to achieve the greatest return in a week or a month.
- Challenge club members to only purchase stocks from particular sectors. For example, the competition can be limited to technology or healthcare stocks.
- Specify the type of stock purchases club members can make. A competition could be long only; meaning club members can only buy stocks expecting a future price increase. Alternatively, the competition can specify that only short purchases are allowed, meaning club members can only purchase stocks expecting a future price decrease.
- Challenge club members to select stocks based upon different characteristics, besides industry. For example, only stocks with a P/E ratio below 25 can be allowed during the competition. Additionally, stocks can be limited by characteristics, such as, market capitalization.

IV.7 Polling

Beyond stock market competitions, the investment club can create a variety of polls that gauge club members' opinions about the stock market, the domestic economy, and the global economy. Polling challenges club members to think holistically about the stock market and the economy to apply their research to a variety of questions. Below are example polls the club can initiate.

- Polls can pose questions about the stock market can be given. Example questions include, “Will the S&P 500 return more than 10% this year?”, “Which sector will provide the greatest returns this year?”, and “Will the price of oil continue past \$100 this year?”.
- Polls can also ask questions about the health of the domestic economy: “Will the U.S. Real Estate market bottom this year?”, “When will Ben Bernanke stop cutting interest rates?”, “Which presidential candidate will best stimulate the economy?”.
- Additionally, polls can question club members about the global economy. Example questions include, “Which emerging market will boast the greatest return this year?”, “Will the Euro continue a favorable trend relative to the U.S. dollar this year”, and “Will global markets slowdown this year as the credit problems in the U.S. affect the global markets?”.

IV.8 Club Sponsored Activities

To encourage member participation, the investment club must provide activities beyond stock market competitions, polls, and stock pitches. Below is a list of proposed activities.

- Sponsor a trip to the Federal Reserve Bank of Boston to attend an economic education program, such as the Federal System Overview.
- Tour Wall Street and attend an education seminar at the New York Stock Exchange.
- Invite guest speakers from within the WPI community to provide insight into the stock market.
- Invite external speakers that currently are involved in the financial services industry to speak about investment management, investing methodologies, and financial services career placement.
- Create short movie clips (several minutes long) touting a long or a short position for a particular stock. This presents members with a theatrical outlet for their investing passion.

IV.9 Organizational Requirements

In order to be formally recognized as an on-campus organization, the WPI investment club must create an organization constitution and a letter of intent to describe the club's purpose.

IV.9.1 Constitution

Constitution of the WPI Investment Club

Article I. Name

The name of the club will be the WPI Investment Club.

Article II. Purpose

The purpose of the investment club will be:

1. To educate students about the investment practices, strategies and the risks and gains associated with them.
2. To provide broader knowledge of the opportunities presented to each individual about money management and financial institutions, enabling them to make smarter investment choices for their future.
3. To help interested members find positions in the fast paced financial services industry.

Article III. Membership

Membership is open to all WPI students. No one will be discriminated on the basis of race, creed, religion, color, age, sexual orientation, disability, veteran status, marital status or national origin. Members have the freedom to discontinue membership at any time. A member may be removed on the condition that he/she act in an unethical manner. For the removal of a member are responsible the club members.

Article IV. Officers, Duties and Requirements

1. The Executive Board will consist of the following officers
 - a. President
 - b. Vice President
 - c. Secretary
 - d. Treasurer
2. Each officer, upon accepting office, shall agree to abide by the WPI Investment Club constitution without exception.
3. The term of office for all members of the Executive Board shall be one academic year. Members elected to the Executive Board in exceptional elections caused either by resignation (Article VII) or removal from office of the Executive Board (Article VIII), shall hold their offices until the end of the term of office of the members they replaced.

4. No member shall hold more than one office position in the Executive Board of the WPI Investment Club at the same time.
5. Only members that participate in at least 50% of club events are eligible to run for an officer position.

Article V. Meetings

Meetings will be held once every two weeks. If required, extra meetings will be called. Any officer of the executive board may call a meeting.

Article IV. Elections & Officer Replacement/Removal

Officers will be elected by self nomination process subjected to a subsequent general body election. Nominations must be submitted the week before the election. The election must take place before the conclusion of Term C. If there are no challengers for a position, the sole volunteer will be appointed based on the legacy executive board's unanimous decision. Officers will be elected based on skill, experience, and passion.

The executive board may remove an officer based on poor performance or a negative influence on the club environment. An animus agreement of the executive board is required for officer removal. An Executive officer may be removed if a petition is procured that is representative of majority of the officer body.

Article VIII. Finances

The WPI Investment Club will be funded by the SGA. We hope in the future, once the club has proven its investing capabilities, the club will grow into a non-profit organization that manages a portfolio containing real securities.

Article IX. Advisor

An advisor(s) will be selected or removed by unanimous decision of the executive board. The advisor(s) must be a full-time WPI faculty member who has a wide knowledge of the stock market, its principles and possible investment strategies. The advisor is a non-voting member.

Article X. Amendments/Revisions

Amendments will be brought to the attention of the officers for consideration. An amendment may be ratified by a majority of the officer body. Any officer may propose an amendment.

Article XI. SOC Enabling Clause

The WPI Investment Club agrees to abide by the policies of Worcester Polytechnic Institute as well as all federal, state and local laws. Any changes to this constitution and/or bylaws will follow, in word and spirit, all WPI policies and all federal, state and local laws.

Figure 10 - WPI Investment Club Constitution

IV.9.2 Letter of Intent

The letter of intent is required by the WPI Student Government Association (SGA) to formally recognize the investment club as an on-campus organization. This letter enables the investment club to hold an information session on-campus and to apply for an SGA budget in the following academic year. The letter is produced below.

Dear Student Organization Council,

There is currently a void on-campus for students that wish to learn about investing, in particular, investment management and investment planning. To fill that void, we propose to create a new student organization, called the WPI Investment Club. Creating an investment club on-campus will provide students with the skills necessary for retirement planning and will help students find careers in the financial services industry. We will serve students with varying amounts of investment knowledge by providing services that teach basic skills and then later apply those skills in sponsored events.

The investment club will create a series of tiered educational materials geared towards students of varying investment knowledge to help educate club members. Additionally, the investment club will feature investment literature that can further educate club members. The investment club will also offer an array of activities for club members. There will be fictitious investing challenges to test the skills of club members, which is a direct application of the material that club members will learn. The investment club website will allow club members to comment on stocks and to rate (buy, sell, or hold) stocks. Their ratings will then be scored depending upon the underlying stock's performance, which serves as another way to apply the knowledge of club members. The investment club will also seek to engage club members by inviting external speakers from the financial services industry to talk to club members about investment management topics. Furthermore, the investment club will sponsor trips to locations of interest, such as Wall Street or the Federal Reserve Bank of Boston.

The need for an investment club at WPI is real. Students need to be able to manage their own investments or at least understand investment management to successfully manage their finances later in life. The investment club will assist club members in the education process by providing the necessary investment material and by sponsoring events that will make the process exciting. For students that are already investing savvy, the investment club includes interactive activities to test the knowledge of students and the investment club will help students find careers in the financial services industry. Please allow us to fill a void on-campus by creating the investment club, which will make campus life more diverse and vibrant by bringing together and educating WPI students.

Sincerely,

Prof. Radzicki
Club Advisor

Michael Diamant
Vice-President

Divya Matthew
Secretary

Cordell Rogers
President

Veselin Iliev
Treasurer

IV.10 Information Session

To promote and to raise awareness of the WPI investment club, an information session was held for all WPI students on March 25, 2008. The information session included a short presentation by investment club officers to outline goals and expectations for next year and years following, and a question and answer session to address the concerns of WPI students. The information session drew approximately fifty students. Dozens of additional students who could not be present at the information session contacted club officers with their desire to join the investment club. The presentation made to students is included in Appendix A.

V Website Development and Design

V.1 Introduction

The website development receives inspiration from Web 2.0 design principles and the Motley Fool CAPS website. As explained, CAPS delivers a stock rating universe that leverages Web 2.0 design principles to individual investors. The WPI investment club website seeks to capitalize on the benefits of Web 2.0 design principles and the innovations produced by the CAPS website. The WPI investment club serves as the backbone of club operations.

The website design was approached by first developing the backend database and then constructing the frontend user interface. The database design process is reviewed first, followed by a review of the frontend user interface design. Database design entails understanding database requirements, modeling, and construction. The frontend design is depicted through screenshots and screenshot descriptions.

V.2 Database Design

V.2.1 Database Requirements

1. All users must be categorized as either club member or administrator. The title, administrator, encompasses all club members that are officers. Officers require administrative privileges to control content on the club website.
2. All users must have the following information stored: first name, last name, year of graduation, major, investing style, favorite sector, investing experience, and risk tolerance. Optionally, users can include a picture of themselves and a personal statement about their investing goals and ideas.
3. Club members are able to modify their personal profile, rate stocks, post stock comments, vote for favorite comments, maintain a personal investing blog, vote in polls, and submit new stocks for club coverage.

4. Club members are allowed to maintain a personal investing blog where a member's thoughts can be published. Blogs will be made interactive because club members are allowed to post replies to a blog entry. This feature stimulates debates and new ideas.
5. Club members can vote in polls that will periodically appear on the website. Polls are another way for the club to have members think critically about the stock market and the economy. Club members can vote only once in each poll and the poll must be active in order to accept votes.
6. Club members are allowed to have one active pick per stock. If a club member would like to change his or her rating on a stock that has been previously rated, the club member must mark that pick as inactive. Marking a pick as inactive disables further scoring for that pick and allows the club member to enter a new active pick, which will be scored.
7. Administrators have all of the abilities of club members and additionally can add and remove stocks, comments, polls, and users. Administrators are also in charge of managing club news events and upcoming meeting details.
8. All users receive a score for each stock pick and an aggregate score that encompasses all picks. For each stock pick, a player's score is the return of their stock, adjusted to reflect whether or not the player selected the stock as a buy, a sell, or a hold. A player's aggregate score is calculated by the following formula: $0.5 * (\text{Average Stock Score}) + 0.5 * (\text{Accuracy Rating})$. A pick is considered accurate if the pick returns at least 2%. 2% has been chosen as the benchmark because it factors in the cost of trading (for a more detailed discussion, please see the section entitled *Average Trading Fees*). The accuracy rating is calculated as the percentage of accurate picks out of total picks.
9. Each stock that is covered by the club must store the following information: company name, company overview, stock ticker, stock price, user comments, user ratings, in-depth stock analysis (link to PDF), club rating, date of club rating, and community rating.
10. A stock has a club rating, which represents the opinion of the club at the time when the in-depth stock analysis is presented. The community rating is derived from the ratings entered by users. If the majority of users believe the stock is a buy, then the community rating is buy. The community rating is independent of the club rating.
11. Club members cannot submit a stock pitch for a penny stock. That is, a stock whose current price is less than \$1.00.
12. Club members can participate in external stock market simulation challenges. The database must maintain a list of competitions, a link to each competition, and the winner of each competition, the competition start date, and the competition end date.
13. The database will be presented to users in the form of a website. A website creates a visually appealing frontend and makes database interaction transparent to the user. Website usage must be as transparent as possible to enhance the user experience.
14. The database will allow club members to vote on stock pitches heard at club meetings. Club member stock pitch votes determine whether or not a stock heard at a club meeting will be added to the investment club's stock coverage. Club officers can enable and disable a stock pitch poll, and club members can only vote for active stock pitch polls.

V.2.2 E/R Model

V.2.2.1 Overview

The Entity-Relationship (E/R) model represents a framework that illustrates how a database will be eventually implemented. The E/R model functions at a fundamental level and is not concerned with higher level items, such as relations. The E/R model is a conceptual design that translates business requirements into a good design that can later be used in the formation of the database. See Figure 11 for a diagram of the E/R model that uses the crow's foot modeling notation. Although the E/R model provides a solid starting point for database design, it is not capable of capturing all business requirements. Below is a list of requirements that are either partially or fully unmet by the E/R model. Included is an explanation of how the requirement is met in a later stage of development.

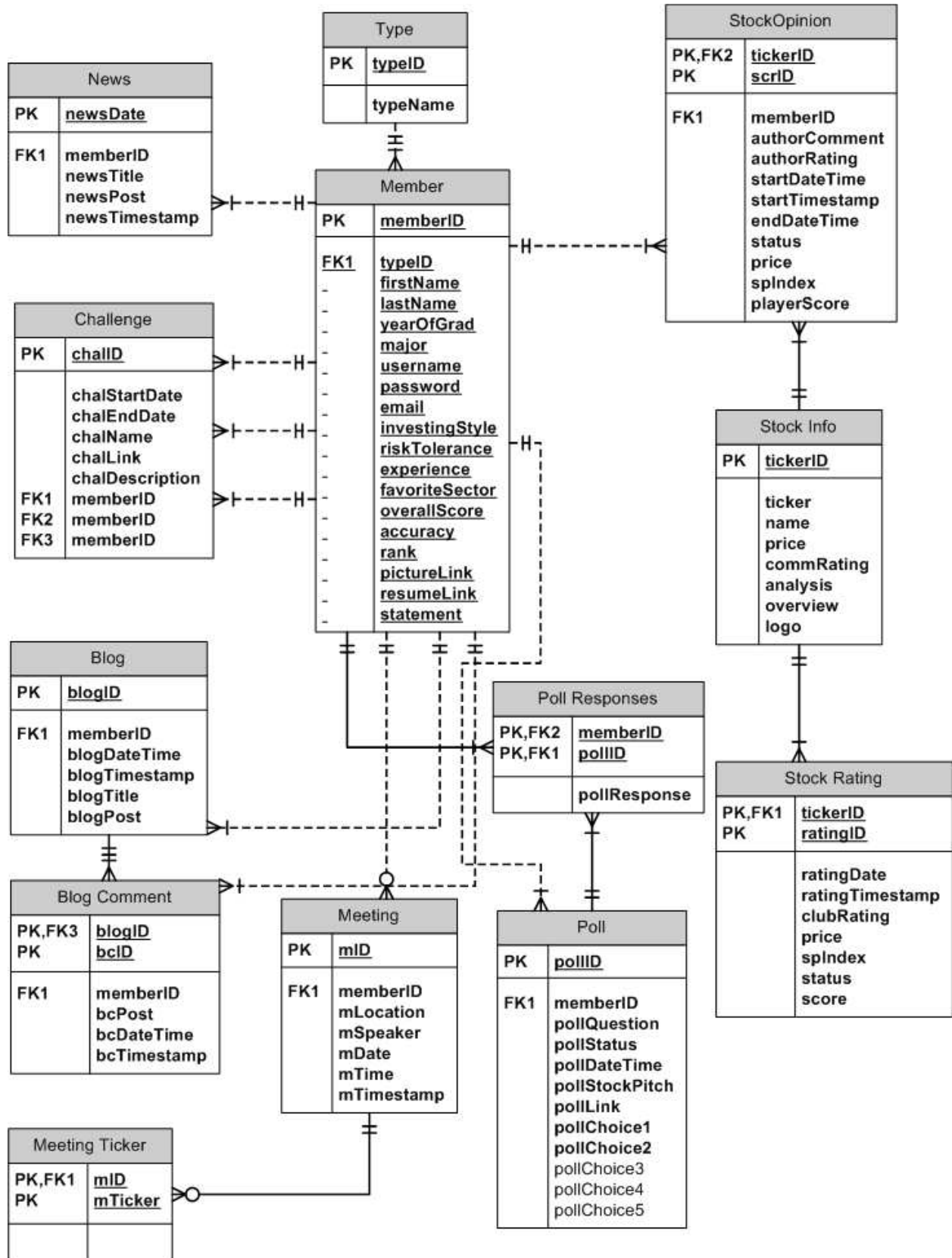


Figure 11 - E/R Model

V.2.2.2 Requirements not Met by E/R Model

Requirements that are partially fulfilled have been *italicized*.

- Requirement 3 – The E/R model cannot capture member editing privileges. This requirement will be fulfilled during implementation in conjunction with the use of member’s typeID to determine what content can and cannot be edited.
- Requirement 5 – The E/R model cannot enforce a single vote per poll nor can it enforce that voting only occurs when the poll is active. This requirement will be captured with application logic and SQL queries during implementation.
- *Requirement 6* – The E/R model cannot enforce that a club member can only have one active pick per stock. This rule will be enforced during implementation with PHP logic and SQL queries.
- *Requirement 7* – The E/R model cannot prevent club members from performing actions that are administrator specific. Like requirement 3, this requirement will be fulfilled by parsing the member’s typeID.
- *Requirement 9* – The E/R model cannot force attributes to be required. This requirement can be captured by specifying a “NOT NULL” integrity constraint or by checking user input before submitting to the database (for example, by using JavaScript).
- Requirement 11 – The E/R model cannot constrain what types of stocks are submitted by users. This constraint will be captured through the use of form validation using JavaScript during implementation and can be controlled by user administration.
- *Requirement 12* – The database administrators must ensure the winner of each challenge is in fact the true winner. The E/R model cannot capture this part of the requirement.
- Requirement 14 – Like requirement 5, the E/R model cannot enforce a single vote per stock pitch poll nor can it enforce that voting only occurs when the stock pitch poll is active. This requirement will be captured with application logic and SQL queries during implementation.

V.2.3 Relational Model

V.2.3.1 Introduction

Before translating the E/R model into the relational model, normalization must be performed. Normalization is a process that seeks to remove redundancy in design. Redundancy wastes space and can cause update, insert, or delete anomalies. The normalization theory analysis explains the approach taken to remove redundancy in the data.

V.2.3.2 Normalization Theory Analysis

- Originally, the tables Blog, Blog Comment, News, and Upcoming Meeting had a primary key consisting of the timestamp and the author. Timestamp refers to the attribute date or time, whichever is present in the corresponding table. Timestamp is the candidate key because it uniquely identifies all other attributes in the relation. Thus, the attribute, author, is not a necessary part of the key and was removed.
- The Upcoming Meeting table originally had tickers as an attribute. Tickers is a multi-value attribute because at each meeting it is possible to discuss one or more tickers. To ensure data integrity and to avoid data anomalies, the Upcoming Meeting Tickers table was created.

- Originally, the Blog table included the attribute, comments. Comments is a multi-value attribute because each blog can handle one or more comments. As with the tickers attribute in the previous bullet, a new table was created to properly handle the multi-value attribute, comments. The new table is Blog Comment.
- The table, Stock Information contains three functional dependencies. The primary key, ticker, name, ratingDate. Ticker implies all other attributes, which makes it a key. The name attribute implies a particular ticker and the attribute, ratingDate, implies a particular club rating of the stock. It is unlikely, but possible that a company's ticker will change throughout its public trading lifetime. To normalize the Stock Information table, a surrogate key, named Ticker ID, has been created to serve as the primary key. A given ratingDate and ticker imply a particular clubRating. It is likely that the club will change ratings on a particular stock over time. Without the creation of a separate table for clubRating, there will be a delete anomaly when the club issues a new rating for a stock. Thus, to normalize the Stock Information table, the Stock Rating table was created. Now, Stock Information is also normalized.
- The Stock Comments/Ratings table is normalized because dateTime, author, and ticker imply a unique set of all attributes in the table.
- The Member table is normalized because the only functional dependency that exists is the primary key, memberID, which implies all other attributes.
- The Type table is normalized because of the following functional dependency: typeID implies typeName.
- The Challenge table is normalized because the only functional dependency that exists is the chalID, which is the primary key.
- The Poll table is normalized because the only functional dependency that exists is the pollID, which is the primary key.
- The Poll Responses table is normalized because the primary key, which is a combination of memberID and pollID, implies ansNum.

V.2.3.3 Relational Table Definitions

Each table in the E/R model serves a specific purpose in the design of the database. Each table's purpose is defined below.

Type

The Type relation defines the different user access levels. For example, the type ID 1 can refer to general members, while the type ID 2 can refer to club officers. Different type IDs represent different access rights on the website. For example, only club officers should be allowed to modify website content. This requirement is fulfilled through the implementation of a type ID system.

Member

The Member relation holds information about each member, such as name, major, investing experience, risk tolerance, and scoring rank.

News

The News relation stores information for each news posting. This information includes the news post author, title, post content, and the posting date and time.

Challenge

The Challenge table stores information about each external investing simulation challenges, such as start and finish date of the challenge. Additionally, the top three placing members are stored as winners for each challenge.

Blog

The Blog relation stores information about each blog post a member makes. This information includes the post content, title, and date of posting.

Blog Comment

The Blog Comment relation stores information regarding each comment made in response to a particular blog posting. This relation is part of an identifying relationship with the relation Blog, because the foreign key, blog ID, is used to identify each blog comment.

Meeting

The Meeting relation stores information about each club meeting, such as, meeting location, speaker, date, and meeting creator.

Meeting Ticker

Meeting Ticker identifies stock tickers that are discussed at each meeting. This relation is part of an identifying relationship with the Meeting relation because a meeting ID (mID) is used to identify each ticker associated with each meeting.

Poll

The Poll relation stores information associated with each poll on the website, including poll question and poll choices. The Poll relation also stores information about stock pitches. A stock pitch is a specific form of a poll, which is why a stock pitch can be stored in the same relation as a poll.

Poll Responses

The Poll Responses relation stores responses to polls and stock pitches and the member who replied to the poll/stock pitch. Poll Responses is a weak entity because it is identified by the foreign key, poll ID from the Poll relation and the foreign key, member ID from the Member relation. This means that a poll response cannot be identified unless the poll and the member submitting the response is known.

Stock Info

The Stock Info table stores information about each stock covered by the club, such as the ticker, company name, stock price at time of club rating, and the community rating.

Stock Opinion

The Stock Opinion relation stores member submitted opinions about each stock in the Stock Info table. This relation stores, among other attributes, the start and end date of each pick, as well as the stock price and S&P500 index at the time of opinion submission. This relation is a weak entity because the foreign key, ticker ID from the Stock Info relation must be known to identify a stock opinion.

Stock Rating

The Stock Rating relation stores information about past and current club stock ratings. This table is needed because it is possible that over time the club will change its coverage on a stock. For example, the club may issue a sell rating after having had a buy rating for the previous six months. To maintain past rating information, the Stock Rating table has been created. This relation is a weak entity because the foreign, ticker ID from the Stock Info relation must be known to identify a club's stock rating.

V.2.3.4 SQL Data Definition Language (DDL) Statements

SQL DDL statements are used to construct the database tables or relations. Once the relations are constructed, data can be input into the database. Data entry will occur after the completion of the website frontend design. The website frontend will provide website users with an easy-to-use interface to interact with the database.

- CREATE TABLE Type (typeID INTEGER, typeName VARCHAR(30) NOT NULL, PRIMARY KEY (typeID));
- CREATE TABLE Member (memberID INTEGER, firstName VARCHAR(30) NOT NULL, lastName VARCHAR(30) NOT NULL, yearOfGrad INTEGER NOT NULL, major VARCHAR(50) NOT NULL, username VARCHAR(30) NOT NULL, password VARCHAR(30) NOT NULL, email VARCHAR(30) NOT NULL, investingStyle VARCHAR(30) NOT NULL, riskTolerance VARCHAR(30) NOT NULL, experience VARCHAR(30) NOT NULL, favoriteSector VARCHAR(30) NOT NULL, statement TEXT NOT NULL, pictureLink TEXT, resumeLink TEXT, typeID INTEGER NOT NULL, overallScore VARCHAR(30) NOT NULL, accuracy INTEGER NOT NULL, rank INTEGER NOT NULL, PRIMARY KEY (memberID), FOREIGN KEY (typeID) REFERENCES Type);
- CREATE TABLE News (newsID INTEGER, newsDateTime VARCHAR(30) NOT NULL, newsTitle TEXT NOT NULL, newsPost TEXT NOT NULL, newsAuthor INTEGER NOT NULL, newsTimestamp TIMESTAMP NOT NULL, PRIMARY KEY (newsID), FOREIGN KEY (newsAuthor) REFERENCES Member (memberID));
- CREATE TABLE Blog (blogID INTEGER, blogDateTime VARCHAR(30) NOT NULL, blogTitle TEXT NOT NULL, blogPost TEXT NOT NULL, blogAuthor INTEGER NOT NULL, blogTimestamp TIMESTAMP NOT NULL, PRIMARY KEY (blogID), FOREIGN KEY (blogAuthor) REFERENCES Member (memberID));
- CREATE TABLE BlogComment (bcID INTEGER, blogID INTEGER, bcDateTime VARCHAR(30) NOT NULL, bcPost TEXT NOT NULL, blogAuthor INTEGER, bcAuthor INTEGER NOT NULL, bcTimestamp TIMESTAMP NOT NULL, PRIMARY KEY (bcID, blogID), FOREIGN KEY (blogAuthor, blogID) REFERENCES Blog (blogAuthor, blogID), FOREIGN KEY (bcAuthor) REFERENCES Member (memberID));
- CREATE TABLE Meeting (mID INTEGER, mDate VARCHAR(30) NOT NULL, mTime VARCHAR(30) NOT NULL, mLocation VARCHAR(30) NOT NULL, mSpeaker CHAR(3) NOT NULL, mAuthor INTEGER NOT NULL, mTimestamp LONG NOT NULL, PRIMARY KEY (mID), FOREIGN KEY (mAuthor) REFERENCES Member (memberID));
- CREATE TABLE MeetingTicker (mID INTEGER, mTicker CHAR(10), PRIMARY KEY (mID, mTicker), FOREIGN KEY (mID) REFERENCES Meeting (mID));
- CREATE TABLE Poll (pollID INTEGER, pollChoice1 TEXT NOT NULL, pollChoice2 TEXT NOT NULL, pollChoice3 TEXT, pollChoice4 TEXT, pollChoice5 TEXT, pollAuthor INTEGER NOT NULL, pollQuestion TEXT NOT NULL, pollStatus VARCHAR(30) NOT NULL, pollDateTime VARCHAR(30) NOT NULL, pollStockPitch VARCHAR(3) NOT NULL, pollLink TEXT NOT NULL, PRIMARY KEY (pollID), FOREIGN KEY (pollAuthor) REFERENCES Member (memberID));

- CREATE TABLE PollResponses (pollID INTEGER, pollMemberID INTEGER, pollResponse TEXT NOT NULL, PRIMARY KEY (pollMemberID, pollID), FOREIGN KEY (pollID) REFERENCES Poll(pollID), FOREIGN KEY (pollMemberID) REFERENCES Member(memberID));
- CREATE TABLE StockRating (ratingID INTEGER, ratingDate VARCHAR(30) NOT NULL, ticker CHAR(10) NOT NULL, clubRating CHAR(10) NOT NULL, price VARCHAR(30) NOT NULL, ratingTimestamp TIMESTAMP NOT NULL, status VARCHAR(30) NOT NULL, score VARCHAR(30) NOT NULL, spIndex VARCHAR(30) NOT NULL, PRIMARY KEY (ratingID), FOREIGN KEY (ticker) REFERENCES StockInfo (tickerID));
- CREATE TABLE StockInfo (tickerID INTEGER, ticker CHAR(10) NOT NULL, name TEXT NOT NULL, commRating VARCHAR(30) NOT NULL, analysis TEXT NOT NULL, overview TEXT NOT NULL, logo TEXT NOT NULL, PRIMARY KEY (tickerID));
- CREATE TABLE StockOpinion (soID INTEGER, ticker CHAR(10) NOT NULL, author INTEGER NOT NULL, startDateTime VARCHAR(30) NOT NULL, endDateTime VARCHAR(30) NOT NULL, authorComment TEXT NOT NULL, authorRating CHAR(10) NOT NULL, status VARCHAR(30) NOT NULL, price VARCHAR(30) NOT NULL, spIndex VARCHAR(30) NOT NULL, playerScore FLOAT(7, 2) NOT NULL, startTimestamp TIMESTAMP NOT NULL, PRIMARY KEY (soID), FOREIGN KEY (author) REFERENCES Member (memberID), FOREIGN KEY (ticker) REFERENCES StockInfo (tickerID));
- CREATE TABLE Challenge (chalID INTEGER, chalStartDate VARCHAR(30) NOT NULL, chalEndDate VARCHAR(30) NOT NULL, chalName TEXT NOT NULL, chalLink TEXT NOT NULL, chalDescription TEXT NOT NULL, chalFirstPlace INTEGER NOT NULL, chalSecondPlace INTEGER NOT NULL, chalThirdPlace INTEGER NOT NULL, PRIMARY KEY (chalID), FOREIGN KEY (chalFirstPlace, chalSecondPlace, chalThirdPlace) REFERENCES Member (memberID, memberID, memberID));

V.2.3.5 SQL Data Manipulation Language (DML) Statements

SQL DML is used after the database framework has been constructed, that is, after SQL DDL statements have been successfully entered into the database. As the title suggests, SQL DML allows users to manipulate data in the database. DML statements can be used to view, insert, remove, or update data. DML statements, also called queries, are frequently employed throughout the WPI investment club website to execute user commands. Several example SQL DML queries are listed below.

- SELECT SO1.playerScore, M1.pictureLink, M1.memberID, M1.username, SO1.price FROM StockOpinion SO1, (SELECT MAX(playerScore) AS 'maxScore' FROM StockOpinion WHERE ticker = '\$ticker') SO2, Member M1 WHERE SO1.playerScore = SO2.maxScore AND SO1.author = M1.memberID;

This query selects the club member with the highest score of all club members that have submitted a stock rating for a particular stock. The result of this query is visible on any stock's page. The box labeled "Score Leader" represents the output of this query.

- SELECT COUNT(soID) FROM StockOpinion WHERE author = '\$memberID' AND ticker = '\$ticker' AND status = 'Active';

This query selects the count or the number of stock ratings a user has for a particular stock. The output of this query is in the box labeled "Your Opinion" on any stock's page. If the user has an active opinion for the stock, the query will return one and the user's stock opinion will be displayed. If the user has no active opinion or has never rated this stock, the query will return zero and will display the stock rating form.

- INSERT INTO Poll VALUES ('\$pollID', '\$pollChoice1', '\$pollChoice2', '\$pollChoice3', '\$pollChoice4', '\$pollChoice5', '\$memberID', '\$pollQuestion', '\$pollStatus', '\$pollDateTime', 'No', 'None');

This query demonstrates how to add data into the database with SQL DML. Here, a new poll is being inserted into the database with values that the user has input via the website frontend interface.

- DELETE FROM Member WHERE memberID = '\$deleteMemberID';

This query demonstrates how to remove data from the database with SQL DML. Here, a member is being deleted from the database. The particular member being deleted is inputted via the website frontend interface.

V.3 Frontend Website Design

The frontend website design is best captured through screenshots. The following screenshots show various features of the website grouped into broad areas that will provide readers with an understanding of website capabilities. A website demo is necessary to show all features and capabilities.

V.3.1 General Functionality

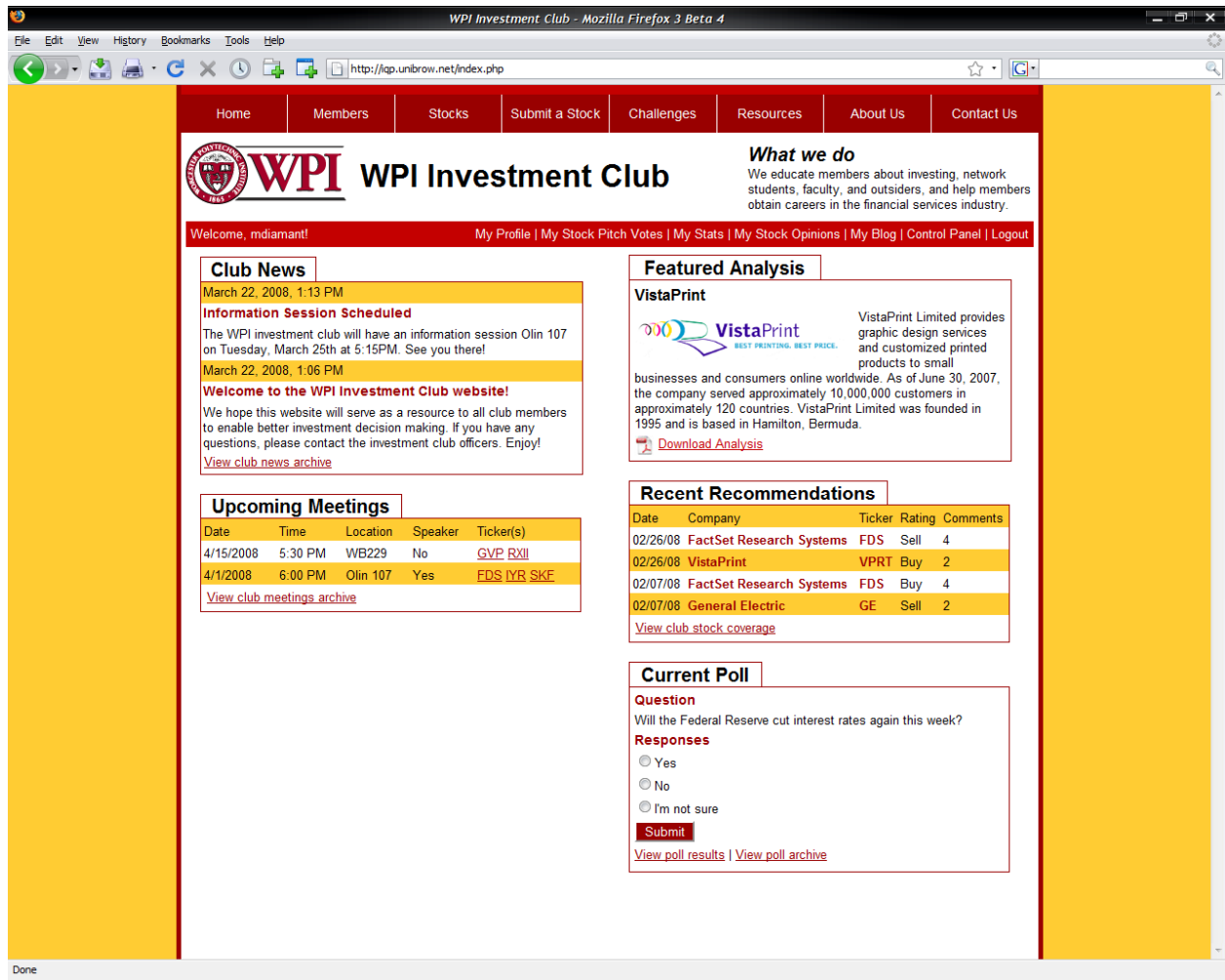


Figure 12 - Homepage

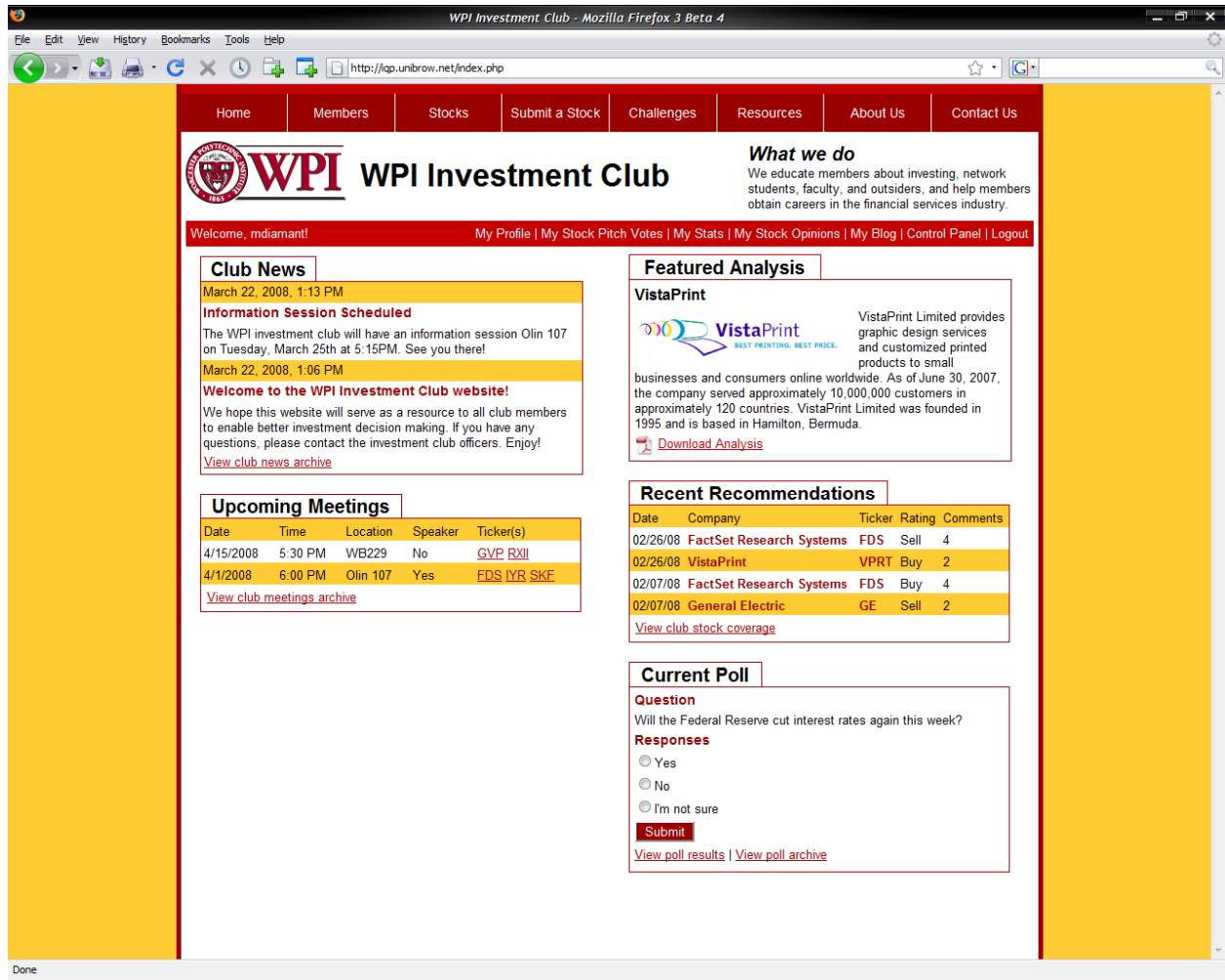


Figure 12 represents the homepage, which is the page first seen by visitors. The homepage provides a broad amount of information to users. In the left column, users can quickly see recent club news and upcoming meetings to inform them about club happenings. In the right column, a club stock analysis is presented at random, along with background information about the firm in question. The “Featured Analysis” presents the club’s research upfront to website visitors. Below, users can view which stocks have been receiving the most ratings, and how the community (club members) thinks these stocks will perform. The homepage also features an interactive poll that allows club members to submit their opinion about a current topic in the investment world.

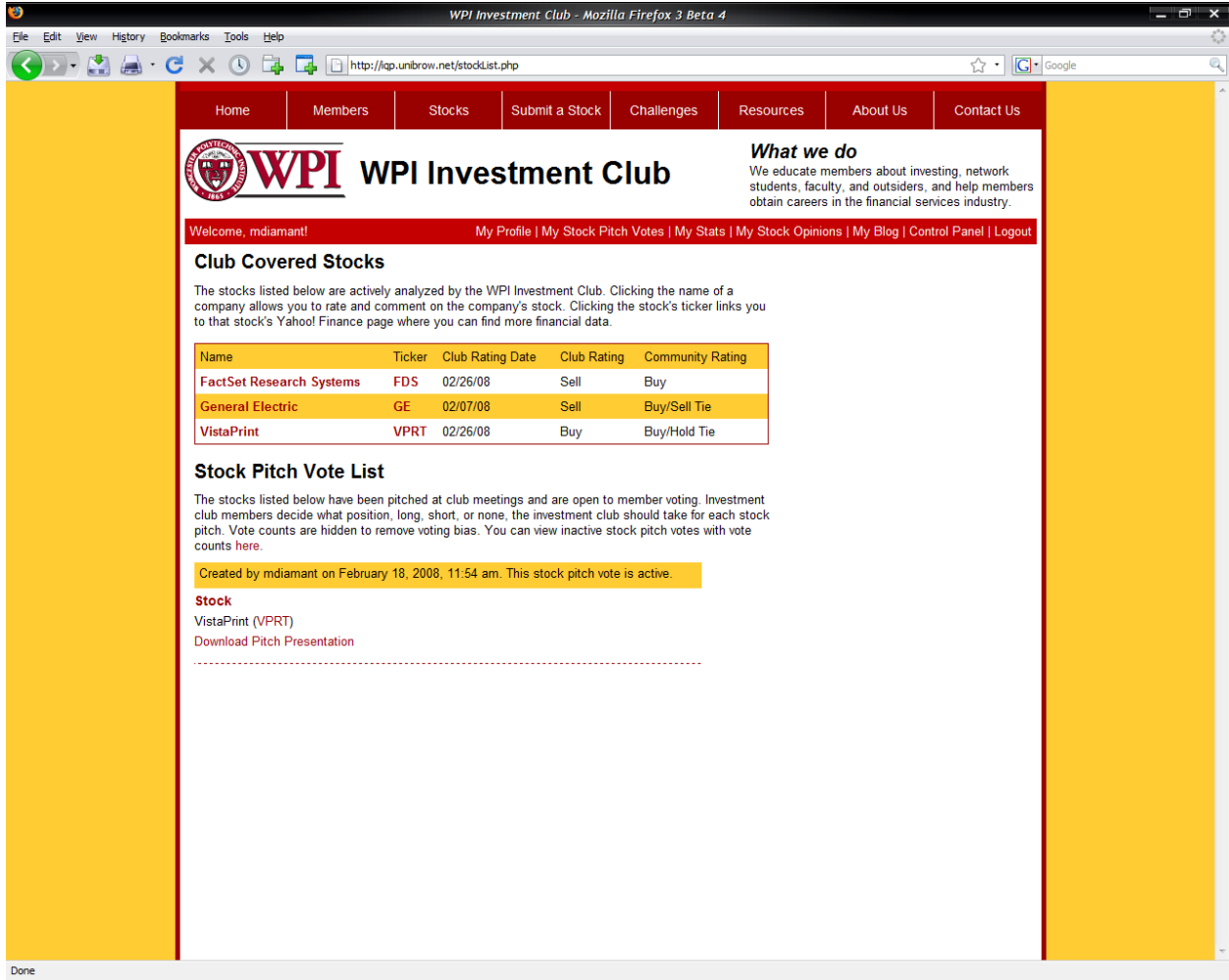


Figure 13 - Stock List Page

Figure 13 presents the stock list page that summarizes the stocks under coverage by the WPI investment club. Basic information, such as the date that the club rated the stock, the club rating, and the dynamically generated community rating about each stock is presented to the user. Also listed on this page are stock pitch votes. Once a club is pitched in a club meeting, club members must vote on whether or not they agreed with the stock pitch. Only active stock pitches in which a user has not voted in will appear. Club members can download the pitch presentation to review what was said during the club meeting.

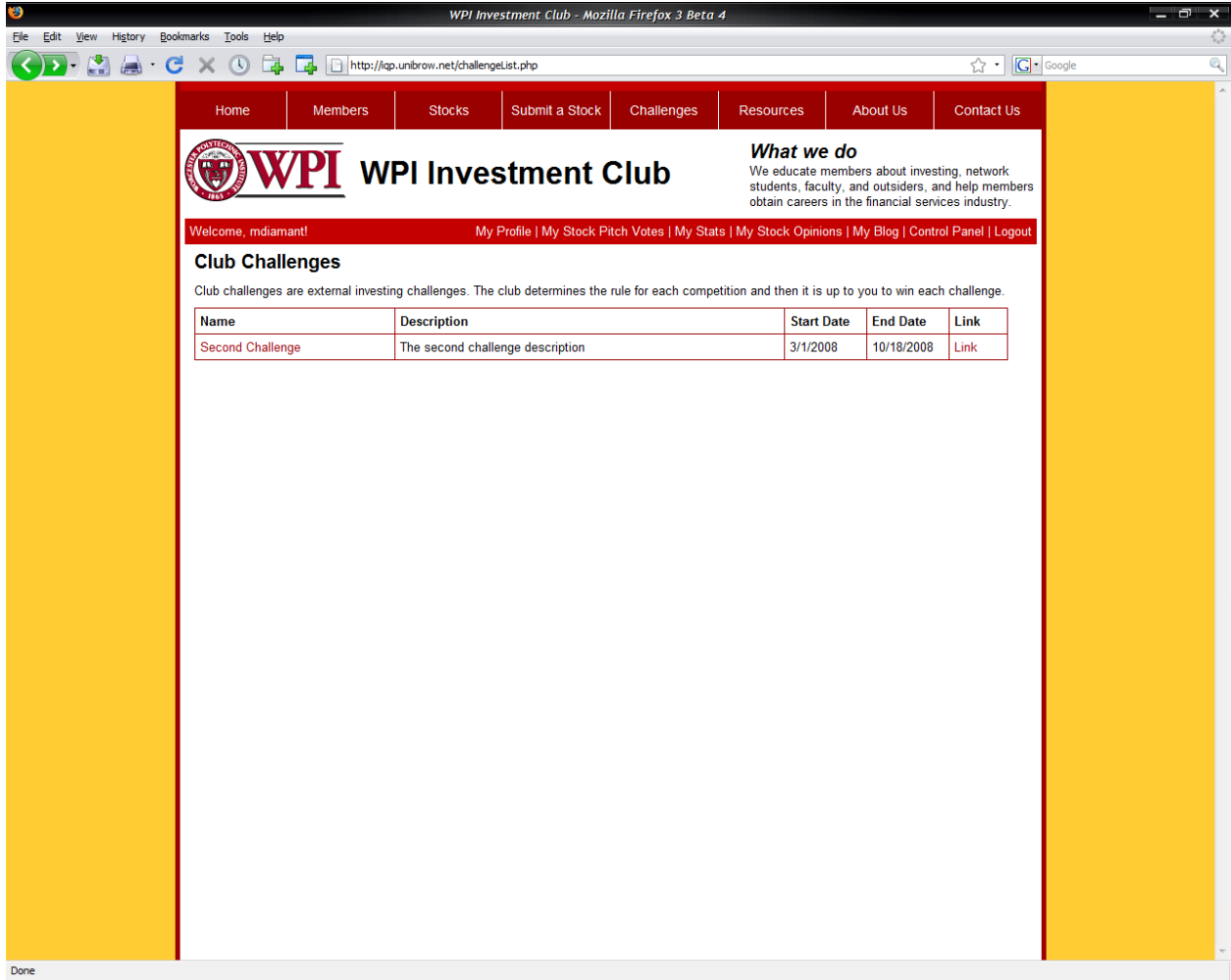


Figure 14 - Investing Challenges List

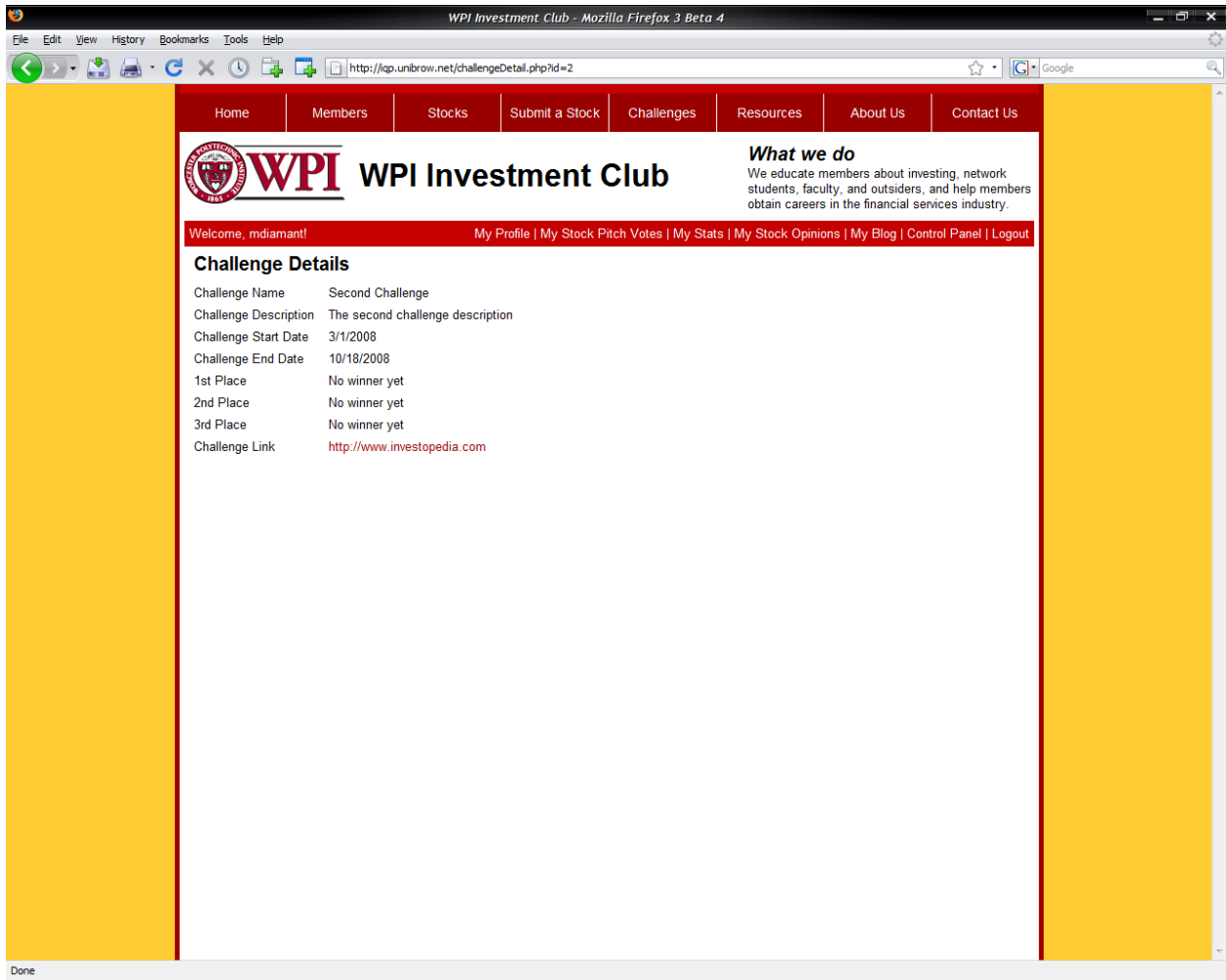


Figure 15 - Investing Challenge Detail Page

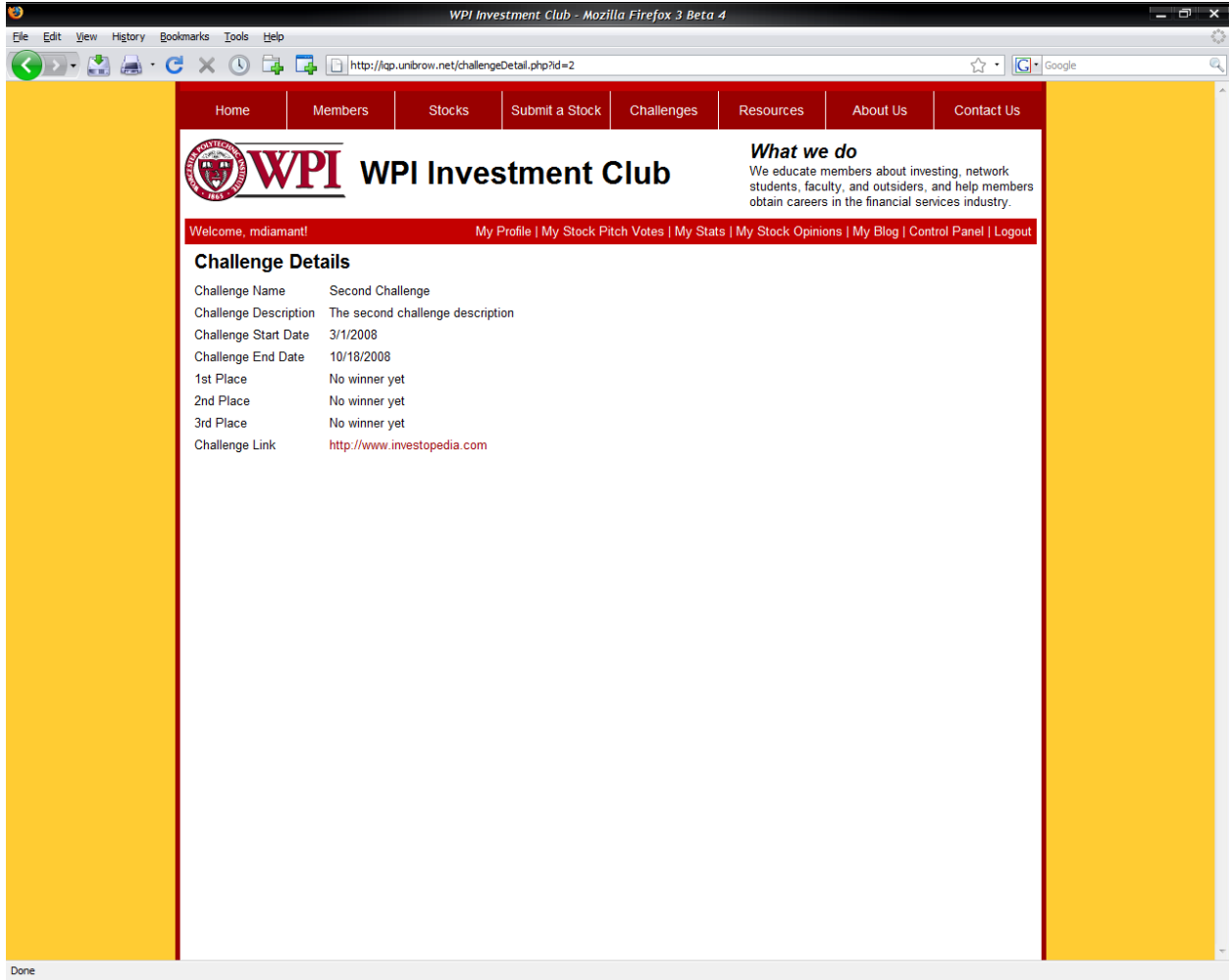


Figure 15 display information about challenges sponsored by the investment club. The challenges are fictitious investing simulations hosted on an external website. Figure 14 displays a list of challenges currently available to club members for participation. Clicking a challenge name in the challenge list displays the details of that challenge, which is illustrated in

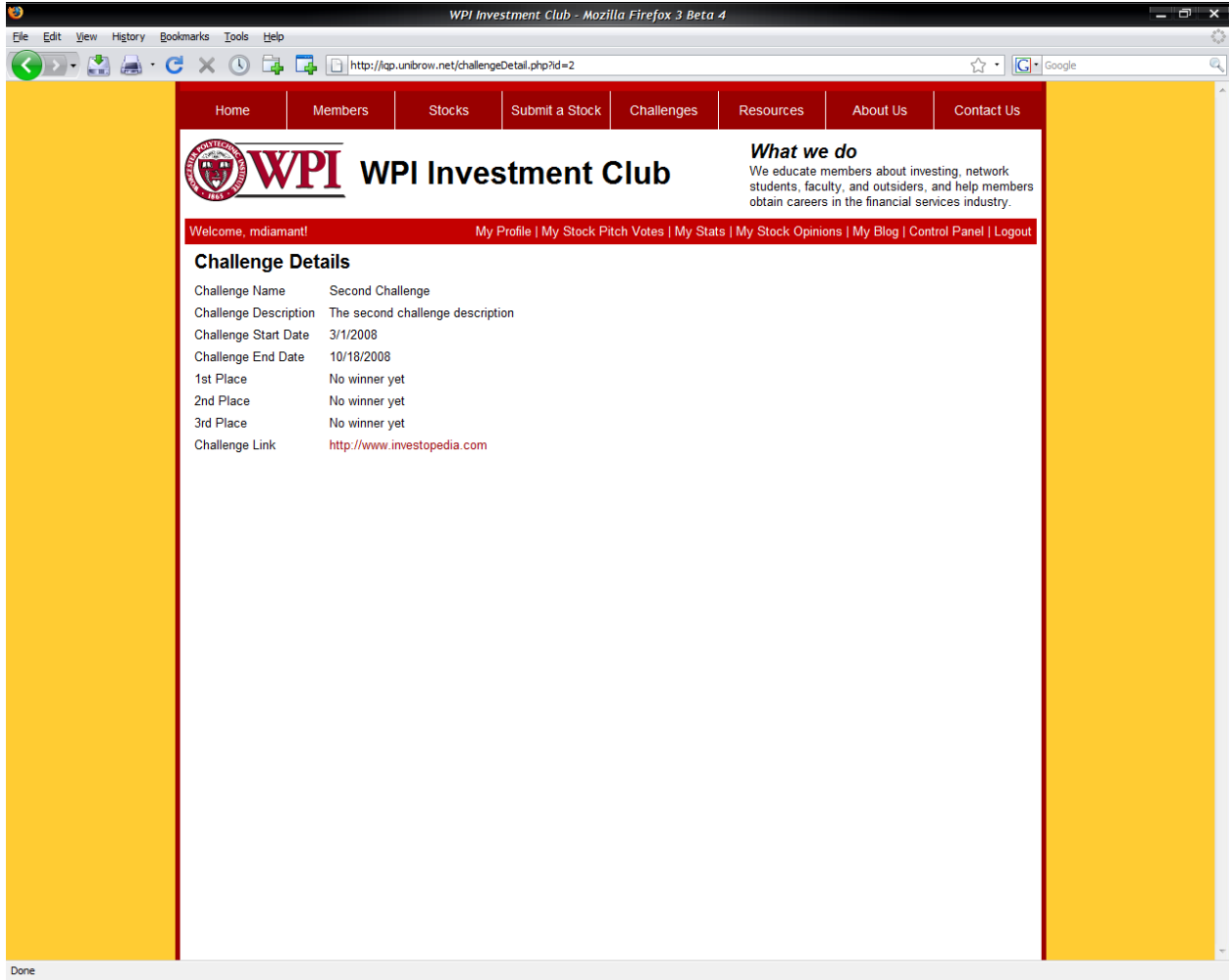


Figure 15. Once a challenge ends, club officers can enter the names' of the top three challenge winners and the winners will appear on the challenge details page in

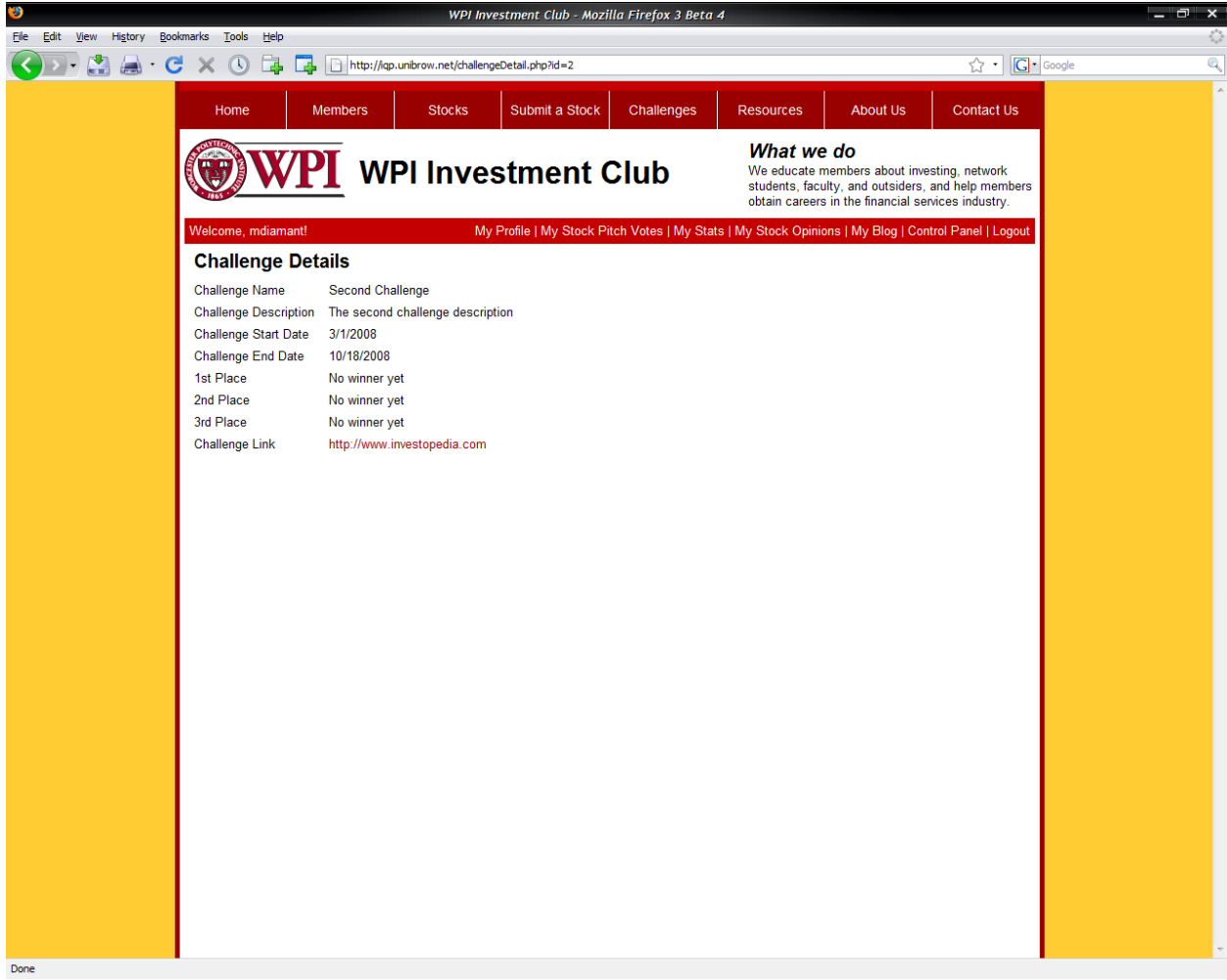


Figure 15.

The screenshot shows a web browser window displaying the WPI Investment Club website. The browser's address bar shows the URL: <http://qip.unibrow.net/stockDetail.php?id=FDS>. The website has a red navigation bar with links: Home, Members, Stocks, Submit a Stock, Challenges, Resources, About Us, and Contact Us. Below the navigation bar is the WPI Investment Club logo and a "What we do" section. A welcome message for user "mdiamant" is displayed, along with links to profile, stock pitch votes, stats, opinions, blog, control panel, and logout. The main content area is titled "FactSet Research Systems (FDS)" and is divided into several sections:

- The Company:** They deliver financial information.
- Your Opinion:** A table showing the user's opinion:

Start Date:	March 17, 2008, 4:00 pm
Start Price:	\$44.01
Rating:	Buy
Stock Gain/Loss:	23.88%
S&P Gain/Loss:	4.14%
Score:	+19.74

 A "Change your opinion" link is provided below.
- Detail Data:** A table showing current market data:

Current Price:	\$54.52
Last Trade Time:	3/20/2008 4:02pm
Change in Price:	\$1.58 (2.9%)
Open:	\$52.68
Daily Range:	\$52.68 - \$54.67
Volume:	575,860
- Club & Community Opinion:** A table showing community sentiment:

Club Rating	Sell
Start Price	\$54.32
Score	-4.12
Community Buys	3 votes (100%)
Community Sells	0 votes (0%)
Community Holds	0 votes (0%)
- Score Leader:** A profile for user "mdiamant" showing a start price of \$44.01 and a score of +19.74, accompanied by a small photo.
- Community Comments:** A list of comments from other users:
 - drui: Rating: Buy | Start Price: \$53.76 | Start Date: March 19, 2008 | Status: Active | Score: +1.09. Comment: "Just reported a terrific quarter -- they will continue to run."
 - mdiamant: Rating: Buy | Start Price: \$44.01 | Start Date: March 17, 2008 | Status: Active | Score: +19.74. Comment: "Earnings come in tomorrow and it will skyrocket!"
 - mherrera: Rating: Buy | Start Price: \$51.74 | Start Date: February 7, 2008 | Status: Active | Score: +5.92. Comment: "Diamant's right for once!"
 - mdiamant: Rating: Buy | Start Price: \$51.43 | Start Date: February 7, 2008 | Status: Inactive | Score: -0.23. Comment: "Going to the moon!"

Figure 16 - Stock Detail Page

Figure 16 illustrates the stock detail page. The stock detail page is one of the more important pages in the entire website. Figure 16 shows the stock details for FactSet Research Systems (FDS). At the top of the page, company information is presented to the user. In the left column, my opinion is visible since I am logged in and I have previously rated this stock. I am able to see the stock's percentage gain or loss and the S&P 500's percentage gain or loss in the same period of time. The difference between these two percentages is the stock score, which in this case is 19.74. This implies that my stock pick is beating the S&P500 by 19.74%. If I did

not have an active stock opinion or if I had never rated FDS, Figure 17 would be displayed in place of my pick's statistics.

The screenshot shows a web form titled "Your Opinion". At the top, a yellow banner reads "You have not rated this stock. Submit your opinion below." Below this, there is a "Rating" dropdown menu currently set to "Buy". Underneath is a "Rating Rational" text area with a vertical scrollbar. At the bottom left, it says "Price at Rating \$54.52". A red "Submit" button is located at the bottom center of the form.

Figure 17 - Submit Stock Opinion

Similar to the “Your Opinion” section, the “Club & Community Opinion” section lists statistics about how the club and community have performed in their rating of this stock. The left column of this section lists the club rating, the club’s starting price, and the club’s score. The club’s rating represents the club’s decision after hearing a stock pitch and receiving club member votes. It represents the majority consensus, which is why having the opportunity for an individual club member to rate the stock is important. The right column shows community information, specifically, the number of club members with active buy, sell, and hold ratings. These ratings are used to determine the community rating on the stock list page, which indicates current club member sentiment.

The stock detail page, shown in Figure 16, presents trading information about the stock in the “Detail Data” section. The user can see the current price, the last trade time, the change in price, the stock opening price, the stock’s daily price range, and trading volume. Below the “Detail Data” section is the “Score Leader” section. Here, the top scoring club member for the stock in question will be listed. In the case of FDS, it happens to be me because no one has achieved a higher score.

The “Community Comments” section shows all club member stock opinions and stock rating details, such the stock rating, the start price, the start date, the rating status, and score. Club member comments allow club members to provide insight and justification for their stock rating. The comment feature exists because the WPI investment club aims to educate club members about how to invest, and one way to stimulate thought is to force club members to provide some rational about their investment decisions. The hope is that the comments made by club members represent research.

V.3.2 Personal Member Functionality

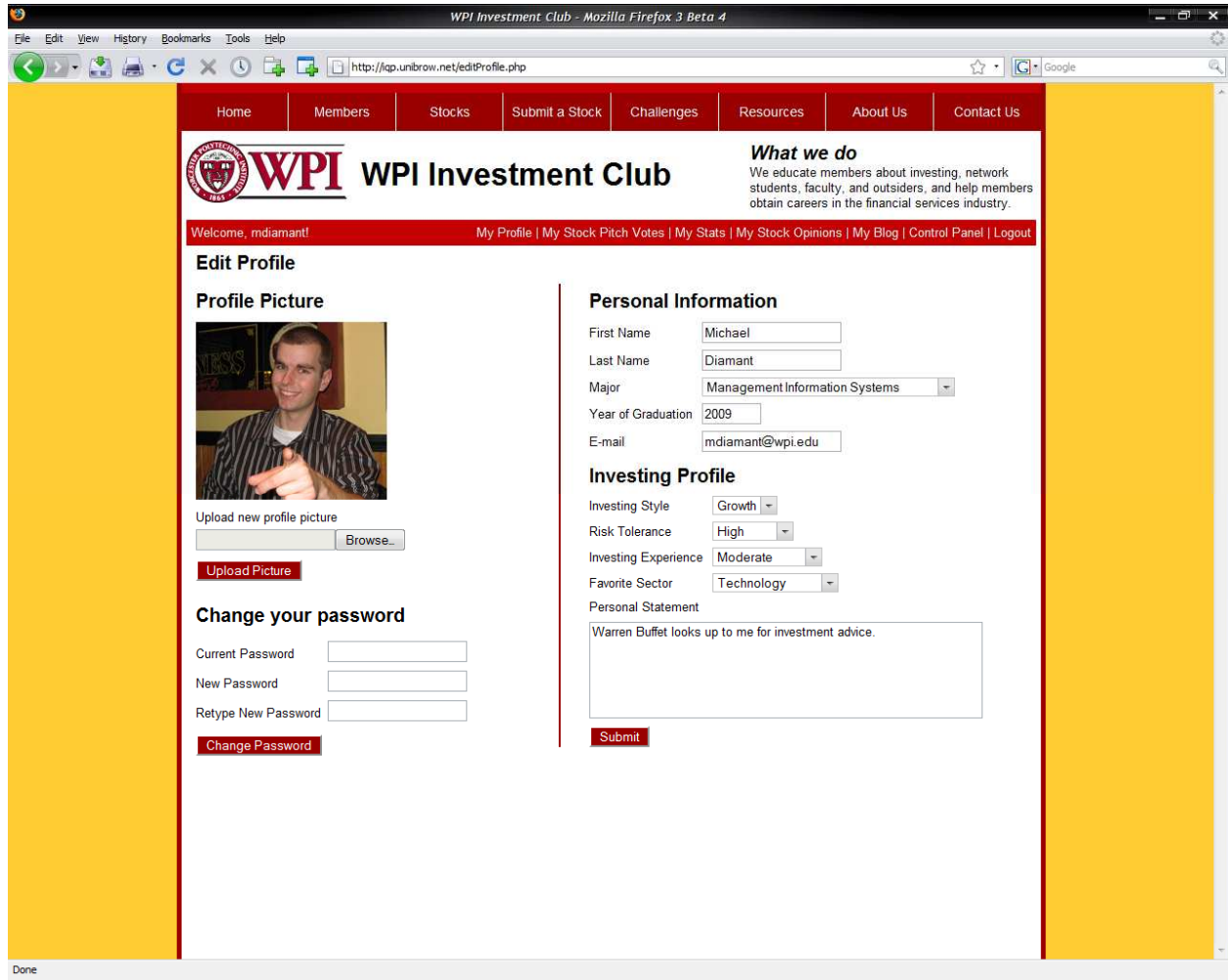


Figure 18 - My Profile Page

Figure 18 displays a sample user's profile page. The profile page allows users to maintain personal information and to develop an investing profile, which can help explain decision making. For example, if a club member has listed technology as his/her favorite sector, then it would make sense that this club member only rates technology stocks. The investing profile also helps club officers understand member demographics, that is, the strengths and experience levels of club members.

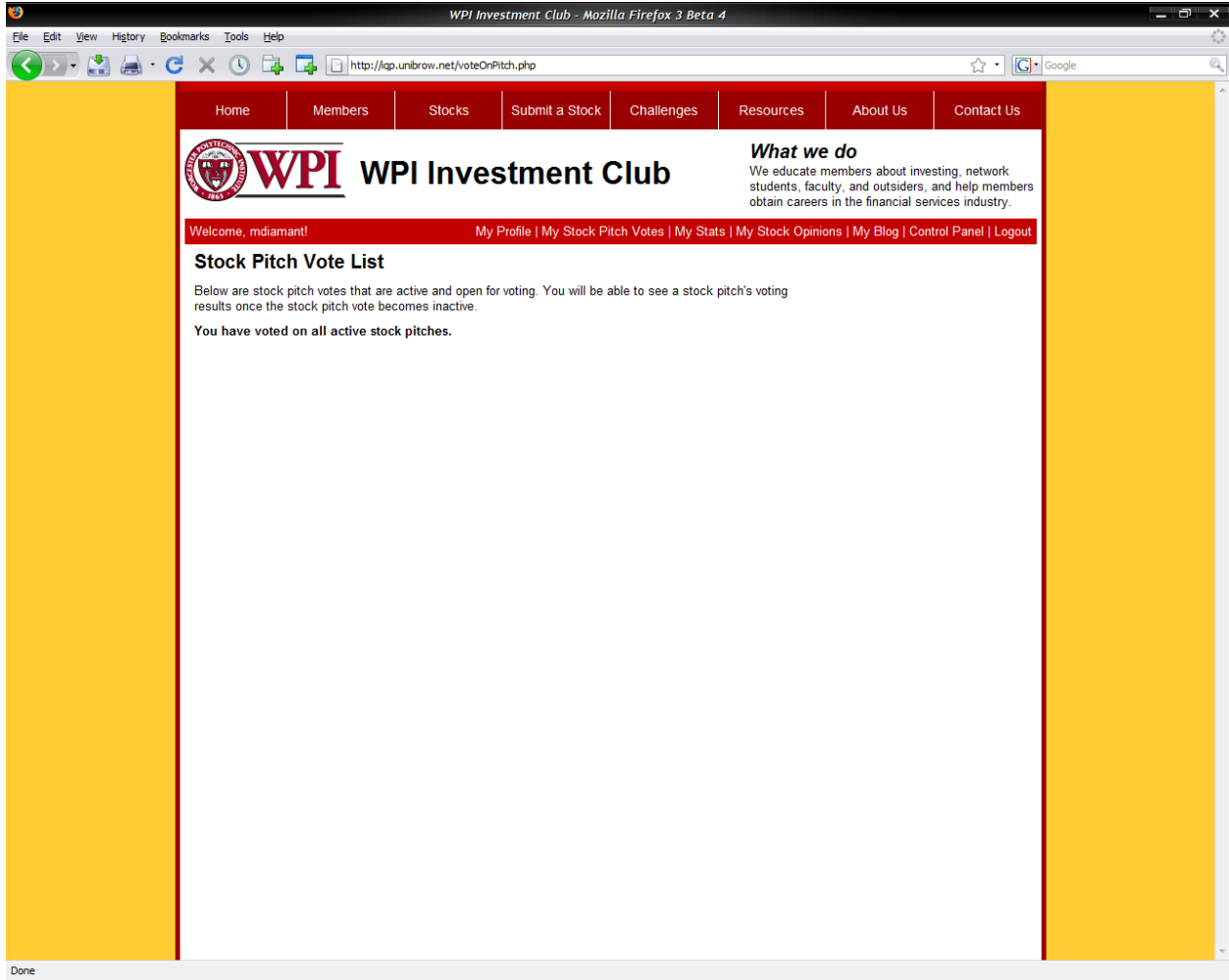


Figure 19 - Stock Pitch Votes

Figure 19 displays the stock pitch vote page. Club members have access to a summarized view of stock pitch votes. As new stock pitch votes are enabled by club officers, they are listed on this page. This page keeps club members current with all voting opportunities. Instead of scanning the stock list pages for stock pitch votes that require a club member's vote, the club member can instead view this single, summarized page. In the example page shown above, I have voted for all stock pitch votes, which is why none are listed.

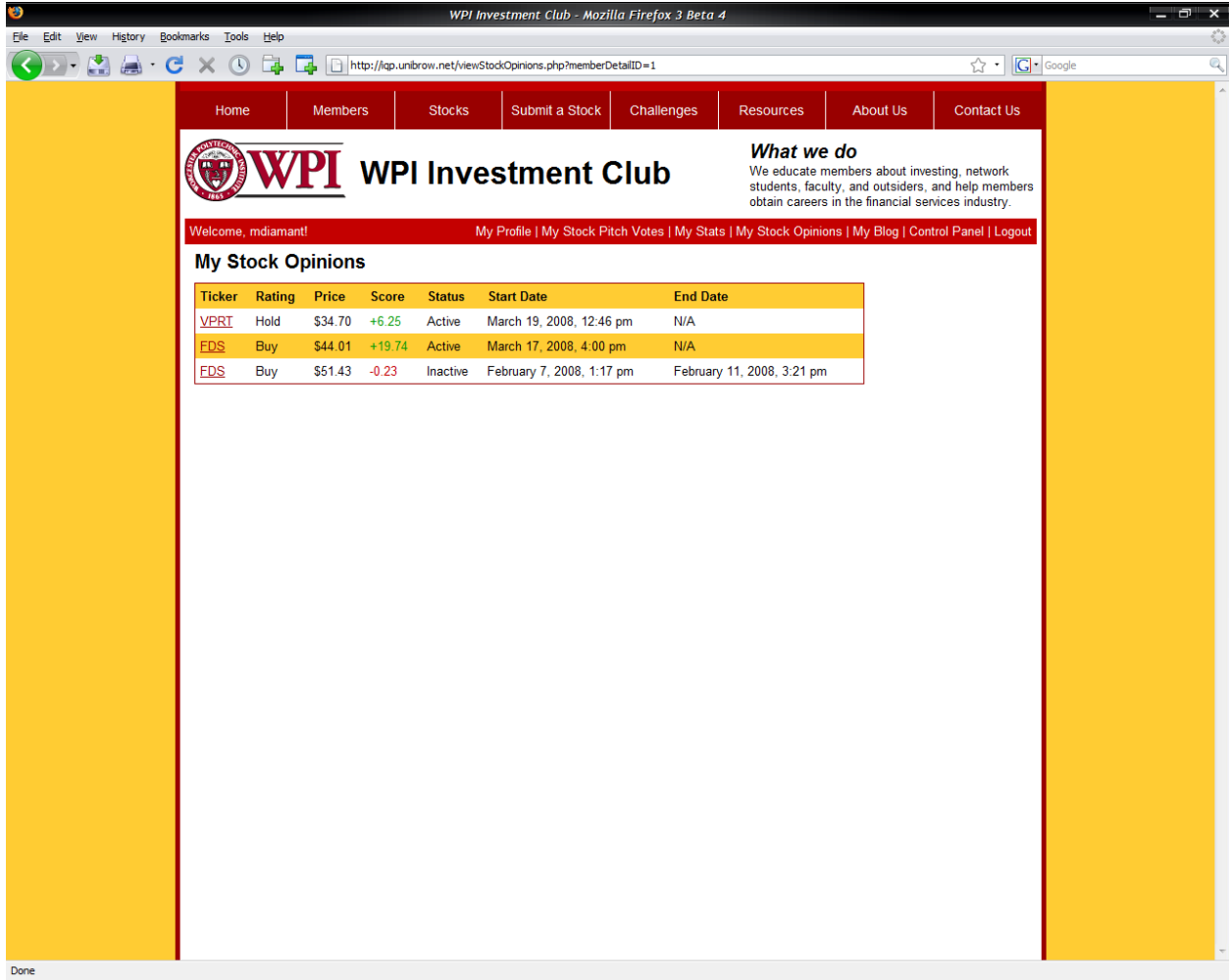


Figure 20- Stock Opinion Summary Page

The stock opinion summary page, which is shown in Figure 20, provides club members with a high level look at all of their stock picks, active and inactive. The page presents each pick as one row and provides basic information, such as the starting price, starting date, and score. Club members can view each other's stock opinion pages, which helps club members find other club members that have similar investing styles.

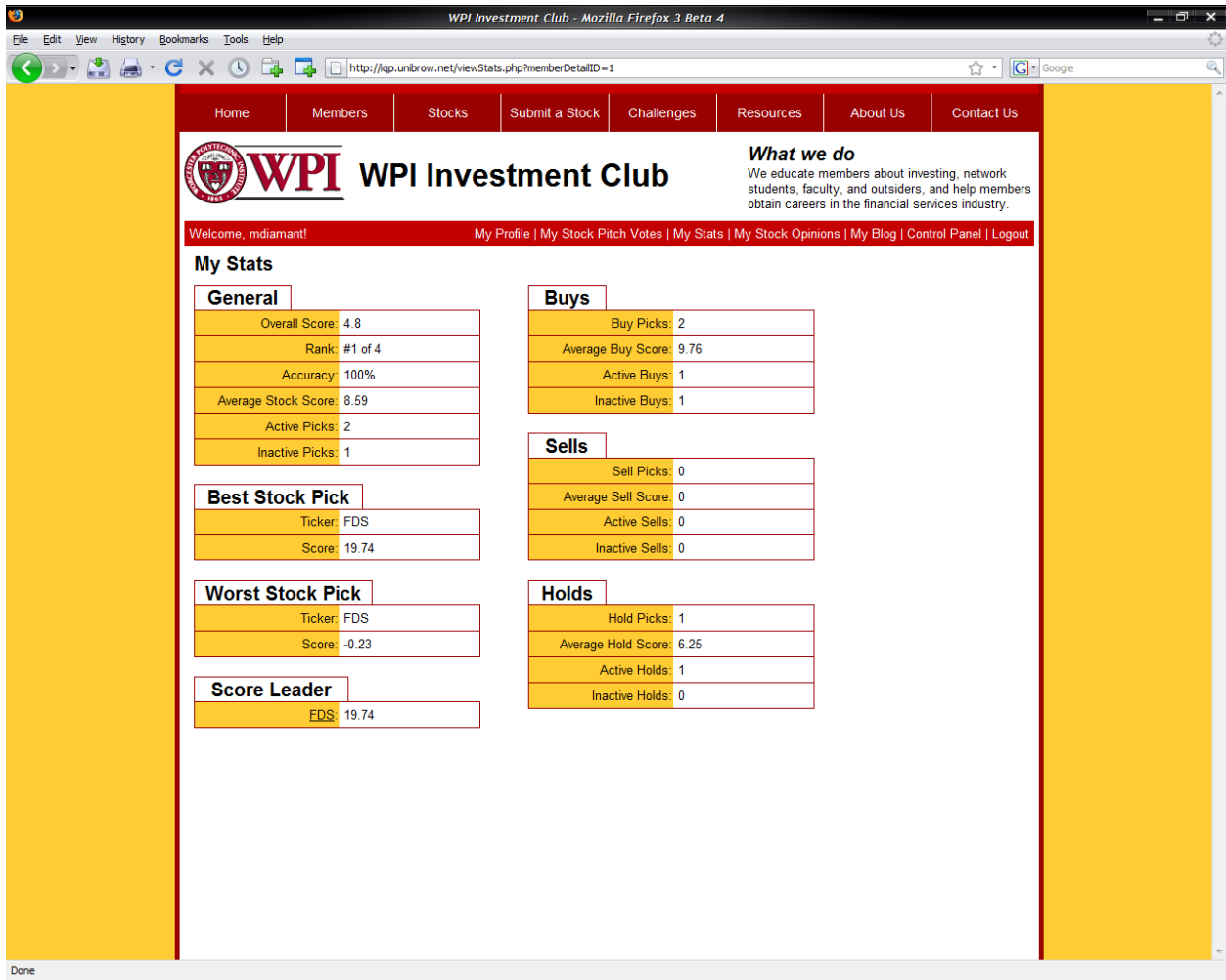


Figure 21 – Statistics Page

Figure 21 displays a club member’s automatically generated statistics page. Here, club members have their performance benchmarked. In the “General” section, club members can view their overall score, rank, accuracy, average stock score, and active and inactive pick counts. These statistics paint a broad picture of a club member’s performance. Below the “General” section is information about the club member’s best and worst stock picks, and if the club member is the score leader of any stock or stocks, it is listed in the “Score Leader” section. Since I was the score leader for FDS, FDS appears in the “Score Leader” section.

The right column presents information about a club member’s buy, sell, and hold ratings. For each type of rating, the club member can see the number of ratings, the average rating score, and the number of active and inactive ratings. It is helpful to divide the information by rating type because now a club member can determine if he/she is better at selecting buys, sells, or holds.

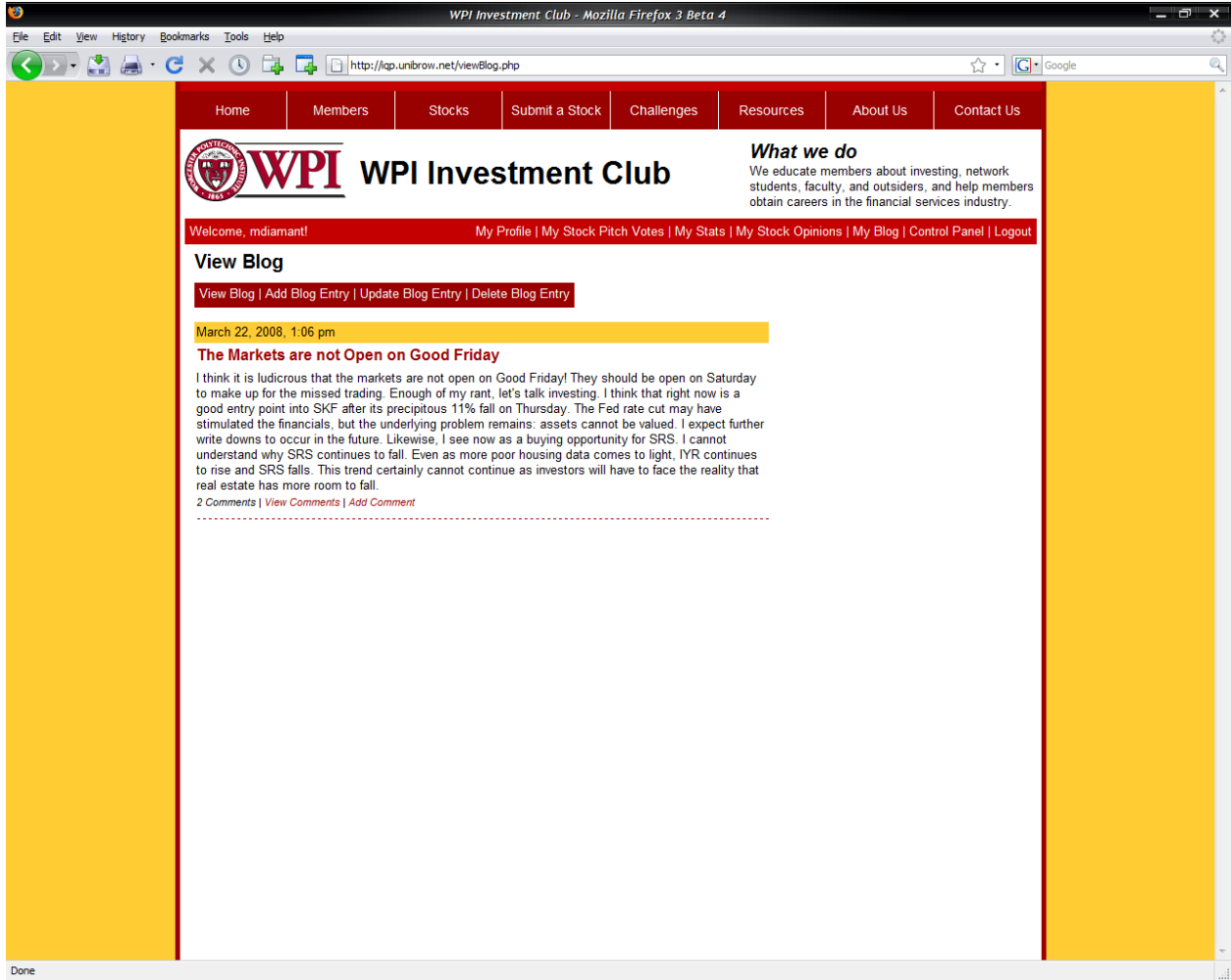


Figure 22 - View Member Blog

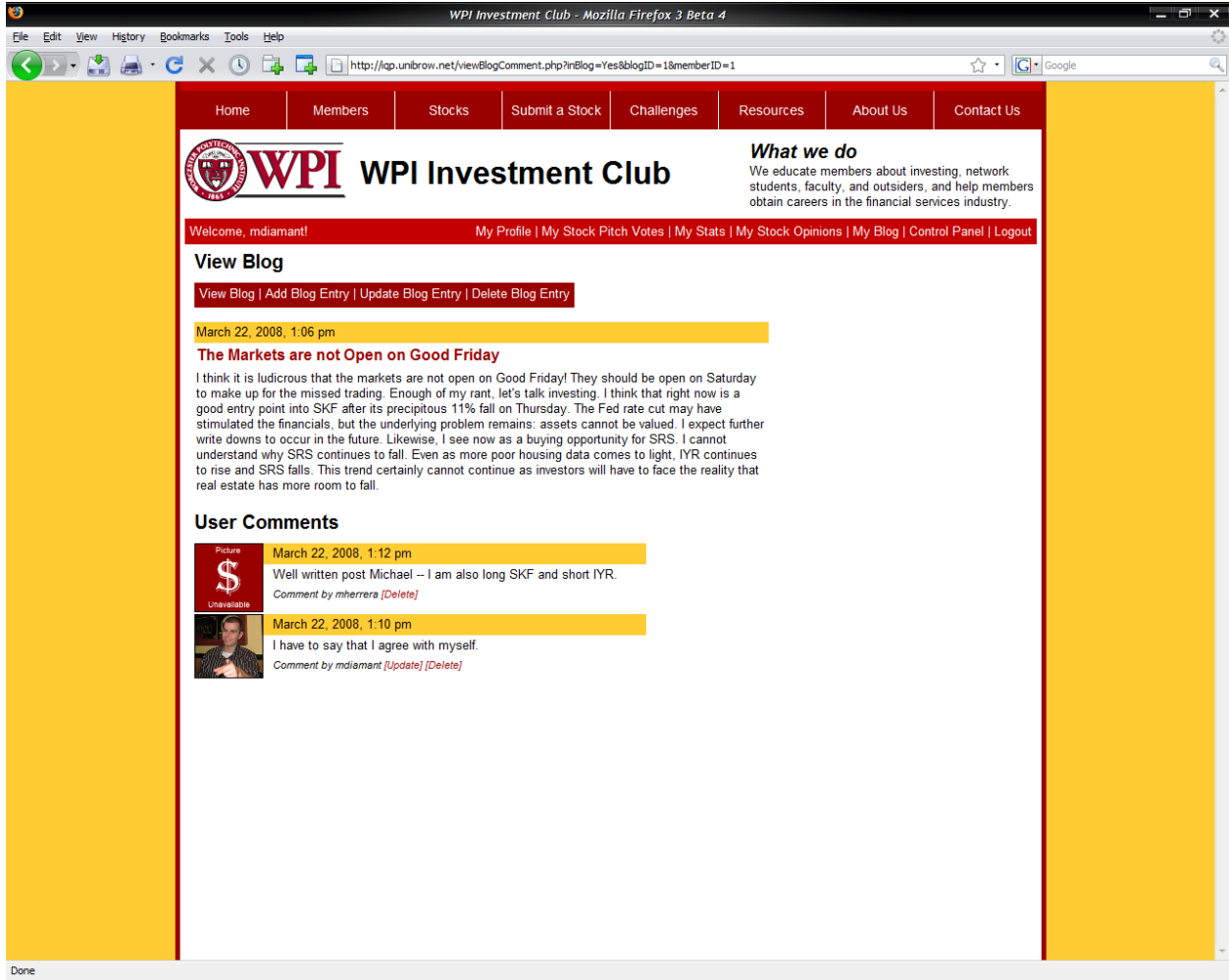


Figure 23 - Blog Comments

Figure 22 and Figure 23 illustrate member blog functionality. In particular, Figure 22, displays a sample blog post, and Figure 23 shows a view of comments made about the blog post in Figure 22. The blog page serves to allow club members to voice their opinion about investment issues that are not appropriate for the stock detail comment section. For example, in the above blog entry, I provide commentary about the recent performance of several exchange-traded funds (ETFs), which I could not do on any stock detail page. The blog provides club members with the opportunity to present additional educational material to everyone else. To make the blogs truly interactive, a comment feature exists. The example blog entry has two comments. The blog comments represent a way of creating a two way dialog among club members and to stimulate debate on the website about investment topics.

V.3.3 Administrative Functionality

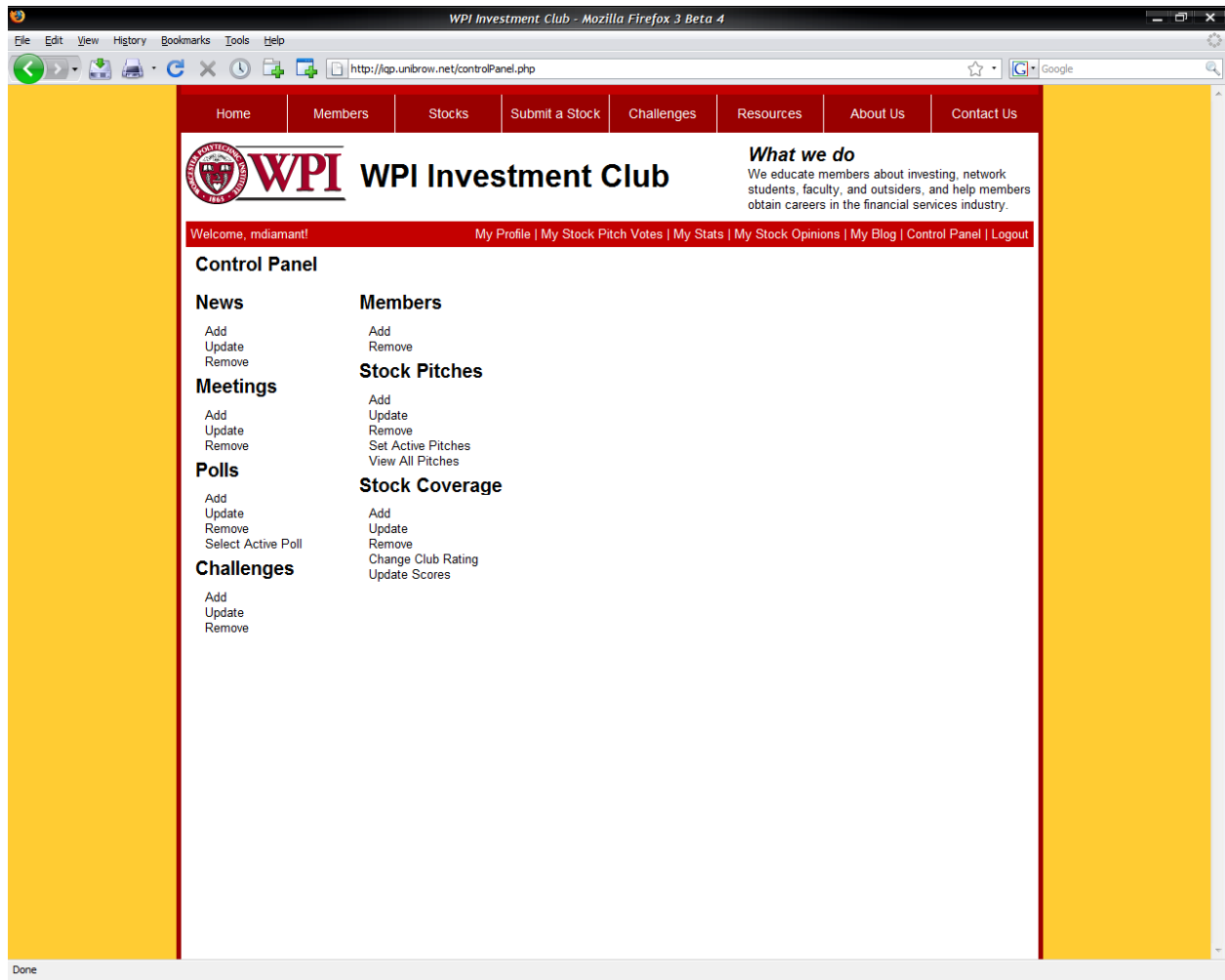


Figure 24 - Club Officer's Control Panel

The control panel is displayed in Figure 24 and can only be accessed by club officers. The control panel allows club officers to administer the entire website. Functionality is grouped by headers (e.g. News) that represent a section of the website. Actions that the club officer can take are listed below the header. Using News as an example, a club officer can add, remove, or update news entries.

One feature to take note of is the Update Scores feature under the Stock Coverage header. Clicking this link will update every club member's stock score and to calculate overall rank and accuracy. It is, however, inconvenient for club officers to manually update scores. In addition to the ability to manually update scores, a script has been programmed to automatically update the stock scores each night at midnight. This removes the responsibility from club officers to update club scores daily, but leaves the option for club officers to update scores at will.

The following figures show examples of how various add, remove, and update pages appear. Only several examples are given because most administrative functionality is similar. For example, the difference between adding a new news item and a new poll is just the form to input information is different to represent the different fields necessary.

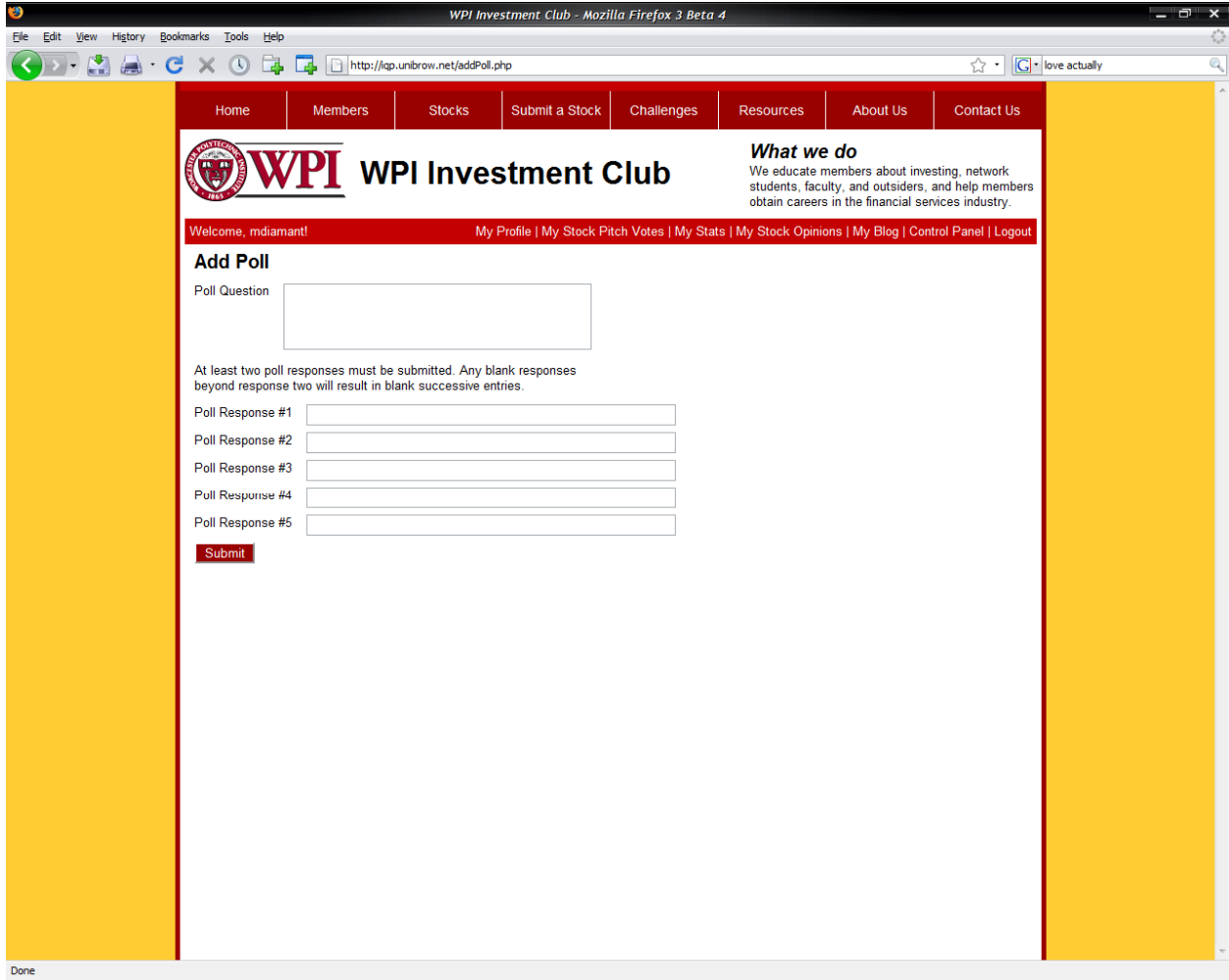


Figure 25 - Adding a Poll

Figure 25 exemplifies how a poll is added to the website. Like other administrative functions, adding a poll is driven by user inputs on a form. Clicking submit enters the form data into the database.

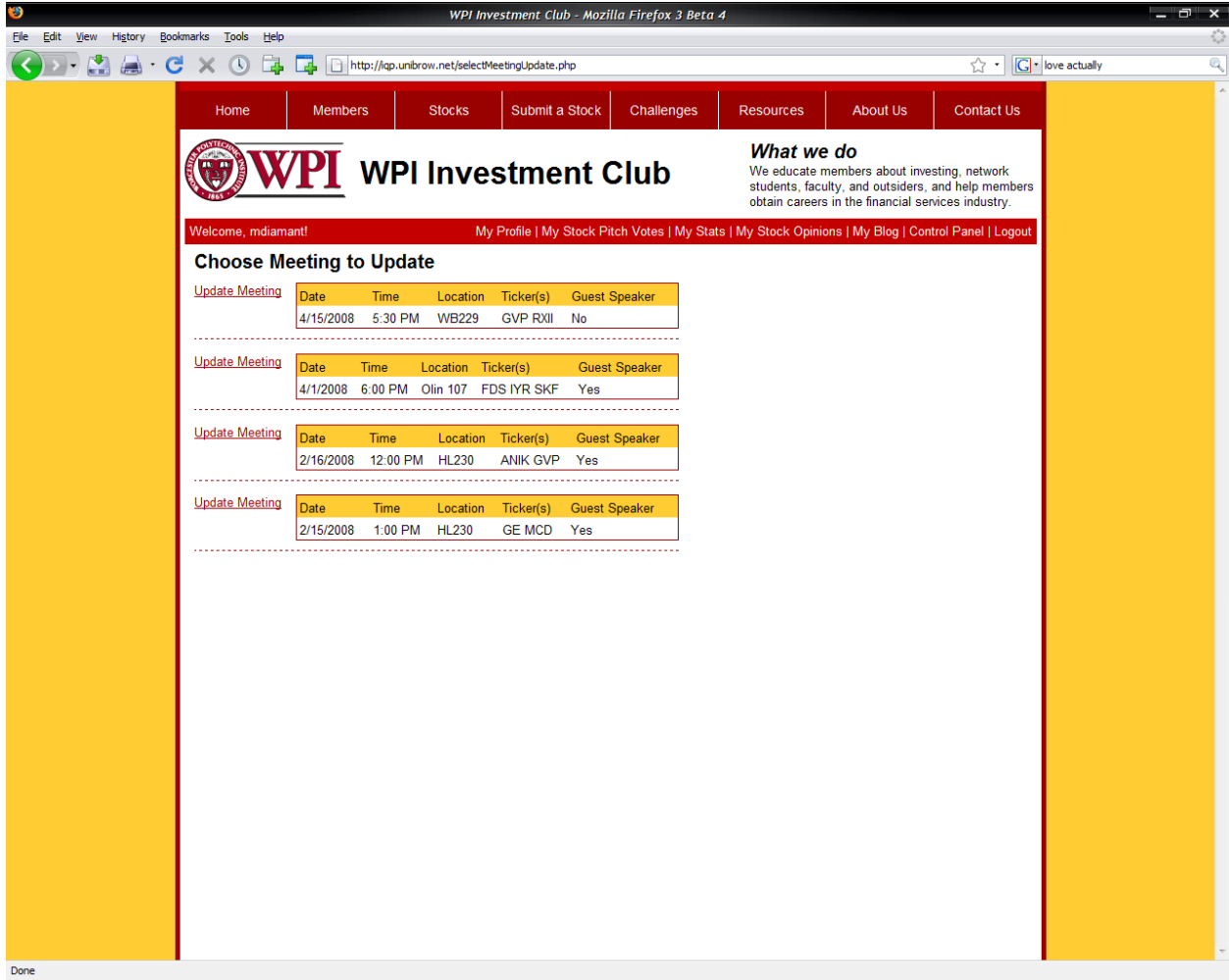


Figure 26 - Select Meeting to Update

Figure 26 shows one example of administrative editing functionality. Pictured in this example is the ability to update the details of a meeting already entered into the database. Figure 26 is representative of administrative editing pages, which provide the user with an intuitive point and click interface to update content.

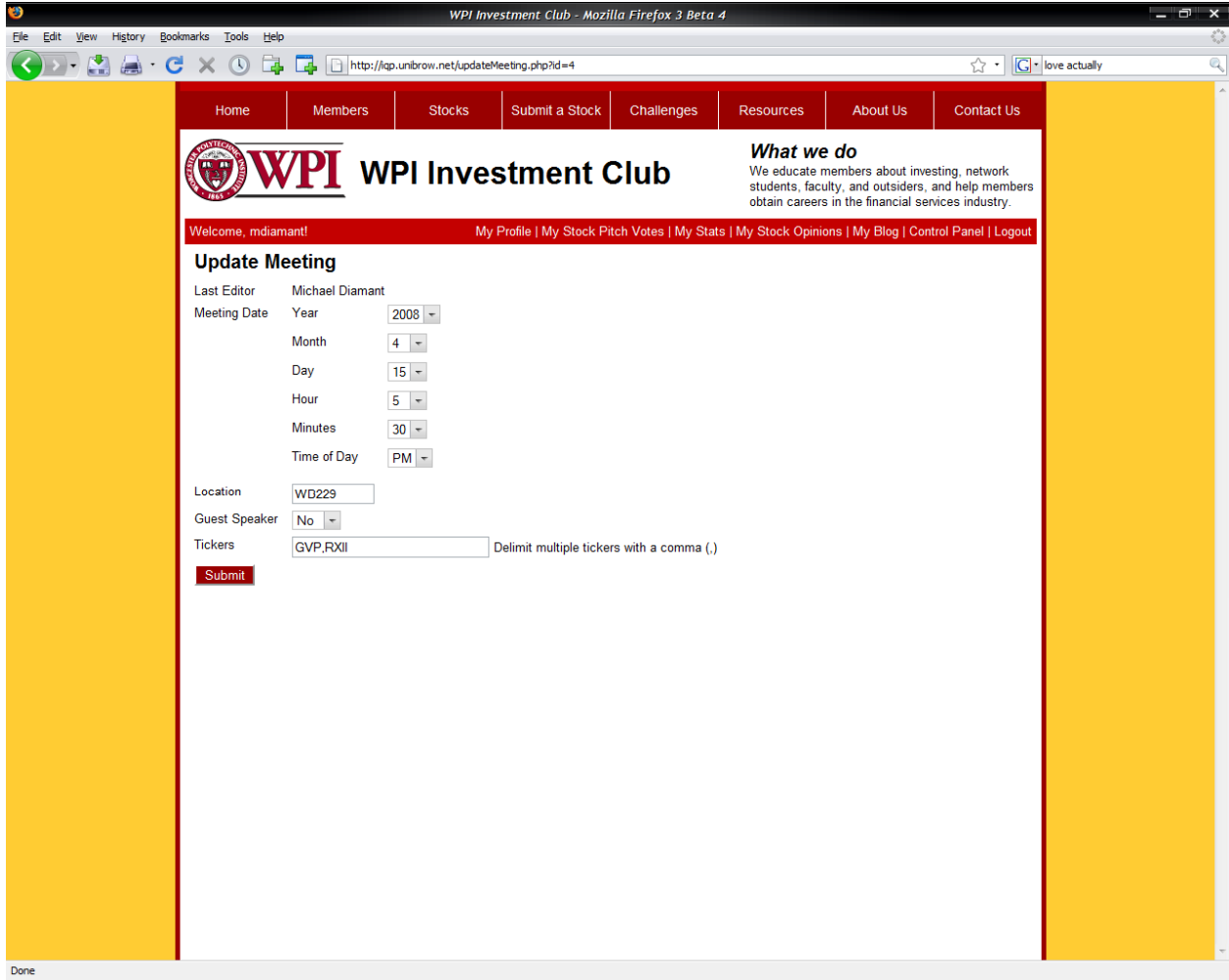


Figure 27 - Updating a Particular Meeting

Figure 27 displays the result of clicking “Update Meeting” on a particular meeting in Figure 26. Updating a particular meeting or any other content on the website involves user submission of information through a form.

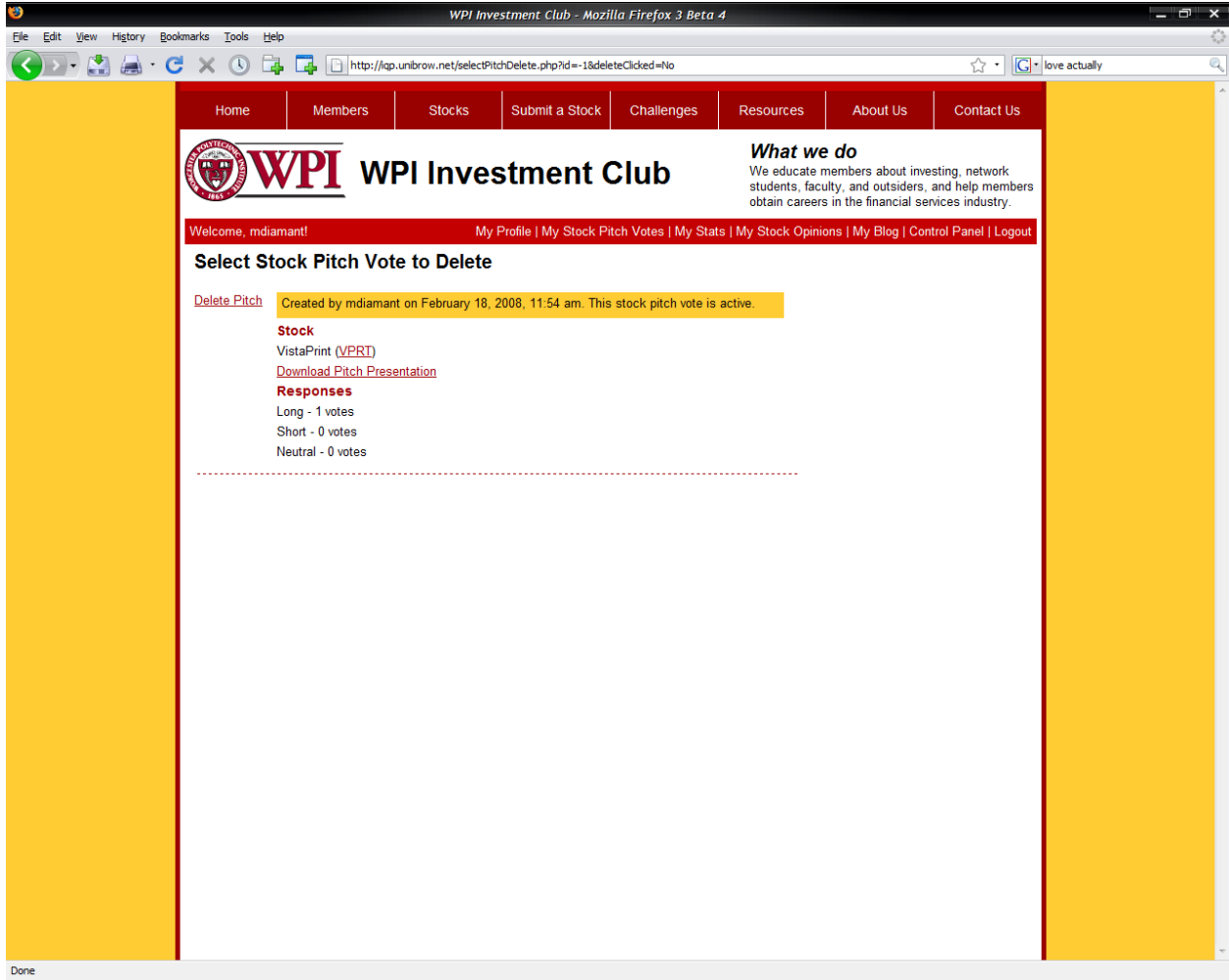


Figure 28 - Select Stock Pitch Vote to Remove

Figure 28 shows an example of how a club officer can remove content from the website. In this example, the content to be removed is a stock pitch vote. Similar to the interface shown in Figure 26, club officers can easily remove content from the website by pointing and clicking.

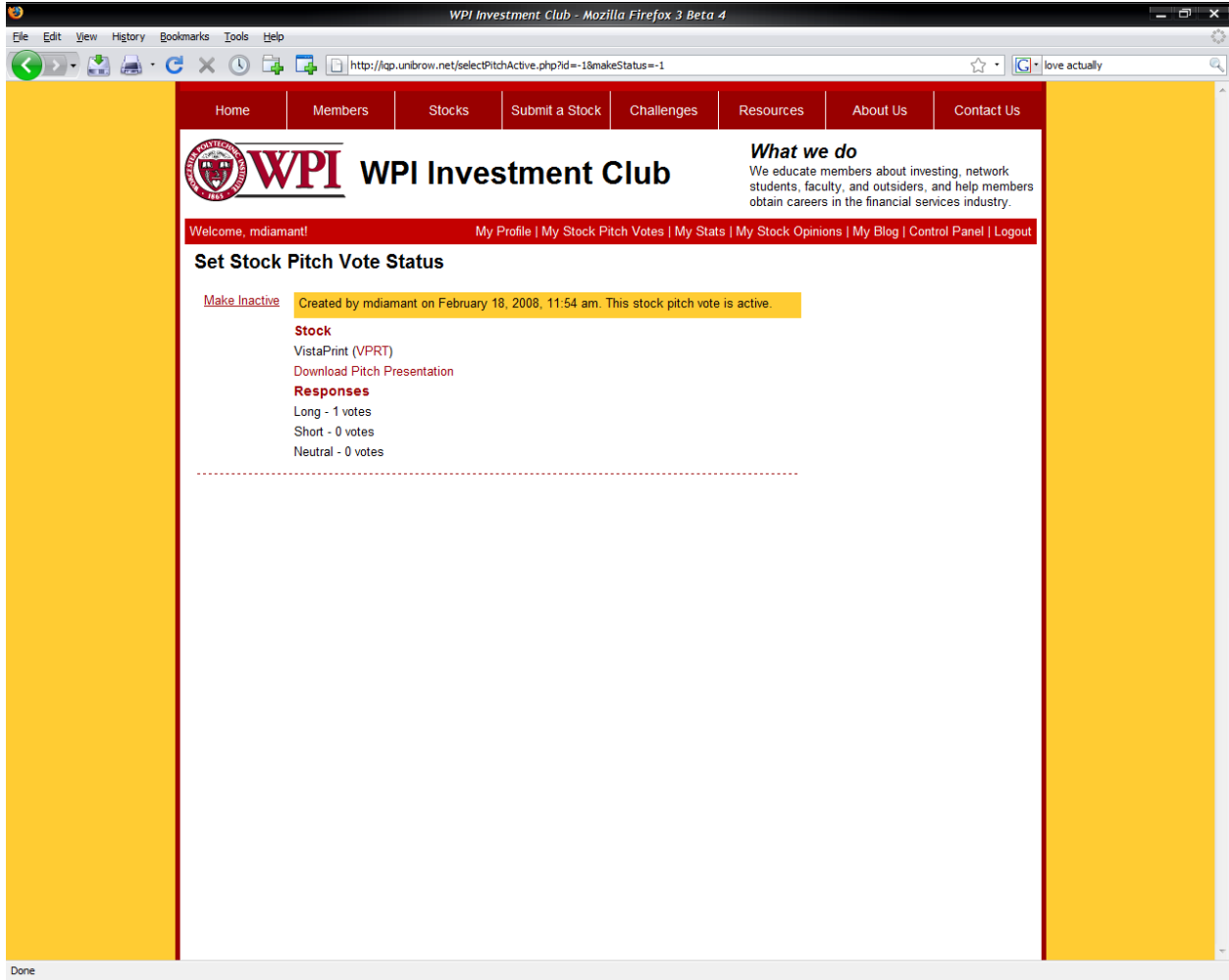


Figure 29 - Set Stock Pitch Vote Status

Figure 29 demonstrates how club officers can change the status of a stock pitch vote. Setting the vote to inactive prevents it from being displayed to users and making it active presents the vote to club members. Similar to previous figures, like Figure 28, the user controls website functionality through an intuitive interface.

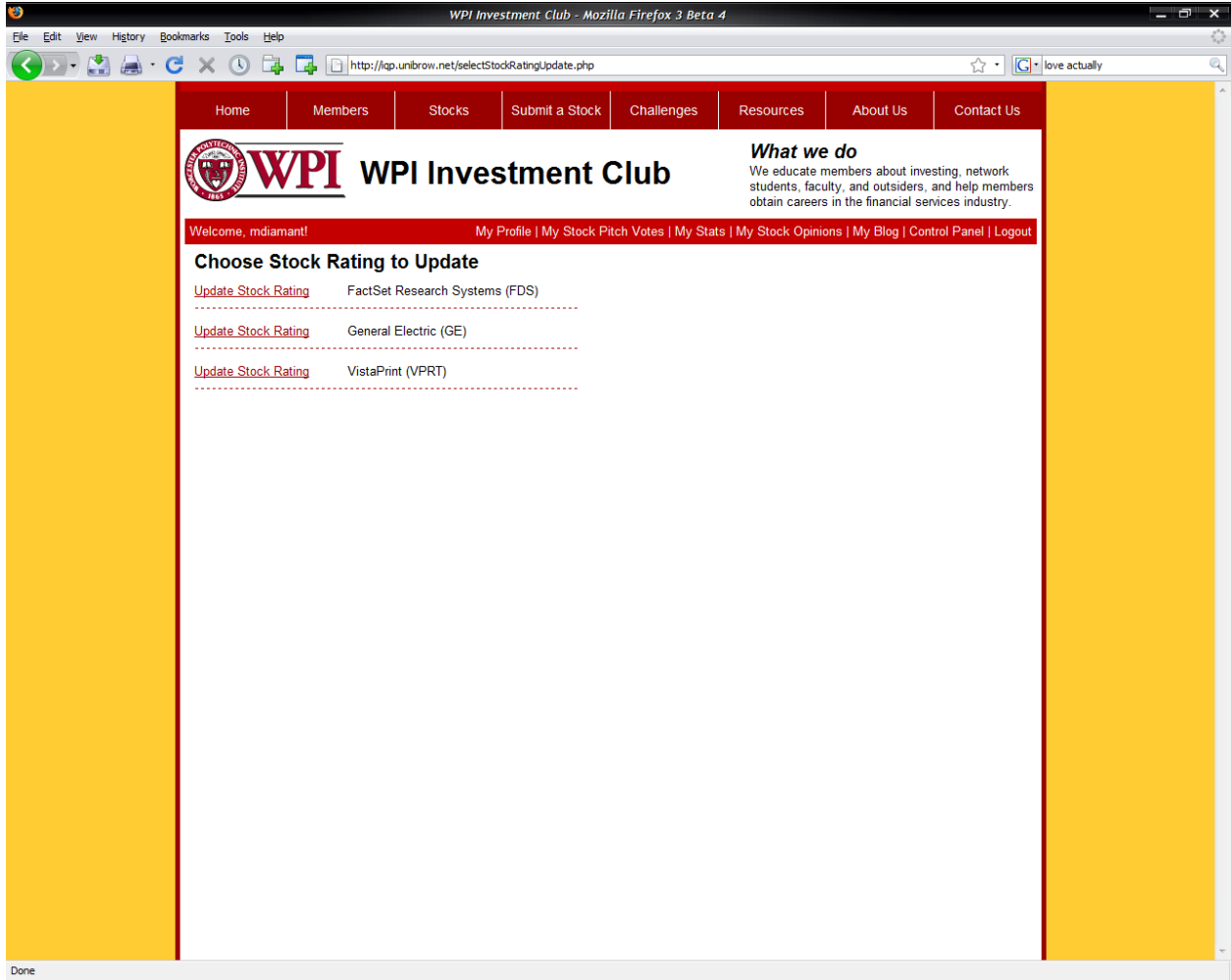


Figure 30 - Change Club Stock Rating

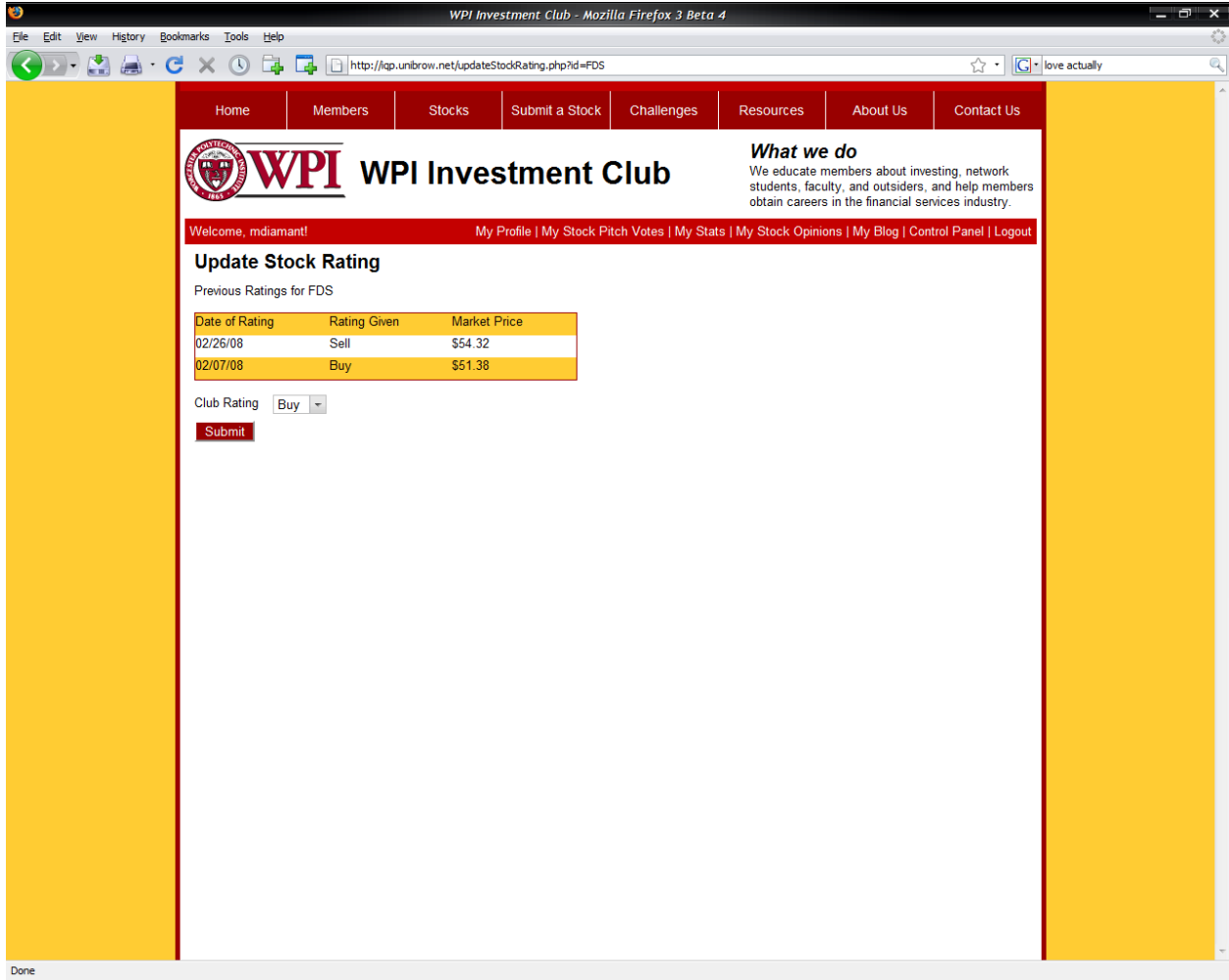


Figure 31 - Set Club Stock Rating

Figure 30 and Figure 31 illustrate the process of updating the club's rating of a particular stock. Figure 30 presents a complete list of stocks covered by the investment club and allows a club officer to select a particular rating to update. Figure 31 shows the result of selecting a particular stock. Club officers view a rating history of previous ratings and are presented with a dropdown menu to select a new rating.

The screenshot shows a web browser window titled "WPI Investment Club - Mozilla Firefox 3 Beta 4". The address bar displays "http://qap.unibrow.net/addMember.php". The website has a red navigation bar with links: Home, Members, Stocks, Submit a Stock, Challenges, Resources, About Us, and Contact Us. Below the navigation bar is a header section with the WPI logo and the text "WPI Investment Club". To the right of the logo, it says "What we do" and "We educate members about investing, network students, faculty, and outsiders, and help members obtain careers in the financial services industry." Below the header, a red bar contains the text "Welcome, mdiamant!" and a series of links: "My Profile | My Stock Pitch Votes | My Stats | My Stock Opinions | My Blog | Control Panel | Logout".

The main content area is titled "Add Club Member" and is divided into two sections:

- Personal Information**
 - First Name:
 - Last Name:
 - Major:
 - Year of Graduation:
 - E-mail:
 - User Type:
- Investing Profile**
 - Investing Style:
 - Risk Tolerance:
 - Investing Experience:
 - Favorite Sector:

A red "Submit" button is located at the bottom of the form.

Figure 32 - Add Club Member

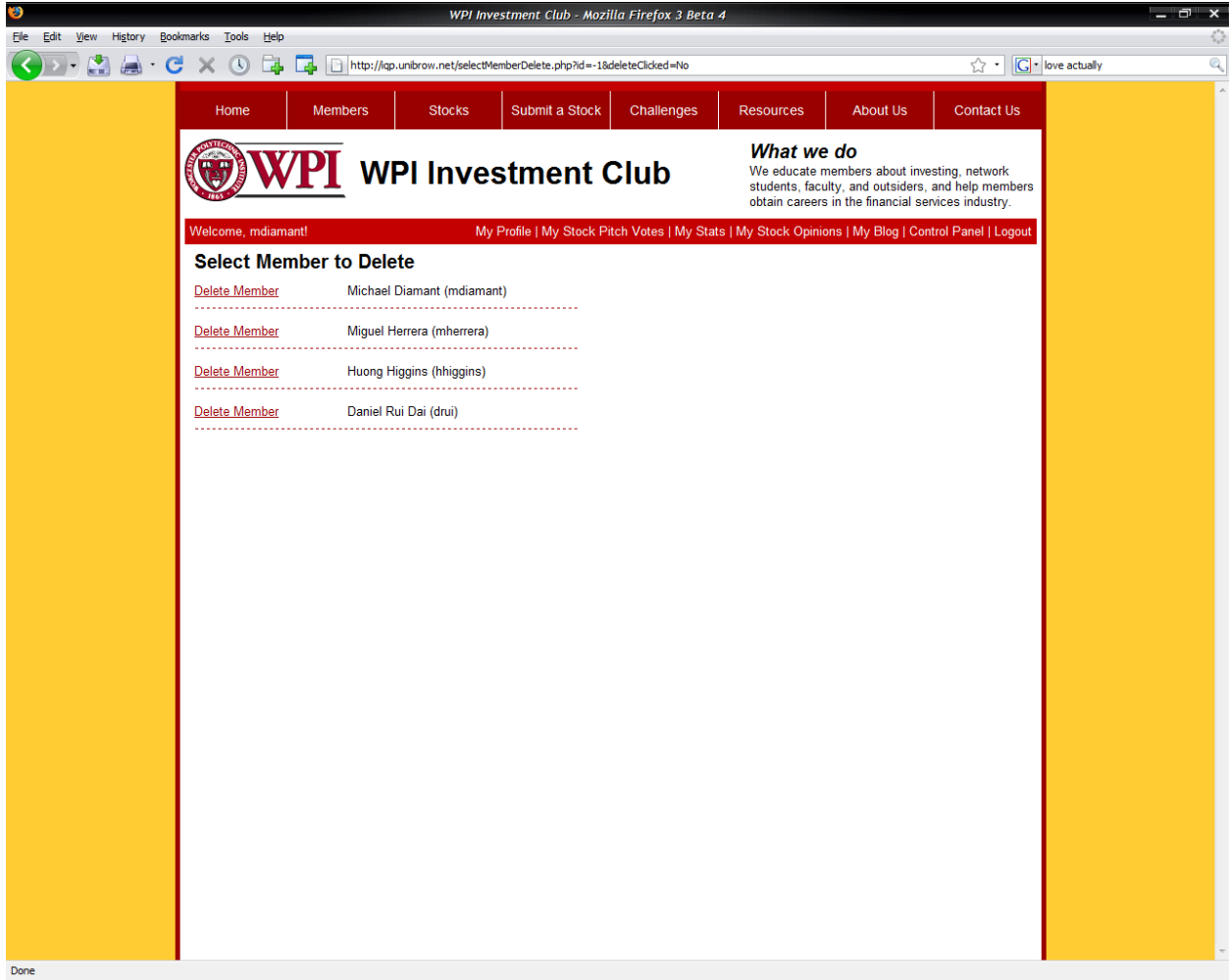


Figure 33 - Remove Club Member

Figure 32 and Figure 33 display the two interfaces used to manage website users. Figure 32 shows the form used to add users to the website. Similar to other forms, information is collected through several forms of input, including text boxes and dropdown menus. Figure 33 shows how a club officer can remove a user from the website. User removal is a simple process that only requires a club officer to select the user or users that are to be removed from a list. The database system transparently handles the removal process.

V.4 Financial Data Stream

The WPI investment club website makes use of financial data in order to calculate and to benchmark financial performance of club members. The financial data stream that the WPI investment club utilizes is the Yahoo! Finance data stream. Each stock on Yahoo! Finance has a link to download recent data, as shown in the highlighted red box below.

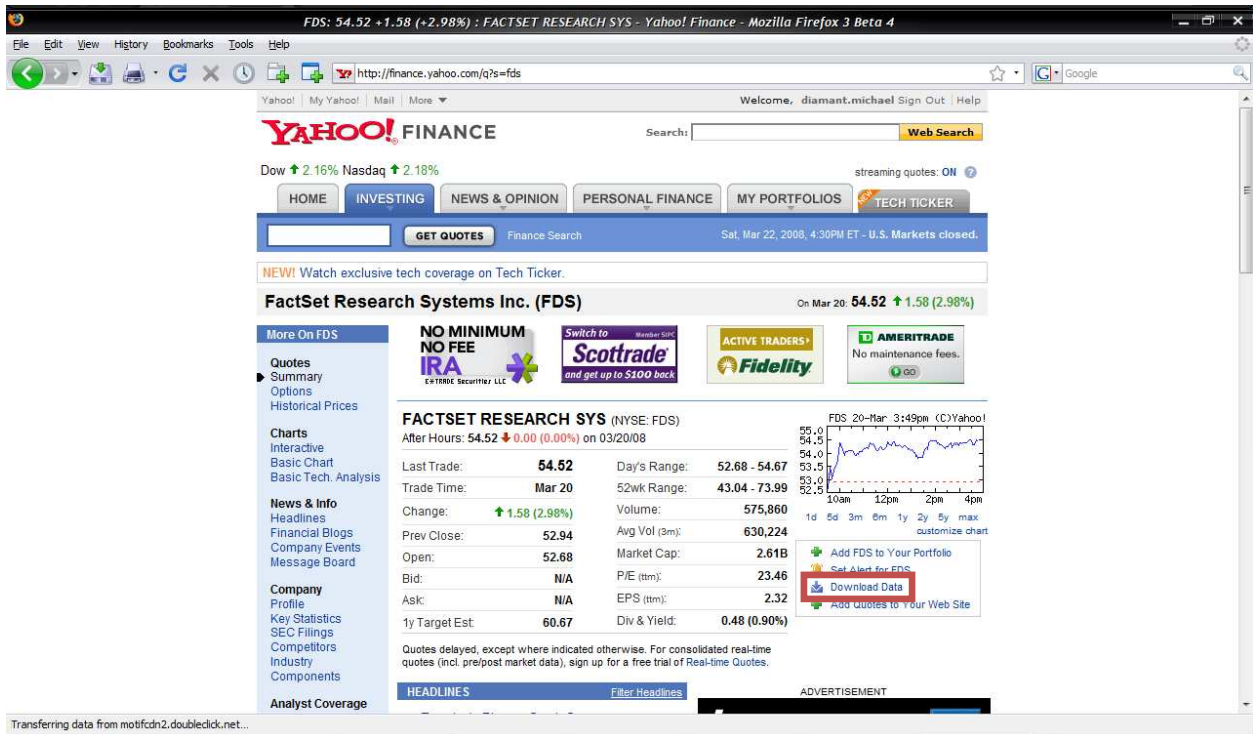


Figure 34 - Download Financial Data from Yahoo! Finance

The downloaded data comes in Excel spreadsheet format, which can be parsed to read the data contained within the document. The data contained in the spreadsheet is the data shown in the “Detail Data” section of the stock detail page. Each time a user views the stock detail page, the underlying script that was programmed into the WPI investment club website, downloads the appropriate spreadsheet, parses the data contained in the spreadsheet, and outputs the financial data. The financial data stream is critical to the operation of the website. Having a constant stream of financial data allows the S&P 500 index level and stock prices to be tracked. This is essential to calculating and benchmarking club member financial performance. Without the stream of financial data obtained from Yahoo! Finance, it would be impossible to provide stock rating services on the WPI investment club website.

V.5 Website Address

The website for this IQP will reside at the following URL: <http://iqp.unibrow.net>. The website cannot be hosted by WPI because WPI does not support PHP. PHP is the programming language used throughout the website to interact with the database and to parse financial data. Thus, without PHP support, the website would be completely static, without user interaction. The website will continue to be hosted at the above address to ensure full website functionality.

VI Investment Literature

VI.1 Model Stock Pitch and Report

The model stock pitch serves to provide an example to investment club members on how to pitch a stock. The stock pitch format is taken directly from the form presented on the investment club website. The report follows a stock pitch and provides additional details

explaining why a particular stock is a buy or a sell. The stock used for this example is FactSet Research Systems (FDS).

VI.1.1 Model Stock Pitch

Background Information

Company Name: FactSet Research Systems

Ticker: FDS

Industry: Information & Delivery Services

Market Cap (\$): 2.56B

Rating: Buy

Company Ratios

P/E Ratio: 23.61

Current Ratio: 3.72

ROE (%): 28.45

ROA (%): 20.35

Operating Margin (%): 32.36

Industry Average Ratios

P/E Ratio: 16.41

Operating Margin (%): 8.50

Short Response

What makes this company unique? In other words, what is its competitive advantage? For what time period is your rating valid?

FDS aggregates financial news from hundreds of databases into one analytical software suite that allows users, typically financial analysts, to track and to research portfolios, companies, industries, and economies. Their software suite is divided into solutions for buy-side and sell-side analysts, allowing them reach a greater target market. Their recent acquisition of DealMaven, another produce of financial workflow software increases the ability of FactSet to serve customers. I rate FDS a buy for the next year because the software that FDS produces helps financial institutions differentiate themselves from competition. Thus, even in the face of a recession, these firms should be investing in the services FDS provides.

Why will this company outperform/underperform companies in the same industry?

Competitors to FDS include Bloomberg, Reuters, and Thomson. Reuters and Thomson are many times larger than FDS, but currently hold partnerships to buy and sell financials news and data from FDS. It would be to their disadvantage to stop doing business with FDS and may make FDS a potential buyout candidate. Bloomberg competes directly with FDS as a provider of financial workflow software. Although Bloomberg is larger, FDS holds a distinct advantage. Bloomberg customers must install the Bloomberg terminal, a physical unit, while FDS customers simply register for service online and access data online with minimal amounts of local software installation. This approach allows FDS to be more agile in rolling out software updates, which are simply sent over the Internet and helps FDS setup new customers more quickly. FDS also boasts a 90% customer retention rate over the past fifteen years, which speaks to the quality of their products. FDS will outperform other companies in the same industry because their products are more agile than that of competitors, such as Bloomberg.

After performing fundamental analysis, which aspects of the stock are strongest?

Many points stand out positively after my fundamental analysis. FDS boasts an ROE and an ROA over 20%, which imply that FDS returns strong value for invested capital and assets.

The firm carries no debt and has over \$170 million in cash, which will allow FDS to continue investing in new products even in tough economic times. Another data point that attests to the strong financial position that FDS holds is its current ratio, 3.72, which indicates that FDS will have no problem covering short-term liabilities. It is also noteworthy that FDS operating margins are approximately four times greater than the industry average, which indicates that FDS operates more efficiently and at lower variable costs than industry competitors.

After performing fundamental analysis, which aspects of the stock are weakest?

No anomalies exist in the financial statements of FDS and as explained above, FDS touts much fundamental financial strength. The only area that indicates any possibility of weakness may be the P/E ratio. The FDS P/E ratio of 23.47 is greater than the industry average of 16.41, and is significantly greater than the Thomson P/E ratio of 5.91. FDS also has a P/E ratio that is higher than the S&P500 average P/E ratio, which is 19.43. Currently, an elevated P/E ratio is appropriate because FDS increases earnings at a rate that is faster than the industry average. However, a higher P/E ratio indicates greater expectations for future growth and if financial institutions choose not to invest in FDS software during the current economic slowdown, then FDS will suffer from multiple contraction, which will bring down the stock price.

VI.1.2 Model Stock Report

The screenshots below capture the stock report.

Written by Michael Diamant
March 12, 2008

WPI Investment Club Research Report

FactSet Research Systems (FDS)

Stock Rating

Buy rating for one year on strong earnings growth, dynamic product offering, and commitment to quality of service.

Company Background

FactSet Research Systems, Inc. is a leading provider of financial information and analytic applications for investment professionals. The firm aggregates hundreds of financial databases into one software suite. The software suite is divided into three solutions: (1) **DIRECTIONS**, (2) **IBCentral**, and (3) **Marquee**. DIRECTIONS is the solution for investment managers, providing company, real-time, portfolio, market, and economic analytics. IBCentral is the solution for sell-side financial professionals. IBCentral includes capabilities similar to DIRECTIONS and also includes M&A tools and integrates a suite of financial analysis tools designed to work in Microsoft Office from their recent acquisition of DealMaven. Marquee is an analytics, research, and market data solution that also integrates with DIRECTIONS and IBCentral. Marquee provides level II streaming quotes, real-time portfolio management, and real-time scrolling financial news. FactSet provides consulting services to work with clients during and after product installation. FactSet provides specialized care for clients through 24-hour support, free global training seminars, online tutorials, and a dedicated security team. FactSet Research Systems was founded in 1978, has offices around the world, and is headquartered in Norwalk, CT.

Competitors Overview

1. **Bloomberg** (Privately held) provides financial data through its Bloomberg terminals. It has expanded internationally and offers additional services, like Bloomberg TV.
2. **Reuters Group** (RTRSY) is best known as a news agency, but actually derives 90% of income from financial services business.

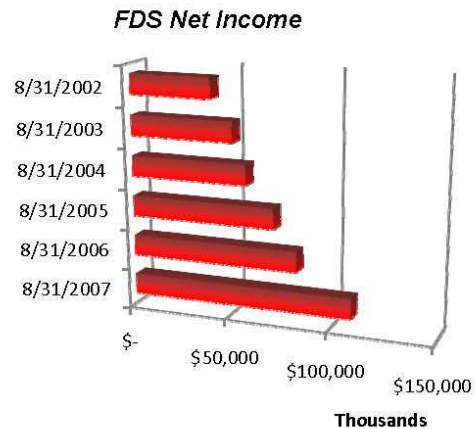
3. **Thomson Corporation** (TOC) offers financial data through its flagship program, Thompson ONE. Thomson is in the process of acquiring Reuters to form an information giant.

Key Facts

- User community grew to all-time high of **35,000** users in fiscal year (FY) 2007.
- Employee count grew **23%** to **1,653** in FY 2007.
- Client retention exceeded **95%** in FY 2007.
- International subscriptions have increased approximately **10%** since 2004 to compose **30%** of all sales.

Financial Performance

FactSet's financial performance is solid. Over the past 29 quarters, FactSet has experienced 27 consecutive quarters of growth. Below, is a graph of net income from 2002-2007 and a horizontal analysis of net income growth.



FDS Year-Over-Year Net Income Growth

8/31/07	8/31/06	8/31/05	8/31/04	8/31/03
32%	16%	24%	13%	26%

Written by Michael Diamant

March 12, 2008

Growth Story

The reason to buy FactSet is threefold. FactSet has had strong financial performance as is evidenced through by YOY net income growth since 2002. FactSet has superior operating margins, **32.36%**, versus an industry average of 5.91%. FactSet has a P/E ratio of 23.32, which undervalues FactSet. The firm has grown net income over 20% on average for over five years, currently has no debt, and a cash reserve of \$171.31M. Furthermore, FactSet boasts a return on equity (ROE) of **28.45%** and a return on assets (ROA) of **28.45%**. The industry average P/E ratio of 22.10 again reflects that FactSet is undervalued because FactSet is growing at a pace much greater than the industry average.

Beyond its fundamentals, FactSet is also a buy because of its commitment to its clients and employees. The commitment to clients is evidenced by a retention rate over 95%. FactSet was named in January 2008 as one of FORTUNE'S "100 Best Companies to Work For". It was ranked **20th** on the small companies list and **52nd overall**. I can attest to these ratings because I visited FactSet headquarters for an onsite job interview. During the day I was exposed to the company software and to the employees. Each employee I met throughout the day was **incredibly bright** and well-versed in their product and was **very upbeat** about company culture. FactSet truly works together as a team that incorporates and values all employees, which is an intangible benefit that translates into a better product and better support.

The third reason for FactSet's growth and buy rating is the product itself. FactSet provides its software suite almost entirely over a privately owned wide area network (WAN). This provides a distinct advantage in that there is minimal software to install on local client machines and all data and updates are serviced through the WAN. With competitor's services, such as Bloomberg, the client must install a Bloomberg client terminal onsite. This imposes large monthly subscription fees and presents difficulties when a customer decides to deactivate membership. In contrast, FactSet can deactivate a subscription merely by disallowing access to the WAN, which is a significant operational benefit. It is FactSet's thin client approach in their software suite

design that provides an advantage over larger competitors.

Price History



FactSet's stock price has suffered over the past 52 weeks, dropping over **19%**. Comparatively, the S&P500 has only lost 4%. Currently, the stock sits **14.1%** below its 200 day moving average and is **29%** below its 52-week high. Weak stock price history should not discourage investment because the economy and specifically, the financial services sector is experiencing a slowdown due to subprime fallout. However, the growth story for FactSet remains intact and this weakness should be looked upon as a buying opportunity.

Conclusion

FactSet is down nearly 30% from its 52-week high and there may be further downside risk because of the current economic slowdown. This price depreciation should be considered a buying opportunity because FactSet is well-positioned to weather a financial storm with its \$171.31M cash reserves and a healthy current ratio of **3.721**.

Financial institutions cannot stop subscribing to FactSet even in a slowdown because FactSet has **integrated their software** with other popular software, like Microsoft Office. Furthermore, FactSet's software suite provides a competitive advantage by aggregating and organizing information. In fact, because FactSet helps financial institutions create a competitive advantage financial institutions should look **more** to FactSet during an economic slowdown to stimulate business.

The easy to setup subscription approach that FactSet has embraced will continue to attract financial institutions and help FactSet spread into new markets.

Figure 35 - FDS Investment Club Research Report

VII Conclusion

VII.1 Summary of Accomplishments

The project has been successful in achieving all goals described in the project motivation. The online operational base is functioning and fulfills all of the database requirements. The investment club is in the process of being formed on-campus and I have found three other individuals that are highly interested in acting as leaders to develop the organization. Our team of officers has setup the investing club to be fully functional by A-term 2008. The information session held in D-term 2008 has proven to me that there exists significant interest in investment education at WPI.

The project is also a success in terms of my personal development. Developing the investment club required researching existing clubs and having many brainstorming sessions to shape the WPI investment club. The positive response from WPI students completes my personal motivations for investment club development at this time. Next year, as the investment club begins operating, I hope to leverage the online operational base as a tool that will enable student learning to fulfill my remaining personal motivations. The development of the investment club website has been a beneficial learning experience in website and database development. This learning experience has taught me firsthand how to better manage large web-enabled database development projects.

Accomplishing the setup of the investment club and developing my personal technical skills through the development of the investment club website, represent the fulfillment of IQP requirements. The WPI investment club fulfills a social need by providing a new environment to students to share investing ideas. The project fulfills technical requirements through the web-enabled database that has been constructed to manage club operations. Research has been performed on existing investment clubs to form a model for the WPI investment club. Research has also been performed on the implications of information overload on individual investors and I have suggested one new way in which information overload can be reduced. Furthermore, the future projects that are listed below represent new avenues into which research can be conducted.

This IQP represents a success to me and to the WPI community. From a personal perspective, the project has enabled to me to grow my leadership and technical skills, and has helped me develop my ideas into a meaningful product, the online operational base. The WPI community will benefit from this IQP indefinitely. Each year, students will collaborate with each other and exchange new investing ideas. As the WPI investment club matures, the benefit provided to the WPI community will only continue to grow as the WPI investment club is better able to handle more students.

VII.2 Future Projects

Although the goals of this project have been reached, there are projects that can be undertaken in the future that use the work for this IQP as a starting point. The most prominent project would be the development of the tag-based rating system for financial information. The group that takes this task must develop the RSS news reader to parse financial news from a source like Yahoo! Finance. Second, the current database must be modified to allow financial news and user-submitted tags to be submitted. Third, an algorithm must be developed to efficiently search each news article for the user-submitted tags. Last, a formula for scoring the article sentiment must be devised. The aim of the project would be to reduce information overload and as an extension of the system, testing can be conducted to determine if in fact,

information overload is reduced. Testing should aim to discern how effective the system is in aiding investment decisions. For example, test participants can be told to make an investment decision in a timed environment. In one case they are given access to the news articles and the sentiment ratings (generated before the test), and in a second case, participants are given just news articles.

A second project idea can focus on how information overload affects individual investors. The interested group can study how individual investors make investment decisions by polling and interviewing individual investors. It may also be of interest to study how the brokerage firms of the participating individual investors provide information to the investors. In particular, how do their websites organize research materials? By studying the brokerages' websites, the group can create several layouts that represent different ways to display information. Then, the group can ask participants to make an investment decision with the information presented in each of the layout styles. After making a decision, the participants can be asked to indicate if they were overloaded by information. This study would be helpful in understanding how information overload affects individuals and how can investors and brokerage firms organize their information to better support investment decisions.

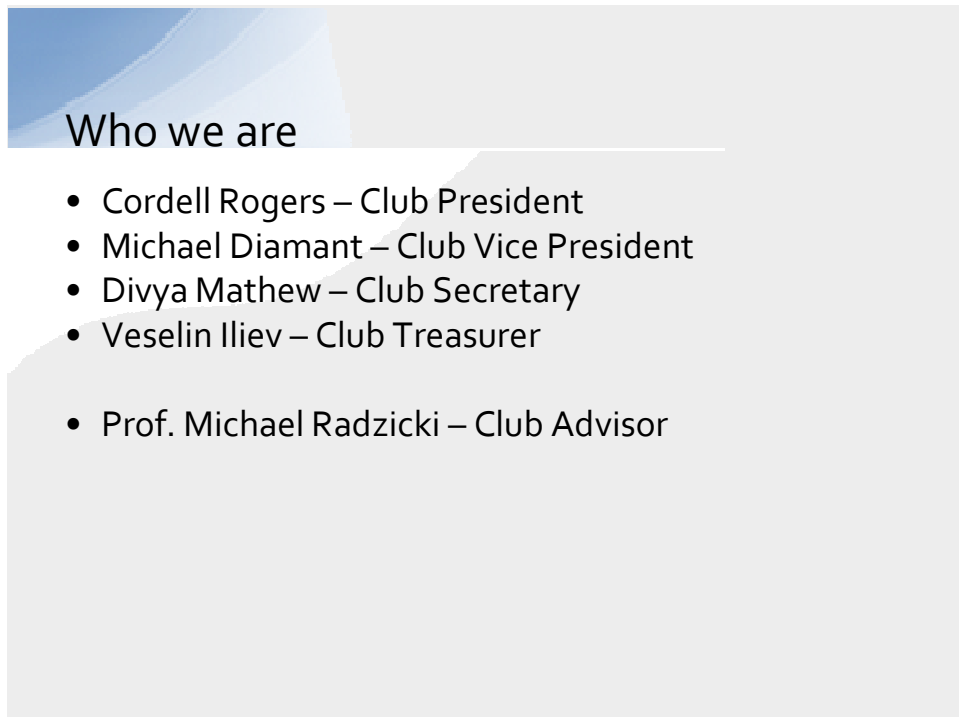
A third project idea is to study information overload and decision making in a different context. A study conducted by Brad Tuttle and F. Greg Burton studied information processing per unit of time. In their study, participants were asked to hypothesize how a stock's price will move in the future when given a number of financial information cues. When participants were given an incentive, money, the researchers noted that participants took longer to respond and processed additional information cues. Their study suggests that an individual has a limited amount of information processing ability per unit of time and that their overall information processing ability is higher. The study also suggests that the proper incentive can induce an individual to spend more time making a decision, which according to their results, allows an individual to process more information (Tuttle & Burton, 1999).

An IQP group can study how to align incentives of decision makers in the workplace with the goal of improving the firm (e.g. increasing shareholder value in a public company). The group can look at previous attempts to align the incentive of a decision maker with the shareholders and how much of an incentive is necessary to induce the use of more information in decision making. The group can also conduct tests to see at what point do incentives stop providing information processing benefits, that is, when do individuals become overloaded with information? The work done in this IQP would help firms deal with the principal-agent problem, an example of an asymmetric information problem, where the principal tries to align the incentives of the agent with that of the principle. In addition, the work done on this IQP would develop a deeper understanding of information processing capabilities, an issue that is also critical to function of firms.

A fourth project idea is to use the online database developed for this project to assist learning in finance and accounting classes at WPI or possibly in regional high schools. The online database can be used to provide an interactive learning environment for students. The database can be used to track students' abilities to pick stocks, much like a stock simulator. The group that undertakes this project can modify the database to reflect a classroom environment rather than a club organization environment, such as removing the news feature and adding features deemed appropriate for the classroom setting. The group can deploy the database in classrooms and interview database users for feedback. For example, the group can look for ways to improve the existing system and for features that should be added. The goal of this IQP would

be to discover how it is possible for an online database, like the one created for this IQP, to be used to assist financial education at the high school or college level.

Appendix A: Investment Club Information Session Presentation



Our Mission

- To have students to **learn** and **practice** good investment strategies
- To help interested students build a **career** in financial services
- To have **fun!**

Club Activities

- Host meetings twice a month to introduce new investment strategies and ideas
- Invite guest speakers to present and to educate us on various investment topics
- Hold group stock evaluations to explain the process investment research and evaluation
- Host fictitious investing competitions
- Present an investment education series throughout the year

Current Achievements

- Obtained knowledgeable and dedicated club advisor
- Developed a relationship with SGA to ensure future club support
- Created a club website to provide resources and to promote investment research

Club Future

Short-term Goals (1-2 years)

- Grow club membership and continue to develop club activities
- Provide resources to club members and dedicate more library space to investing resources

Long-term Goals (3-5 years)

- Transform club into a non-profit organization to allow investing with real money
- Sponsor trips to places of interest (e.g. Wall Street)

How to Join

- Sign-up today
- Come to any of the club meetings next year
- Contact us via e-mail
- Sign-up at the activities fair during new student orientation

Contact Information

- Club officers ticexecs@wpi.edu
- Cordell Rogers – crogers@wpi.edu
- Michael Diamant - mdiamant@wpi.edu
- Divya Mathew – divmath@wpi.edu
- Veselin Iliev – veselin@wpi.edu

Thank you

- Questions?
- Comments?
- Concerns?

See you in A-term 2008!

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