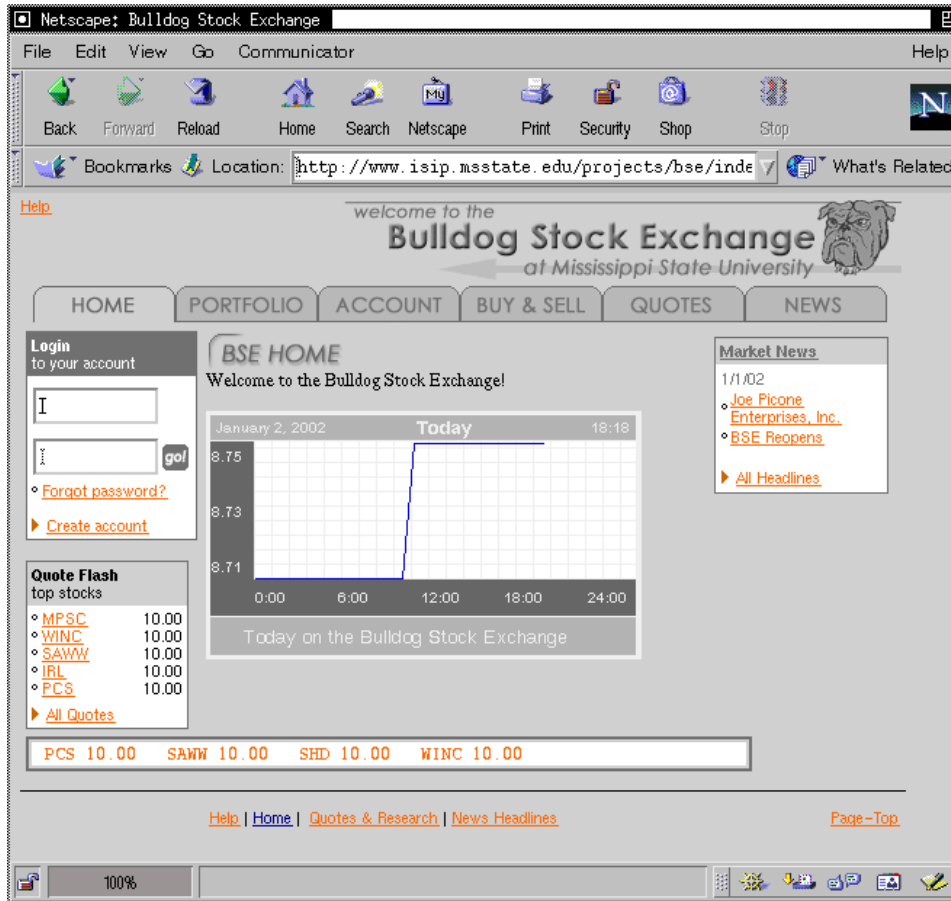


final report for

Bulldog Stock Exchange

2001 Schillig Special Teaching Projects Program



submitted to:

David Cole
Provost and Vice President, Academic Affairs
P.O. Box BQ
608 Allen Hall
Mississippi State, MS 39762-5566

December 31, 2001

submitted by:

J. Picone and C. Roberts
Department of Elect. and Comp. Eng.
Mississippi State University
Box 9571
413 Simrall, Hardy Road
Mississippi State, Mississippi 39762
Tel: 662-325-3149, Fax: 662-325-3149
{picone, roberts}@isip.msstate.edu



EXECUTIVE SUMMARY

The senior design sequence in the Department of Electrical and Computer Engineering has played a pivotal role in the College of Engineering's entrepreneurship thrust by pioneering several new enhancements to the design experience for undergraduates. One extremely novel and exciting idea we have proposed is the development of an internal stock market in which students' senior design teams will create "publicly-traded" companies representing their teams. This web-based application will teach engineers the importance of being responsive to real-world customers such as stockholders and sponsors, and train them in some of the associated mechanics (i.e., quarterly reports and investor relations). This project represents an interesting way to build undergraduate interest in the design sequence at an early stage of their education. This application, if fully developed, has the potential to gain a significant amount of national publicity for MS State.

Perhaps the best way to understand the outcome of this project is to view the applet, located at the URL <http://www.isip.msstate.edu/projects/bse>. This applet, known as the Bulldog Stock Exchange (BSE) was introduced into the Fall'01 Senior Design course. A total of 12 companies were traded by approximately 50 users. Each user was given \$10,000 in stock and each company was seeded with \$25,000 in stock. Student feedback was overwhelmingly positive despite several serious bugs in the software that prevented reliable and robust operation.

The BSE system consists of three main components: user accounts, company accounts, and administrative functions. It was designed to be a fully functioned stock market trading system, much like an E*TRADE or DayTrader. An administrator establishes accounts for the students and companies at the beginning of the semester. Users are then free to log on and trade stock using a buy/sell system that queues transactions and matches buyers with sellers. Companies, which are composed of senior design teams, manage their own company stock, and decide at what price they want to sell their stock. Similarly, users are can invest in any company available — not just their own company. Both companies and the administrator can post news messages to disclose late-breaking stories about significant events. A stock market "ticker" is displayed on the main page showing current prices of the stocks. Graphs automatically generate trend information about stock prices. A number of other user-friendly features have been added to make it easy to trade stock. Some of these features were added as a result of the Fall'01 trial.

The bulk of the software was written during Summer'01 by one undergraduate programmer. After several pilot trials from a selected user group, the system was put into production at the beginning of the Fall'01 semester. Unfortunately, software bugs eventually caused the system to lock and company accounts to become unstable. Hence, we invested additional time over the Christmas break fixing bugs and tuning the interface. Two pilot studies were run with the new code to verify the system. The system was again placed in production operation on January 1, 2002, and will be used in Spring'02. Debugging code was added to make troubleshooting more efficient.

The Institute for Signal and Information Processing, which hosted this project, which is based in the ECE Department, has invested approximately \$2000 of its own money in addition to the \$2520 supplied by the Schillig grant. Though the original grant covered development of the basic applet, we spent more time than we expected debugging code. This was necessary since the applet was not robust enough to handle long-term usage. Now that the applet is fairly stable, we plan to pursue wider scale media coverage for this project through university relations.

1. Introduction

The purpose of the Bulldog Stock Exchange (BSE) is to provide a virtual trading environment. The target users for this project are electrical engineering students participating in the capstone senior design course in the Department of Electrical Engineering. Students create companies on the BSE based on their projects. The goal of this experience is to introduce engineers to real world issues in how businesses operate with respect to their stock market capitalization. This will hopefully help increase student awareness that the business world is not simply about designing a product.

The BSE is not a stock market simulator. A simulator provides an engine to manipulate factors within itself. The BSE is manipulated simply by the users and administrator. As such, this is a facilitating system. This greatly increases the realism of the system. Giving users the influencing factors can provide them with a greater understanding of the factors that influence real-world markets. The success of a company on the BSE doesn't have to be directly related to the success of their project — just like in the real world a company can be failing in their objectives yet succeeding in the open market. Likewise, a project can be going well and yet a company stock still faring poorly. These types of interactions will increase the market awareness of students as they move into real-world jobs.

One primary factor in the success of the BSE is student usage. It wasn't known just how well accepted this would be among students. During an initial run in the Fall 2001 semester this question was answered. While this first run revealed some deficiencies in the BSE design (these will be discussed later) the project proved widely popular among students. In fact, students placed trades within 5 minutes of the opening of the market. The level of usage during the initial run showed the system would be able to succeed as a self-contained system. The initial proposal discussed using external market trends to manipulate values within the BSE but the current implementation doesn't have this. Instead, market factors will depend on the users - a capability that will give users an even greater understanding of what can happen to manipulate the market.

2. Description

The BSE is best understood by examining the applet, shown in Figure 1, and available at the URL <http://www.isip.msstate.edu/projects/bse>. The BSE system consists of three main components: user accounts, company accounts, and administrative functions. It was designed to be a fully functioned stock market trading system, much like an E*TRADE or DayTrader. An administrator establishes accounts for the students and companies at the beginning of the semester. Users are then free to log on and trade stock using a buy/sell system that queues transactions and matches buyers with sellers. Users are automatically notified of the status of their transactions through email. Companies, which are composed of senior design teams, manage their own company stock, and decide at what price they want to sell their stock. Similarly, users are can invest in any company available — not just their own company. Both companies and the administrator can post news messages to disclose late-breaking stories about significant events. A stock market “ticker” is displayed on the main page showing current prices of the stocks. Graphs automatically generate trend information about stock prices. A number of other user-friendly features have been added to make it easy to trade stock.

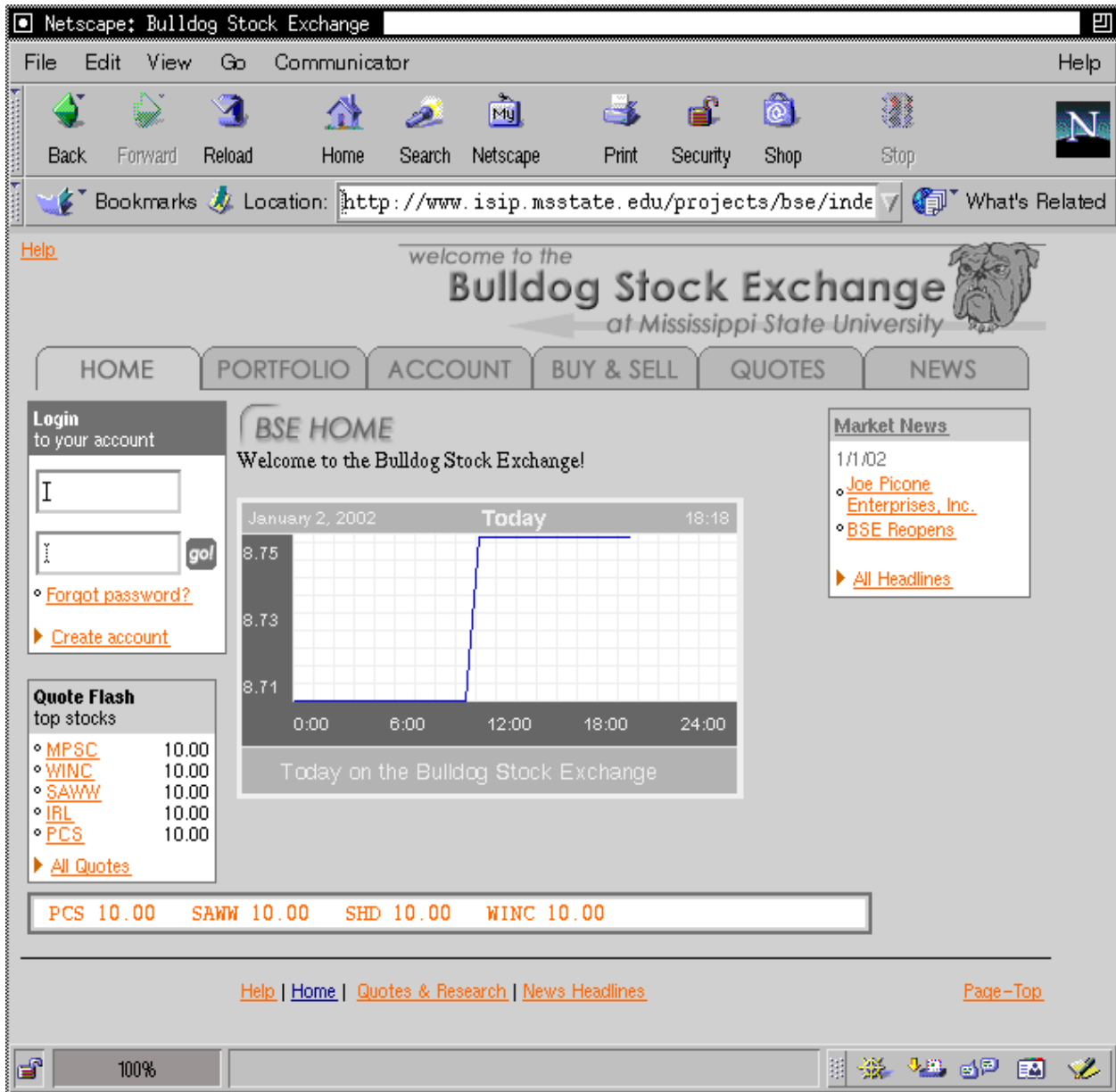


Figure 1. The main page of the Bulldog stock exchange. The overall market trend is displayed graphically. A stock market ticker at the bottom continuously displays stock prices. A news window to the right provides late-breaking information. Users login using the dialog box in the upper left.

Users can research companies in one of two ways. They can view graphs of the company value across different time frames, and also view numeric data on a company such as its current value, opening value, day/year highs and lows, and so on. Also present on every page is a stock ticker showing the current value of each stock and a Quote Flash section listing the top 5 stocks and their current value.

The second way users can do research is through the News window. There is a News section available where the administrator or companies can post periodic updates about the system. A company user is an account that has been created alongside a company to maintain that

company's stock. Those users are able to post market news. Users will be responsible for publishing news on their company — a factor that will help them understand the necessity in increasing knowledge about their project. A public that is unaware is a public that will not buy that stock.

Trading on the Bulldog Stock Exchange passes through a number of steps. In order to make sure the data stays consistent, extra safeguards have been put in place to help maintain the data. Also in place are value checks. Since there is no Securities and Exchange Commission to monitor transactions, some automatic checks have been put into place. If a users transaction offer exceeds these values, the transaction is frozen pending review by the administrator. The values effecting the rules can be changed or disabled by the administrator. The rules are in place to prevent users from drastically changing market values with a single transaction.

Users are able to see what transaction offers have been made by other users and they can respond to those offers. While users can see what transaction offers are pending, users are not able to see who is making the offer. The trading is all handled by the server once the offer has been made, so users are not informed who the trade is being made with.

User account creation and company creation are handled by the administrator. Originally it was planned to have an open system where anyone could create an account but it was decided to have a closed system where users have to submit account requests. This is to prevent users creating a number of accounts to simply drive the value of their stock up or down. Since users aren't putting actual money into the system, there is nothing to stop them from doing this except running a closed system.

The administrator has a number of tools available to help the system move along smoothly. The administrator is able to view information about stocks and transactions that other users can not see, such as the ability to see who all owns a particular stock or who is selling what stock. Besides simply being able to add users and companies, an administrator can manipulate the values of users and companies. Also, companies can be frozen, preventing any transactions from taking place with their stock. Individual user accounts can be locked to prevent that user from logging in (this includes company users). This can also be applied to the entire system — the administrator can freeze trading system-wide, where users can still log in and read news and research but will be unable to place any trades. The administrator can also lock the whole system, preventing anyone from logging in. These features might be used during different periods such as holidays or days when testing is being done on the system. User and company locks might be done if for some reason disciplinary action is being taken on the user or company.

3. Status

Development of the Bulldog Stock Exchange took place primarily during the Summer of 2001. Our original plan was for one month of software development, one month of detailed testing, and one month of interface tuning. Instead, we spent three months developing software and hence entered the Fall'01 semester somewhat unprepared. During the summer, a number of pilot tests were conducted to test approaches for logging in users, handling transactions, handling reporting, and so on. Transactions queueing (described later) proved to be our biggest problem.

The core of the system is a simple SQL database based on a publicly available software package known as MySQL. This database includes all information for user accounts, company data, and transaction requests. Users interact with a web interface that is written using Java Servlets and these servlets interface with the database to handle all of the data.

Transactions on the BSE take place one at a time. During development, we repeatedly ran into problems when we allowed multiple transactions to take place at the same time (which a standard database package allows). A method was put into place to limit transactions. The first method used for this worked fine for a few users but when many users were on the system it began to break down. This was discovered during the first major usage of the Bulldog Stock Exchange during the Fall'01 semester. During usage, data became corrupted as transactions got crossed within the servlet.

To fix this problem, a significant amount of additional work has been done over the Christmas break following the Fall'01 semester on the queuing part of the system. The code for buying and selling has been completely redone. The basic idea remains the same, a transaction based system, but the code that drives it has been overhauled. In the past, transaction locks relied on the database. MySQL has a built-in locking capability that is supposed to prevent multiple events from taking place at the same time. Relying on MySQL's locks proved to work poorly. Transaction locks have now been written solely into the servlet with the main servlet now monitoring all transactions to ensure they only take place one at a time. We also improved the efficiency and reliability of the plotting information, and removed several bugs that had been observed during the Fall'01 trial.

4. Future Plans

This project has the potential to gain significant national attention to MSU. It is believed that no other college or university has come up with a project like this. With education focusing more and more on giving students as broad an education as possible in order to prepare them for all aspects of their careers, an educational system that focuses on the market side of business should be of great interest. The BSE has been restarted for the Spring'02 semester. We expect EE and CPE students to participate in this project. Assuming the first half of the semester goes smoothly, we will then pursue external publicity for this project, and develop a publication for an IEEE educational journal. The applet has already been demonstrated at a number of universities, government labs, and conferences by the PI.

There are, of course, many enhancements that could be made to the basic applet. users have indicated an interest in an on-line chat type feature where they can discuss trading and "convince" people to buy their stock. A discussion board, similar to the News window, has been requested as well. This would be space where students could post messages (News is restricted to companies and the administrator). Two major upgrades that would make the system more portable would be to interface the applet to a more popular database package, Oracle, rather than the low-cost MySQL. In doing so, the database interface would undoubtedly become more modular. Similarly, some aspects of the applet configuration would have to be made domain independent.

The original budget, which consisted solely of UG hourly wages, was spent by 8/15/01.