



A Stock Trading Via the Internet

By

Ms. Pornsurang Sirinit

A Final Report of the Three - Credit Course
CE 6998 Project

Submitted in Partial Fulfillment
of the Requirements for the Degree of
Master of Science
in Computer and Engineering Management
Assumption University

November 1999

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Academic Year November 1999

The Graduate School of Assumption University has approved this final report of the three-credit course, CE 6998 PROJECT, submitted in partial fulfillment of the requirements for the degree of Master of Science in Computer and Engineering Management.

Approval Committee:

The seal of Assumption University of Thailand is a circular emblem. It features a central shield with a blue field containing a white cross and a red field containing a white cross. The shield is flanked by two golden lions. Above the shield is a crown. The shield is surrounded by a wreath of golden leaves. The text "ASSUMPTION UNIVERSITY OF THAILAND" is written in a circular path around the shield. Below the shield, the text "SINCE 1969" is written. The seal is overlaid on the signatures of the approval committee members.

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November 1999

ABSTRACT

Common stocks do indeed offer the possibility of substantially higher returns than can be earned on saving accounts. On the other hand, common stocks are very risky investments. Investors need to have a real time information to support decision-making.

This project presents the stock trading via the Internet, which add on feature to the existence of a Broker Front Office System. This broker system, in turn, communicates with the Stock Exchange. Ultimately, this system will allow World Wide Web users to perform various trading functions remotely over the Internet. The goals of this project are to create an Internet-based environment for supporting business relationships and transactions between clients and stock broking firms. This system is implemented on Windows NT 4.0 Web Server using the Microsoft Internet Information Server (IIS) 4.0 Web Server Platform. The back end relational database is Microsoft SQL Server 7.0. The site is maintained using Java Based Development Tools. This project covers the structured analysis, design techniques, and screen interface. The scope of the project concerns with the front trading session with the interactive enter trading stock order, connecting to the current system, view order information and view marketing information.

The existing system is studied and analyzed and used to be a prototype of this system. Functions and utilities of the system are designed to be user friendly and comfort to the users. Special attention is given to develop the Stock Trading System via Internet to meet user's requirement and to interface between existing systems with database system design.

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I. INTRODUCTION

1.1 Background of the Project

The stock trading is the most popular investment around the world. Many international financial investment firms are now providing the stock trading via the Internet to benefit greatly from the emergence of the Internet commerce. When compared the Investing online with the traditional way, the Investing online gain more distinct advantage. The most important thing is that all investors need to be able to use its necessary equipment that they may already have such as computer, modem, and telephone line.

The Stock Exchange of Thailand (SET) has trading rules regarding sending order by customer is that customers are not allowed to send an order directly to SET. The customers need to trade through the SET's member firms (brokers). There are 27 brokers to provide stock trading to customers. Each broker has the different computer system, which connected to SET's system. SET has fully operated computerized trading since April 1991.

Customers can trade the stock by two ways. The first way is order by calling to the trader and the second way is customers come to broker's trading floor and write the order in order form. Both of these have a limited capacity to expanding the volume of trading because the trading depend on number of traders, the place of company and so on. By the way, when the brokers want to increase the volume of trading, they need to expand the new branch for serving the new clients that are in the different area of the existing branches.

1.2 Objectives of the Project

The objectives of the project on a Stock Trading via the Internet are as follows:

- (a) To increase the volume of stock trading with unlimited capacity because the more volume of trading there is the more commission the company can gain.
- (b) To create an Internet-based environment for a stock trading between clients and brokers that will be a complete system with efficiency, effectiveness and better performance.

1.3 Scope of the Project

The following aims are the scope of this project:

- (a) To study the Existing trading system.
- (b) To apply the front trading process to Internet based environment for customers to sell or buy an order by themselves. A Stock Trading via the Internet will provide the following features:
 - (1) To create order entry (buy/sell) page
 - (2) To create view orders (change/cancel) page
 - (3) To query/report orders information
 - (4) To view marketing information
 - (5) To process data from SET
 - (6) To automatically update the statistical file

1.4 Deliverables

The deliverables of the project are as follows:

- (a) The result of the study and the analysis of the stock trading system
- (b) The screen layout for user interface on a Web Site.
- (c) A new design of Internet based stock trading system.

1.5 Project Plan

The project plan is shown in Figure 1.1.

Activities	July		August				September				October	
	3	4	1	2	3	4	1	2	3	4	1	2
1. Study the current business of stock trading												
2. Analyze the general requirement for stock trading system												
3. Design the new stock trading system via the Internet												
4. Design user interface												
5. Develop web site												
6. Conclude the project result												
7. Submit the project report												

Figure 1.1. Project Plan.

II. LITERATURE REVIEW

2.1 What the Common Stocks Are

Common stocks represent ownership in a business. Business sells shares of stock in order to obtain money that can be used to acquire materials, pay employees, purchase equipment, and repay debts. Individuals and institutions invest in common stocks in order to participate in the expected profits of a business, either through dividend payments or increasing share values. Owners of common stock have a claim to the profits of a firm and generally have the right to elect the directors of a business. (Scott 1993)

2.2 History of Stock Trading

Thailand's National Economic and Social Development Plans have, since 1961, defined the country's direction and growth objectives. Consequently, the Second Plan (1967-71) incorporated planning for a new capital securities market. The Third NESD Plan (1972-76) gave rise to the SET Act of May 1974, bringing into being the Securities Exchange of Thailand, as it was first named. Securities trading commenced on April 30 1975. On January 1 1991, the official name was changed to the Stock Exchange of Thailand. (<http://www.set.or.th> 1999)

In May 1992, an improved SET Act of 1984 (No. 2) itself was replaced by the Securities and Exchange Act 1992 (SEA) which also established the Securities and Exchange Commission (SEC) as the sole supervisor of securities business. The SEA is a comprehensive legislative framework regulating all vital elements of a modern capital market, such as disclosure, investor protection, fund management, takeover procedures and the establishment of securities firms. (<http://www.set.or.th> 1999)

2.3 The Advantages of Online Investing

Investing online will give investors distinct advantages over investing in the traditional way. In order to do this, all they need are necessary equipment, which most investors already have, and an average degree of computer literacy. The necessary equipment include a suitable computer, a modem and a telephone line. (Temple 1997)

The advantages of online investing can be grouped into five broad areas, which include speed, comprehensiveness, cost, convenience, and enlarged investment horizons.

(a) Speed

When they first buy a modem, few users are really prepared for the speed with which data can be transferred between remote computers. Downloading data gives the daily high prices, the daily low prices, the opening, the closing prices and the trading volume for 400 shares. These data will be converted and stored in an orderly fashion, which takes only a couple of minutes on the two-year-old (and, therefore, relatively elderly) computer.

The advantages of using online information sources are already obvious. If we take the capturing of share price data as an example, compare my two-minute download by modem to the time it would take manually to enter 400 closing share prices into separate data files in your PC, not to mention the boredom of doing so day after day.

(b) Comprehensiveness

It is no exaggeration to say that online information and services and particularly World Wide Web sites are expanding at an exponential rate. A

recent survey counted five million host computers linked to the Internet, any one of which could be home to hundreds of files and dozens of Web sites.

(c) Cost

Online investing is a low cost activity. The Internet and World Wide Web offer huge information resources at little cost. Online connection charges are shown in Table 2.1.

Table 2.1. Cost of ISP in Thailand.

Company	Access Time (Hours)	Space Limit (MB)	Initial Fee (Baht)	Monthly Fee (Baht)	Extra charge
A-Net	25	Unlimited	900	-	-
	50	Unlimited	1,700	-	-
	100	Unlimited	3,200	-	-
Asia Infonet	10	2	200	485	40/hr
	20	2	200	875	30/hr
	50	2	200	2,335	N/A
	100	2	200	4,380	N/A
	200	2	200	8,170	N/A
Ideanet	50	2	500	-	25/hr
I-Net	10	2	-	388	N/A
	20	2	-	777	N/A

Table 2.1. Cost of ISP in Thailand. (Continued)

Company	Access Time (Hours)	Space Limit (MB)	Initial Fee (Baht)	Monthly Fee (Baht)	Extra charge
	20	2	-	1,360	20/hr
Info news	12	2	-	500	40/hr
	25	2	-	780	40/hr
	50	2	-	1,220	N/A
Internet KSC	20	5	300	800	25/hr
	15	2	300	450	45/hr
Internet	20	2	200	292	20/hr
Thailand	20	2	300	875	30/hr
	40	2	300	1,362	30/hr
	23.4/month	2	-	1,000	-
	52/6month	2	-	2,000	-
Data Line	30	2	200	585	20/hr
Thai	50	2	200	785	20/hr
	15	2	200	385	20/hr
Lox info	10	2	-	486	40/hr
	20	2	-	875	30/hr

Table 2.1. Cost of ISP in Thailand. (Continued)

Company	Access Time (Hours)	Space Limit (MB)	Initial Fee (Baht)	Monthly Fee (Baht)	Extra charge
	50	2	-	2,400	N/A
	100	2	-	4,300	N/A
Samart	250	2	-	9,700	N/A
Cybernet	10	1	300	500	50/hr
	-	2	300	500	20/hr
World net	20	2	300	600	20/hr
	40	2	300	900	40/hr
CS	25	2	200	700	30/hr
	15	2	200	450	35/hr

From "ISP." Windows Magazine, สิงหาคม 2542. กรุงเทพมหานคร: บริษัท ARIP จำกัด, 2542

(d) Convenience

It should be obvious by now that one of the really compelling aspects of online investing is that data, news, software programs, and other information can be gathered electronically without the need for much physical effort. The information is stored online and can be called up when necessary. The updating is done for you.

Information downloaded from the Internet and other online sources can also quickly be incorporated into existing software with the minimum of effort and technical knowledge. If you wish to spend more time researching stocks and less time tramping the streets to the paper shop, the library, or your local software supplier, this is a compelling advantage.

(e) **Broader Horizons**

As well as enabling you to obtain information about the domestic stock market, it is an inevitable part of using online sources that you will also gain access to information on other markets, different types of securities, new investment ideas and techniques that might otherwise have gone unnoticed.

2.4 The Security Concern

Is setting up an online business worth the risk? Buying and selling goods and services online is expected to grow dramatically over the next five years to seven years. According to Input, an Information technology market research firm based in Mountain View, California, worldwide sales of goods and services traded over the Internet will rocket from \$70 million in 1995 to \$255 million in 2000, a compounded annual growth rate of more than 400 percent. (Alexander 1997)

More than a hundred companies are setting up Internet connections each week, according to Input. Large corporations especially banks and other financial institutions have been doing business electronically for several years. But, thanks to the growth of the Net and World Wide Web (WWW) in particular, electronic commerce is expanding to include individuals and small businesses. Soon it will be a part of everyday life. (Alexander 1997)

Security concerns are the primary factor inhibiting consumers from conducting transactions online, according to an ongoing survey of 23,000 Internet users by Georgia Tech and the university of Michigan. The Hermes Project found people are less likely now than early in 1996 to post credit card information online. The most common reason given is a lack of security: 60 percent of those surveyed agreed “somewhat strongly” or “strongly” that security concerns are a primary reason for not buying. The survey indicates that Web travelers are using the network more to gather information about products and services than to actually buy them. This is a key issue that virtual business must contend with, at least for the foreseeable future. (Alexander 1997)

2.5 Java-based Development Tools

The Java Object oriented Programming (OOP) language developed by Sun Microsystems Systems, Inc., has been widely welcomed in the Web software development community. It allows for active content to replace static pages in today’s Web sites. One of the appeals of Java is its platform independent nature. The same applet can execute in a Web browser running on an Apple Macintosh, a Windows 95/98 PC, or a UNIX workstation, as long as the browser software incorporates a Java virtual machine. This level of compatibility is due to the fact that Java is currently an interpretive language although so called “just in time” or JIT compilers are now appearing, which translate the Java code into a form optimized for the client machine), where each Web browser supporting the Java language has a built in Java language interpreter used to take the Java source code coming down the wire and execute it on the client machine. (Gutierrez 1999)

Java has captured the imagination of programmers, Web surfers, and the business community. From a programmer’s perspective, Java offers true object-oriented (OO) programming, rather than OO extensions to a procedural language. To the Web surfer,

content. But so are scripts such as JavaScript and VBScript, which are commonly sent from Web sites. Even files that we commonly consider data, such as digital images, can be classified as executable content. These files execute on plug-ins- special purpose interpreters. Browser plug-ins are software modules that can be integrated with the Web browser. (Ghosh 1998)

Basically, JDBC follows the standard applet security model. Specially, if a JDBC driver is downloaded as part of an applet and registers itself with the DriverManager, that driver is limited in terms of what it is allowed to do. It is not allowed to write on local disk, it is not allowed to read private files, it is not allowed to connect to random servers. Moreover, JDBC will use that driver only to satisfy connection requests from code that has been loaded from the same source as the driver. In other words, an applet can connect back to its server only and cannot connect to random databases. These policies may appear to be overly restrictive, because in many environments to have an applet downloaded from a server would be nice, which connects back to some different database. (Gutierrez 1999)

The advantages of the Java enterprise technologies are as follows: (Asbury and Weiner 1999)

- (a) Multi-platform language: Java programs written on one platform (e.g., Unix) will run on another platform (e.g., Windows).
- (b) The ability to run Java applets on client machines adds new layers of functionality to the Web such as transaction processing, can be programmed once and run on client machines anywhere, regardless of the client platform (“write once, run anywhere”).

pages embedded with Java applets come alive when viewed. Java applets make the Web an interactive experience rather than a channel surfing pastime. (Ghosh 1998)

Businesses are adopting Java quickly for several reasons. First, it is a true multi-platform language. This means that Java programs written on one platform (e.g., Unix) will run on another (e.g., Windows). Second, the ability to run Java applets on client machines adds new layers of functionality to the Web. Practical business applications, such as transaction processing, can be programmed once and run on client machines anywhere, regardless of the client platform. In contrast, ActiveX control will run only Win32 machines. This strategy is survivable for ActiveX as long as Windows maintains a tight grip on the desktop. Third, Java was originally designed to be a full-featured language to run in embedded systems. It is this kind of cross-platform portability that is making Java such an attractive development language for business. (Ghosh 1998)

Java provides the ability not only widely to distribute software but also to make a significant advancement in client/server computing by placing intelligence in the client. An intelligent client provides the ability to process data locally on the client host machine to the greatest extent possible. Because commercial Web sites may serve a great number of requests, the more processing that can be off-loaded to the client machines, the faster the response times will be and the greater the number of requests that can be served per unit time. (Ghosh 1998)

Executable content applications make the Web an exciting and interactive medium for the Internet surfers. Before executable content, Web pages were mainly static displays of information coded in the HyperText Markup Language (HTML). (Ghosh 1998)

Executable content, also called active content and mobile code, exists in many forms. ActiveX controls and Java applets, are some of the best known forms of active

(c) Java technology remains a viable method of producing reusable Web “objects” that one can combine together in order to construct complete applications.

(d) Portable and easier to maintain that reduces education cost.

2.6 Definition of Terms (Hall 1997)

Bid price: For stocks, the price at which a market maker offers to purchase a stock from a seller.

Broker: A registered person who acts as the intermediary in the purchase or sales of a security for the account of a customer and charges a commission for the service. The term is used for both the member firm acting as an agent and for the registered representative or account executive acting as an agent.

Buying power: The maximum amount of securities a customer can purchase in a margin account using SMA and not depositing any additional cash.

Capital gain: The profit that results when the proceeds from the sales of a security are higher than the security’s cost basis.

Capital loss: The loss that results if the proceeds from the sales of a security are less than the security’s cost basis.

Commission: The fee charged by a broker to buy or sell a stock.

Confirmation: A notice sent from a broker to the customer on the day after the trade that gives the details of the execution of an order, including price, number of units, and commission.

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- Index:** A composite measure of the movement of the overall market or of a particular industry that consists of a large number of stocks and is usually weighted by other factors, such as capitalization.
- Last Price:** The last price a stock trade at during the previous trading day.
- Limit order:** An order to buy or sell a stock at a specified minimum price.
- Margin account:** An account in which an investor buys (or sells short) securities by depositing part of their market value and borrowing the remainder from the brokerage firm.
- Most active:** Stocks with very high trading volume.
- Open order:** Order that remains valid until it is executed or canceled.
- Offer Price:** The price at which a security is offered for sale.
- Stock:** A security representing ownership of a company and entitling its owner to the right to receive dividends.
- Volume:** The total number of shares traded in a given period of time.

III. THE EXISTING SYSTEM

3.1 Background of the Organization

The Stock Exchange of Thailand (SET) has trading rules regarding sending order by customer. That is customers are not allowed a facility that sends an order directly to SET. The customers need to trade through the SET's member firms (brokers). Because investors can be assured of the company's facilities, qualified marketing officers, and other services are extended to clients. Additionally, it is the SET's responsibility to monitor each member's transparency and fairness. Should there be any member firm that fails to comply with the Exchange's regulations, the SET has the right to take punitive action against the company involved. To become a member, a company must first be granted a license from the SEC to operate a brokerage business. It will then be screened by the Exchange before it is allowed to become a member firm. Once it becomes a member, a firm must conform to all the SET's rules and regulations. Here are the SET's member firms:

Table 3.1. Active Member Firms. (<http://www.set.or.th> 1999)

Seq.	No.	Names & Residence of Companies	Symbols
1	2	TISCO Securities Co., Ltd. 48/2 TISCO Tower, North Sathorn Road, Bangrak, Bangkok 10500	TSC
2	3	Adkinson Securities Public Co., Ltd. 132 Sindhorn Bldg., 2/F, Wireless Road, Bangkok 10330	ASL
3	4	Nava Vickers Ballas Securities Co., Ltd. 422 Nava Bldg., Phayathai Road, Bangkok 10330	NVS

Table 3.1. Active Member Firms. (Continued)

Seq.	No.	Names & Residence of Companies	Symbols
4	5	SICCO Securities Public Co., Ltd. 130-132 Sindhorn Tower II 1-2/F, Wireless Road, Bangkok 10330	SICSEC
5	6	Merrill Lynch Phatra Securities Co., Ltd. 252/6 Muang Thai-Phatra Office Tower 1, 6-11/F, Rachadapisek Road, Bangkok 10320	MLP
6	7	Krungthai Thanakit Public Co., Ltd. 159 Sermmitr Tower 15-16/F, Sukhumvit 21 Road, Bangkok 10110	KTT
7	8	ABN AMRO Asia Securities Public Co., Ltd. 175 Sathorn City Tower 3/F, South Sathorn Road, Bangkok 10120	AST
8	10	Union Securities Co., Ltd. 152 Indosuea House, 6/F, Wireless Road, Lumpinee, Pathumwan, Bangkok 10330	IWICU
9	12	Yuanta Securities (Thailand) Co., Ltd. 540 Mercury Tower (One Place Bldg.) 9, 10 Fl., Ploenchit Rd., Pathumwan, Bangkok 10330	YUANTA
10	13	KGI Securities One Public Co., Ltd. 153/3 Soi Mahardlekluang 1, Rajdamri Road, Bangkok 10330	S-ONE
11	14	Capital Nomura Securities Public Co., Ltd. 21/3 Thai-Wah Tower, South Sathorn Road, Bangkok 10120	CNS
12	15	SG Asia Credit Public Co., Ltd. 320 Rama IV Road, Bangrak, Bangkok 10500	SGACL

Table 3.1. Active Member Firms. (Continued)

Seq.	No.	Names & Residence of Companies	Symbols
13	16	National Securities Co., Ltd. 444 MBK Tower 14/F, Phayathai Road, Bangkok 10330	NATSEC
14	19	Kiatnakin Securities Co., Ltd. 500 Amarin Tower 7/F, Ploenchit Road, Bangkok 10330	KKS
15	23	SCB Book Club Securities Co., Ltd. 130-132 Sindhorn Bldg.3, 25-26/F, Wireless Rd., Lumpinee, Patumwan, Bangkok 10330	SCBBCS
16	26	The Ocean Securities Co., Ltd. 163 Thai Ocean Bldg., Surawong Road, Bangrak, Bangkok 10500	OS
17	27	Bangkok First Investment & Trust Public Co., Ltd. 300 Silom Road, Bangrak, Bangkok 10500	BFIT
18	29	Ayudhya Securities Co., Ltd. 898 Ploenchit Tower 4/F, Ploenchit Road, Bangkok 10330	AYS
19	30	Thai Sakura Finance & Securities Co., Ltd. 952 Ramaland Bldg., 12/F, Rama IV Road, Suriyawong, Bangkok 10500	SAKURA
20	32	Dhana Siam Securities Co., Ltd. 44 Dhana Siam Bldg., Soi Lang Suan, Ploenchit Road, Patumwan, Bangkok 10330	DSS
21	34	Phillip Securities (Thailand) Public Co., Ltd. 849 Vorawat Bldg., 15/F, Silom Road, Bangrak, Bangkok 10500	PHILIP

Table 3.1. Active Member Firms. (Continued)

Seq.	No.	Names & Residence of Companies	Symbols
22	38	United Securities Public Co., Ltd. 1550 Grand Amarin Tower, 4-5/F, New Petchburi Road, Rachatavee, Bangkok 10310	US
23	41	Jardine Fleming Thanakom Securities Co., Ltd. 191 Silom Complex Office Bldg., 29/F, Silom Road, Bangrak, Bangkok 10500	JFT
24	42	Kim Eng Securities (Thailand) Co., Ltd. 52 Thaniya Plaza 10-11/F, Silom Road, Bangrak, Bangkok 10500	KESECS
25	43	BNP Prime Perigrine Securities (Thailand) Co., Ltd. 444 MBK Tower 19/F, Phayathai Road, Bangkok 10330	BNPPP
26	47	Seamico Securities Public Co., Ltd. 287 Liberty Square 16/F, Silom Road, Bangrak, Bangkok 10500	Z-MICO
27	49	Warburg Dillon Read Securities Co., Ltd. 93/1 Diethelm Tower A, 13/F, Wireless Road, Patumwan, Bangkok 10330	WDR

3.2 Existing Business Functions

All of the brokers have their own system to enter orders and connect to SET. There are two principle variations of trading system available to broker members to connect to SET. There are Automated Order Matching (AOM) and Screen-based trading or Put Through (PT) transactions. More details of these systems will be described in Section 2.

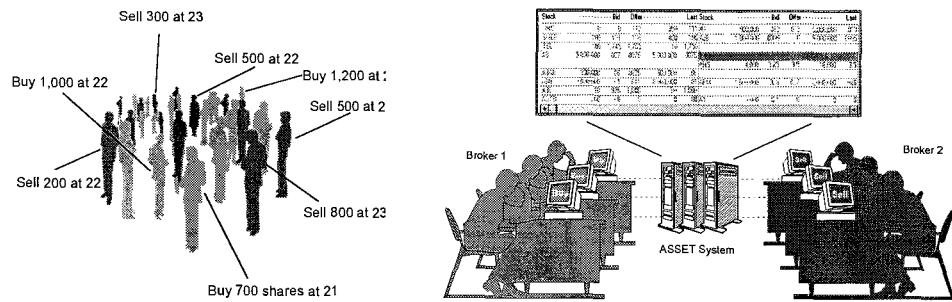


Figure 3.1 shows all of the brokers connected in a common computer network. A broker will use his own computer in different system to enter orders, and to get market information and send the order to SET.

3.2.1 How it Works

[illegible]

As clients telephone their orders to trader, he/she will note all the terms. Figure 3.3 shows the sample when a client has telephoned a BUY order for 1,000 shares of XYZ at 22. The Trader then takes the client's orders to the trading floor and finds the other side to the trade. In this case, of course, the Trader looks for someone willing to sell XYZ at 22 or at a better price -- up to 1,000 shares. When he/she finds the other side, he/she makes a note of his or her broker code in his/her order book as shown in Figure 3.4. For example, 500 shares are bought from broker 14 and 500 shares from broker 122.

Buy

Stock	Volume	Price	Client	Broker
XYZ	1,000	22	A100T12	

Figure 3.3. Sample of Note in the Order Book.

Buy

Stock	Volume	Price	Client	Broker
XYZ	1,000	22	A100T12	¹⁴ -500 ¹²² -500

Figure 3.4. Sample of Note when Order Matching.

Here's a summary of this example in Figure 3.5. First, an order to buy 1,000 shares of XYZ at a price of 22 or better is received. Then, the Trader took that order to the trading floor and found two sellers of XYZ, each selling 500 shares at 22.

		----- Buy	Sell -----	
Stock	Shares	Price	Price	Shares
XYZ	1,000	22	22	500
				500

Figure 3.5. Summary of Stock Order.

From Figure 3.5, because the buyers and sellers agreed on the price, the Trader has a trade -- two trades, to be exact, each trade for 500 shares.

And this happens every day, on trading floors around the world. Buyers meet sellers and agree on prices and volumes for stocks.

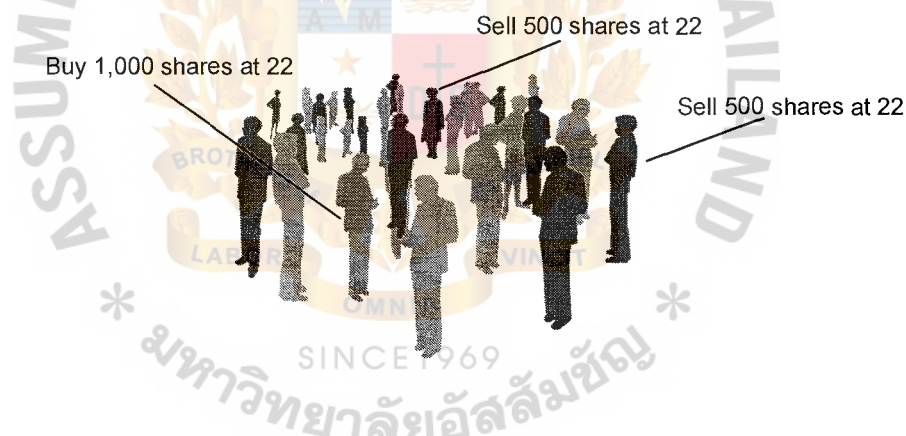


Figure 3.6. Buyers Meet Sellers on Trading Floors around the World.

A computerized trading system works the same way, that is, buyers and sellers meet and agree on prices and volumes.

In a computerized trading system, you enter your buy order for 1,000 shares on the computer. The computer will save your buy order and combine it with any other buy orders at that price. Similarly, selling orders are entered, saved, and combined.

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The result is a consolidated quote or best bid and offer for a stock. Where prices agree, the computer will match orders for a trade as shown in Figure 3.5.

The buying broker entered his order to buy 1,000 shares of XYZ at 22. Two selling brokers entered orders to sell 500 shares of XYZ at 22. The computer saved these orders. Next, it combines orders at the same price:

		----- Buy	Sell -----		
Stock	Shares	Price	Price	Shares	
XYZ	1,000	22	22	1,000	

Figure 3.7. The Combine Orders.

Notice that the computer shows sellers for 1,000 shares of XYZ at 22. It has combined the two sell orders of 500 shares each. Next, the computer will detect that there are buyers and sellers of XYZ at the same price, and will match the orders for a trade. This entire process takes place instantly.

Let's take a more complicated example, an example more like the real trading world. Suppose there are many different buyers and sellers of XYZ stock, all of them buying and selling different quantities at different prices.

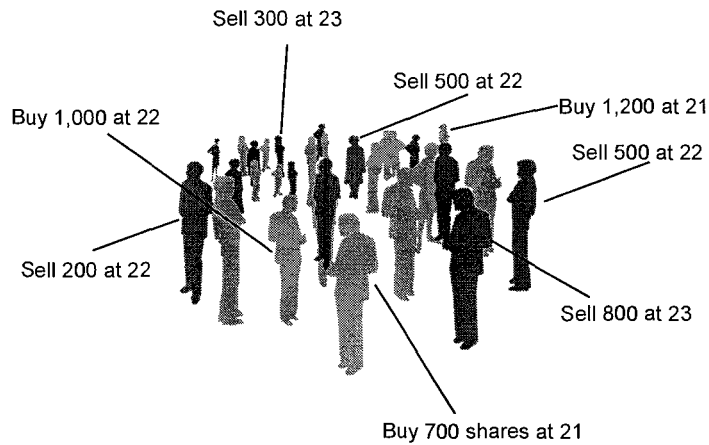


Figure 3.8. There are Many Buyers and Sellers of XYZ.

Here are all of the different buy and sell orders, shown in order by the best price. The best buy, or the highest buying price, is on top, and the best sell, or the lowest selling price, is on top.

		Buy	Sell		
Stock	Shares	Price	Price	Shares	
XYZ	1,000	22	22	500	
	1,200	21	22	500	
	700	21	22	200	
			23	800	
			23	300	

Figure 3.9. The Buys and Sells Shown in Order by the Best Price.

Next, combine (or consolidate) all of the orders at the same price:

	-----Buy		Sell	-----
Stock	Shares	Price	Price	Shares
XYZ	1,000	22	22	1,200
	1,900	21	23	1,100

Figure 3.10. Combined Buys and Sells Shown in Order by the Best Price.

Since there are buying orders at 22 and selling orders at 22, the computer will match these orders. After the matching is done, the computer will combine the remaining orders and show:

	-----Buy		Sell	-----
Stock	Shares	Price	Price	Shares
XYZ	1,900	21	22	200
			23	1,100

Figure 3.11. The Remaining Orders after Matching.

What happened? Well, 1,000 shares of XYZ traded at 22. There was an order to buy 1,000 shares at 22 and two orders to sell at 22. After those trades were done, the computer combined the remaining orders and showed a new consolidated quote. You can see the best buying price is 21 and the best selling price is 22, so there will not be another trade unless an order comes in to match the best buying or selling price.

Of course, buying and selling orders do not have match on quantity -- they only have to match on price.

So far, we have covered only some simple examples. There are other concerns in automated trading. What happens when there are two orders at the same price -- who trades first? If prices agree and quantities do not agree, what happens? What if you have a very large order, and want to hide part of it from the rest of the market? Can you still trade on a trading floor or over the telephone -- do you have to use the computer? Can other brokers see who your clients are? Can you find out what stocks other brokers are buying and selling? What else can you do with the computer?

3.2.2 Price/Time Priority

Orders at the same price are ranked in time priority. That means that the first order entered on the computer at a certain price will be traded first. The following example is like the earlier example of buys and sells:

Stock	----- Buy -----		----- Sell -----	
	Shares	Price	Price	Shares
XYZ	1,200	21	22	500
	700	21	22	500
			22	200
			23	800
			23	300

Figure 3.12. The Example of Buy and Sell Orders.

Here is the table with the time the orders were entered into the computer:

			Buy		Sell	
Stock	Shares	Time	Price	Price	Time	Shares
XYZ	1,200	9:15:22	21	22	9:16:10	500
	700	9:15:24	21	22	9:16:28	500
				22	9:17:03	200
				23	9:05:10	800
				23	9:07:23	300

Figure 3.13. The Orders Were Entered into the Computer with Time.

Let's look a little more closely at the sell orders. The best (lowest) selling price is 22. There are three selling orders at 22: two sells of 500 shares each, and one sell order of 200 shares. The quantity of the order does not make a difference, but the time the order was entered does make a difference. The difference is that, at a given price level, the first orders entered on the computer will be traded first.

Now let's say a buy order for 700 shares at 22 is entered at 9:18:20. The buy order for 700 shares at 22 will take all 500 shares of the sell order entered at 9:16:10, and then it will take 200 shares of the 500 share sell order entered at 9:16:28.

Here is how it works:

700	9:18:20	22	500 shares matched	22	9:16:10	500
			Another 200 shares matched	22	9:16:28	500
				22	9:17:03	200

Figure 3.14. How the Order Are Matched.

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The sell order entered at 9:17:03 does not trade at all yet because the quantity of orders in front of it were sufficient to fill the incoming buy order. After matching, the unfilled orders look like this:

			Buy		Sell	
Stock	Shares	Time	Price	Price	Time	Shares
XYZ	1,200	9:15:22	21	22	9:16:28	300
	700	9:15:24	21	22	9:17:03	200
				23	9:05:10	800
				23	9:07:23	300

Figure 3.15. The Unmatched Orders.

And here is how the consolidated quote looks before and after matching the new buy order (700 shares at 22). Of course, the consolidated quote combines all buy and sell orders by price:

-----Buy		Sell-----	-----Buy		Sell-----		
Shares	Price	Price	Shares	Shares	Price	Price	Shares
700	22	22	1,200	1,900	21	22	500
1,900	21	23	1,100			23	1,100
Before matching the new buy at 22. . . and an instant later, after matching.							

Figure 3.16. The Consolidate Quote.

3.3 The Existing Computer Information System

(1) Broker Front Office System

There are three major vendors to implement the system to all brokers in Thailand in the different system. These systems are as follows:

- (a) ABOS (Advanced Broker Office System) VAX/ALPHA
OPEN VMS
- (b) TABS STATUS/SUN UNIX
- (c) FIS RISC/6000 UNIX

Whichever system has the same main feature as follows:

(a) Order Entry

The Order Entry window lets the user enter buy and sell orders. After an order is entered, it is sent to the trading system (SET). As orders are matched by the trading system, a last sales message is broadcast to all market participants informing them of the trade. An additional message is sent to the buyer and the seller involved in the trade (or deal) advising them in more detail of the transaction. When Broker Front Office system receives a deal report from the trading system, it automatically matches the trade with the underlying order and decrements the open volume for that order by the amount filled by the trade.

If the trading system or the SET rejects an order (due to invalid terms, market closed, etc.), a rejection message is transmitted back to the originating Broker Front Office user then the system marks the order as rejected and informs the user of the rejection and the reason.

(b) View Orders

The View Orders form displays all of, or a user-selected subset of, the orders entered that day, as well as open orders remaining from previous days. Orders are displayed in a scrollable list in LIFO (last in/first out) order. As trade confirmations and cancellation confirmations come from the central trading system, the Order List is updated to reflect the current market state.

(c) Deal Entry

The Deal Entry window allows entry of trades that have been made outside of the trading system (Put Through). With the Deal Entry window, the same broker can be buyer and seller (cross) or two different brokers can represent the buyer and seller (a two firm trade). For a two firm trade, the firm representing the seller enters the trade and a message is sent to the buyer. The buyer then can approve or disapprove of the trade by using the View Deal window. Trades entered by exchange staff are automatically accepted and approved by the system.

(d) View Deal

The View Deal window allows the trader to view all the trades of customers assigned to this trader, and all trades this trader was involved in. Just as with the View Orders window, a user enters search criteria in the fields. Trades matching the user's search criteria are then displayed. The trades and data

shown are based on the user's individual account privileges, and are shown in LIFO order.

The View Deals window displays the order number, confirmation number of the trade, stock symbol, volume, price, the time of the trade, the board or market where traded, a status indicator for exception reporting (cancellation approvals/disapprovals, etc.), side, firm identifier, account identifier, portfolio/client flag ("PC").

When the seller cancels a trade, a message is sent to the buying broker responsible for approving or disapproving of the cancellation.

(e) Customer Information

This screen shows customer information, Daily Order/Confirm, Credit/Position, Profit/Loss, and Customer summary (Order/Confirm).

(f) Market Indicators

The Market Indicators display shows general market indicators, such as the current index value and change, advancing/declining/unchanged issues and volume. This display is updated continuously by market indicators broadcast from the SET system.

(g) Ticker

The Ticker display shows last sales and volumes for all, or for a user-specified subset, of securities. It is driven by the trading system's last sales broadcast.

(h) Actives

The Most Actives display shows the 20 most active securities in the market, the volume leaders. The trading system scans trading information and displays the 20 most active securities. This display is dynamically updated.

(i) Gainers and Losers

The Gainers and Losers display shows the 10 securities with the largest percentage gain in price and largest percentage loss in price as compared to their previous closing prices. This display is dynamically updated.

(j) Price Alerts

The Price Alerts display lets users set price and volume alerts for any security. If and when trading in a security triggers an alert, the user is notified immediately.

(k) Quote Page

The Quote Page is used to view best bids and offers, last sales price, change, and high and low prices, for a selected list of securities. This display can also show the depth of the market for a security. The user selects the securities he or she wishes to monitor on the display. These securities may be displayed in any order, or sorted in alphabetical order, by volume, value, greatest price change, or by sector.

The Quote Page is updated continuously in real-time as the market changes. It can also display stock information in five different column formats -- last sales, last sales and change,

last sales and volume, last sales and change and volume, and best bid and offer (BBO) and last sales.

(l) View News

The News window shows news headlines. For the full story behind a news headline, the user selects the headline of interest and the story appears in another window. The Messages window is used to display stock exchange and system administrator messages. The user can send messages to other brokers connected through Broker Front Office system and to the exchange itself.

(m) Security Information

The Security Information window displays information stored on a security in the market database, such as floor and ceiling prices, dividend information, sector, board lot sizes, etc. This display also shows the five most recent trades in the security and the most recent quotation.

(n) Printing Contracts

Deals and contracts can be printed at any time and can print trade reports in a variety of formats -- by confirm number, order number, stock, account, contra firm, buys and sells, or portfolio/client flag. These reports can be specified for all of, or for any subset of, the trades displayed in the View Trades window.

(2) Automated Order Match from SET

(a) Automated Order Matching (AOM)

The AOM system is designed to support automated matching, semi-automated match and post-trade entry capabilities. Brokers key in their orders from their front office system and this data goes on-line to the SET's mainframe computer with which AOM system arranges the orders according to price-then-time priority. Executed transactions are immediately confirmed back to the member.

(b) Screen-based trading or Put Through (PT) transactions

Brokers can announce bid or offer prices quoted according to the price spread rules of the SET via the ASSET's facility. Any interested brokers can deal and negotiate directly between each other with which the price can be changed and may not follow the price spread rules. After the details of the trade have been agreed upon, they are entered in to the system and sent to the ASSET system for the SET's formal approval.

Whichever type of trading system is applicable depends on the board the shares are traded on. AOM is provided for trading on the main board and the odd lot board, while PT is applied to trading on the special board and the big lot board.

(3) Data Interface

- (a) Brokers and exchange staff may use PC's and/or workstations connected to the Local Area Networks (LAN's) on the trading floor and in the other areas of the Exchange building using the TCP/IP or DECNET communications protocols.
- (b) They may use workstations in their offices, which are connected to the exchange Wide Area Network (WAN) by leased telephone lines

using the X.25 communications protocol. These “remote” workstations may be individually connected to the exchange or they may be part of a Local Area Network in the broker’s office that has a “communications server” which is connected to the stock exchange.

- (c) Brokers may also communicate to AOM via computer-to-computer interface (CTCI) using their own computer system. The broker’s computer would support the company’s private communications network of users. Using CTCI, the broker can write or buy his own user interface software and link his system to AOM by using a standard set of formatted messages.

Each method of access has two types of data interfaces to AOM:

- (a) Interactive interface

This is used for two-way communications between the broker and AOM. For example, the interactive interface is used to send orders to AOM and for AOM to return trade confirmations to the broker. Requests for data and the answers from AOM also use the interactive interface.

- (b) Broadcast interface

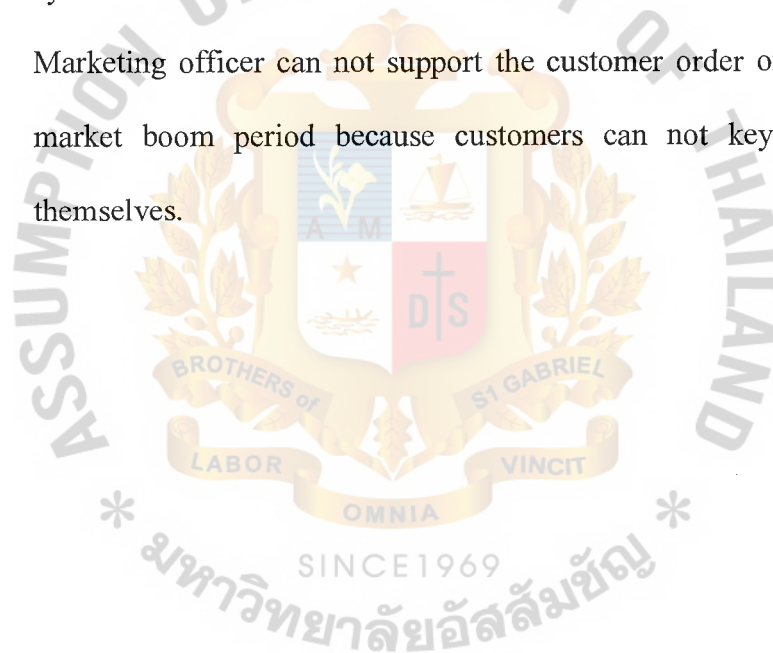
This interface is used for one-way communications from AOM to the broker. Broadcast interface is like a radio station because there is one sender (the stock exchange) and many receivers. The broadcast contains market information messages such as the market index, trading indices, trading volumes, last trade price, best bids, best offers news etc. This information is distributed to brokers, exchange staff,

monitors, price boards, TV walls, data vendors and others who are authorized to receive market information.

3.4 Existing Problems

After studying and analyzing the existing system, some problems can be identified as follows:

- (a) Varies platform computer system.
- (b) Capacity limit of expanding the business because there are many expenses such as the trading floor space, administration cost, the new computer system and so on.
- (c) Marketing officer can not support the customer order on time during the market boom period because customers can not key in an order by themselves.



IV. DESIGN OF THE PROPOSED SYSTEM

4.1 User Requirements

The overall aim of this project is to provide a web application to an existing system an internet/intranet capabilities and still comply with the existing SET trading rules, and initially, the functionality will primarily be trading related functions. In case of the existing system being able to operate this system just will be added-on feature to users to perform various trading functions remotely over the Internet. The requirements of this system are as follows:

- (a) The orders have to be sent to the marketing officer and will be passed to Broker Front Office System and SET system after obtaining approval from the marketing officer.
- (b) Every Broker Front Office System can be connected.
- (c) Information contained is relevant to Brokerage firms.
- (d) Security Aspects, only generally accepted software tools will be used.
- (e) The system is user-friendly and is easy for user to understand and perform.

4.2 The Proposed Functions

- (1) Start up Process

The initial period of the day, the process establishes the CTCI and broadcast communication links and synchronizes market data broadcast message from SET and Broker Front Office System. The system can update the market database change and calculate the statistics that have taken place since the previous end of day processing.

- (2) Gain Access to Web Page

Customer gain access to Web trading page by identifying access code, account number and password.

(3) Entering Order

The prototype order cycle consists of the following sequences:

- (a) Users key in Buy/Sell order via a web browser, when they key in a stock symbol the system will show the current market information.
- (b) The system allows the users to review the information before confirming order.
- (c) After the users confirm the order, the system will give them a confirmation message showing the reference number for future reference. The order will send the information to the web back end and send to the marketing officer
- (d) The marketing officer may approve the order as he sees fit. At this stage it is a mere click of the mouse or press of a certain key.
- (e) If an order is rejected by the marketing officer, the order information will be sent to the customer via the web back end without any information passing to the Broker Front Office System.
- (f) If an order is approved by the marketing officer, the order information will be sent to Broker Front Office System which will process the order as usual. It is assumed that Broker Front Office System will process the validity/integrity of an order and pass a message back to web back end, and subsequently to the

customer. This acknowledgment will bypass the marketing officer, except when an order is rejected.

- (g) There will exist an indication on the customer screen of the current status of the order.

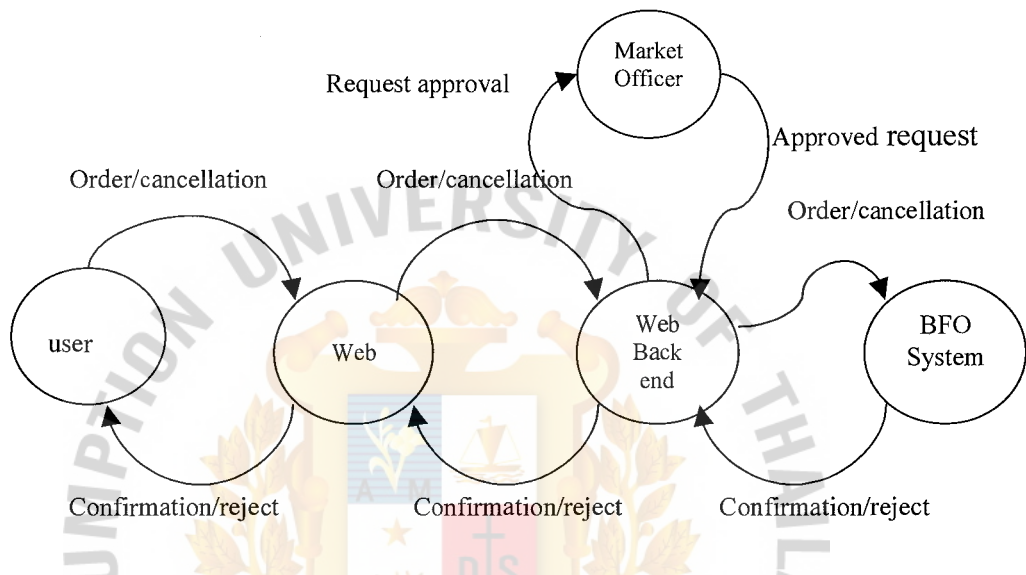


Figure 4.1. Order Cycle.

(4) View Order

Users can view or sort their order trades by date or status and they can cancel or change the orders if that order does not match.

(5) Query/Report

Users can query or print trade reports in a variety of formats such as daily Orders/Confirms, Credit/Position.

(6) View the Marketing Information

User can view the marketing information for helping to make a decision such as quote page, most active, gainers and losers.

(7) Process when Get Information from SET (Broadcast and CTCT)

In order to give the user the most current market data available, the system is linked to the Broker Front Office System and SET Trading System. The SET trading system supplies real time market information during the day, the system can also get market information message such as bids, offers, last trade prices from Broadcast or CTCI from SET.

(8) Automatic Update Market Statistic Files

In case we do not need to update the market statistic files every time the system gets market information from Broadcast because it will take a lot of overhead to do that, the system can set the time for automatic updating of these files.

From the above, the proposed functions are shown in data flow diagrams which are used as tools for structured analysis and design. Figure 4.2. is a Stock Trading System via the Internet Level 0 data flow diagram and the data flow diagrams of level 1 and level 2 of each process are presented in Appendix A.

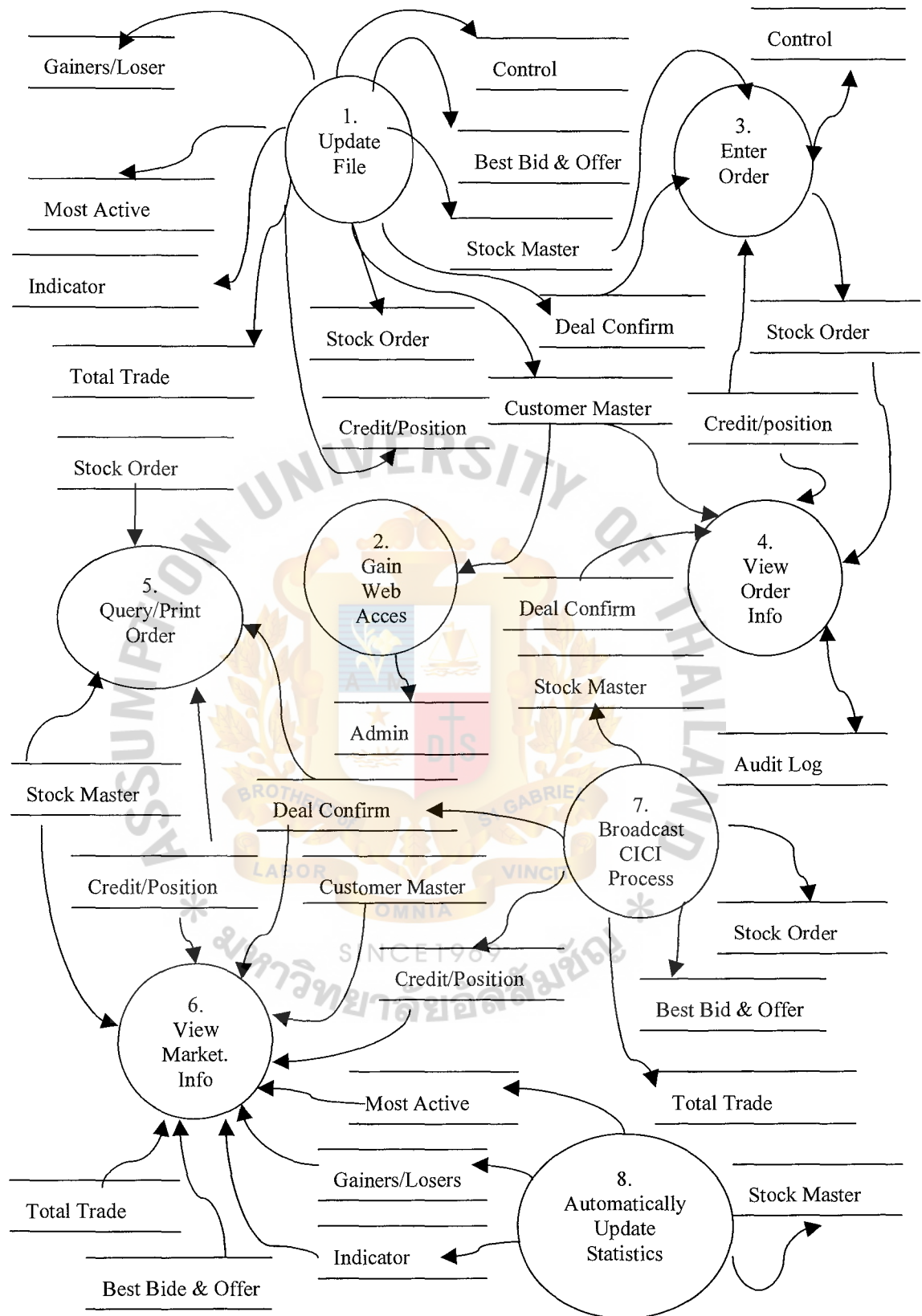


Figure 4.2. A Stock Trading System Level 0 of Data Flow Diagram.

4.3 The Proposed Database

One of the most obvious goals for publishing information on the Web is to make the data available to potential customers. The most crucial ingredient of a database enabled Web Server is its back end database on which queries originating from a Web browser will be processed. In addition to processing user queries, the back end database may also prove useful for a related purpose, providing statistics regarding the types of queries users perform. Whether users consistently request particular types of queries over others or how they structure their queries can be extremely valuable pieces of information when trying to determine the ease of use of your query vehicle or even when tuning the back end for better performance. This system proposed the relational database approach in Structured Query Language (SQL) because it has a powerful tool, that allows operations to get the answers quickly and easily.

The SQL database capacity and performance are discussed below.

(a) Database Capacity

The back end database is capable of handling considerable quantities of data efficiently and quickly.

(b) Performance Tuning

Properly configuring and tuning the back end DBMS of a Web server constitutes one of the most important tasks a Web database administrator can perform in obtaining an efficient query-processing environment. This does place an important responsibility on the administrator to monitor and measure performance results in the background as production query processing occurs. SQL server is a vigorous and complex tools, requiring intimate knowledge of its internal operation as well as the front end application in order to obtain optimal performance.

(c) SQL Server Performance Monitor

SQL Server contains a Performance Monitor program that measures the performance and behavior of objects such as processors, memory cache, threads, and processes. Each of these objects has an associated set of counters that provide information on such things as device usage, queue lengths, and delays, as well as information used for throughput and internal congestion measurements.

(d) SQL Trace

SQL Server 6.5/7.0 has a SQL Trace graphical utility for monitoring and recording database activity at the connection level. SQL Trace can display all server activities in real time or use filters to focus on the actions of particular users, applications, hosts, or SQL commands.

(e) Stored Procedures

When developing client/server architecture applications, especially Web based, many advantages abound to using Stored Procedures for frequently used SQL queries. Fortunately, most Web database application development tools possess a mechanism for using stored procedures. A query inside a stored procedure is saved in a pre-compiled form and does not need to be checked for syntax as an interactive SQL statement would. This translates into better runtime performance, since the overhead of compiling the query each time has been eliminated.

One of the primary reasons for using stored procedures is that they reside on the server and using them reduces network traffic. Only the requests must be sent across the Internet.

(f) Temporary Database Size

SQL Server used a temporary database to store temporary tables and provide working storage. Putting temporary database in RAM can significantly affect overall server performance. Queries that require frequent sorts benefit because that eliminates a lot of physical disk accesses.

The database files in the proposed system are not the real database to maintenance because the exact databases have already been at the Broker Front Office System. These databases are used for the customer to daily trade because the broker firms have a variety of databases on each system so this proposed system provides the standard database for web database.

These databases can be categorized into four types as follows:

(a) Master files

Master files contain permanent data relating to such entities as stock master file, customer master file. Each record in a master file contains data on a particular entity.

(b) Transaction files

Transaction files capture detailed transaction data. Essential elements in a transaction file's record are the types of transaction (sell or buy), stock, price, volume, transaction date, time, or similar entity.

(c) Statistical files

Statistical files are files of trading statistics for user to view or print. The frequency of the computation interval is adjustable. A higher frequency makes the system slow.

(d) Administration files

Administration files are files that keep the privilege of use, audit trail and control file.

All file layouts are presented in Appendix B.

4.4 User Interface Design

A Stock Trading System via Internet is developed for customer to enter the stock order on the web page. The user interface design needs to be an easy-to-use interface. This proposed system tries to design the screen familiar with the existing system.

The forms should meet the following criteria:

- (a) Be easy to complete and use.
- (b) Minimize the errors that can be made in completing a form.
- (c) Not contain too many data or be too sparse or too busy.
- (d) Enhance speed and accuracy through the use of defaults.

All screen interfaces are presented in Appendix C.

4.5 Proposed System Configuration

The proposed system can be shown as seen in Figure 4.29. It would have the following components:

- (1) Web Server

Hardware Specification

- (a) Pentium Pro 200 MHz processor
- (b) 128 MB of RAM
- (c) 21 GB SCSI hard drive
- (d) 3COM EtherLink III NIC card
- (e) 32X CD-ROM Drive, 3.5 inch floppy drive, 17 inch monitor

Operating System Windows NT 4.0 Server (Service Pack 3 or later)

Web Server Software Microsoft Internet Information Server (IIS) 4.0

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Tools Microsoft Visual Studio 6 (Java Tools included),
FrontPage 98

Back-end Database Microsoft SQL Server 7.0 for NT with unlimited
license

Internet Connection and communication Hardware

- (a) Router
- (b) Modem
- (c) Lease line

(2) Client

Hardware Specification

- (a) Pentium Processor
- (b) 32 MB of RAM
- (c) 2.1 GB hard drive

Operating System Windows 95, 98, Unix, Linux

Web Browser Netscape Communicator, Internet Explore 4.0 or
higher (Must support SSL)

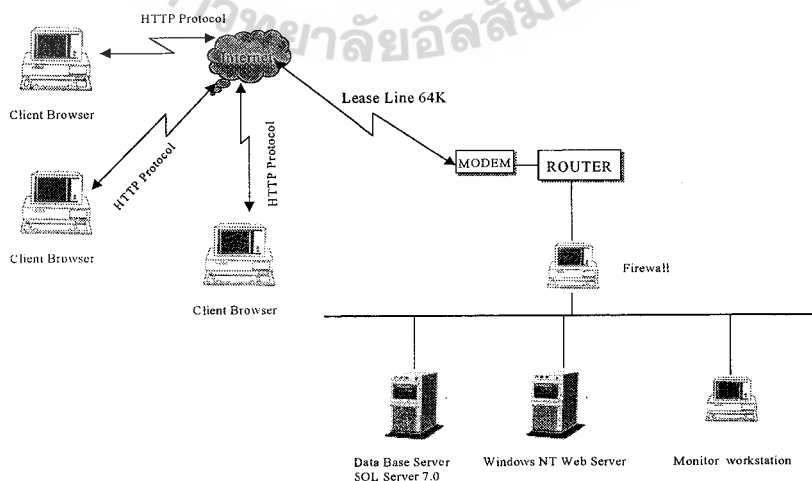


Figure 4.3. The Components of the Proposed System.

(b) Secure Transport

Securing data during transport is important to preventing unauthorized parties from capturing transaction data. Secure Sockets Layer (SSL) keeping secure communications private. The SSL encrypts the conversation between Web Server and Web client that support SSL, including Microsoft Internet Explorer (version 2.0 and higher), Netscape Navigator, and others. User will receive an error message if he/she tries to access the secure pages with a browser that does not support SSL. If the user is using Netscape's browser, he/she will notice that the "broken" key in the lower left corner of the browser status bar becomes solid. If the user is using Microsoft's Internet Explorer, he/she will see a lock in the lower right corner of the status bar. When the user sees these images, he/she can rest assured that the information is sent in a secure manner. For example, stock order information is encrypted while being transmitted between a user's browser and a Web server database application.

SSL is a layered approach providing a secure channel. That is, SSL is simply another protocol in the network protocol stack that rides on top of the TCP/IP stack as shown in Figure 4.5.

Adding SSL to the protocol stack will secure messages against prying eyes that may occur anywhere along the route from client to server. Although an intermediary may be able to see the data in transmission, the encryption will effectively scramble the data so that it cannot be intelligently interpreted.

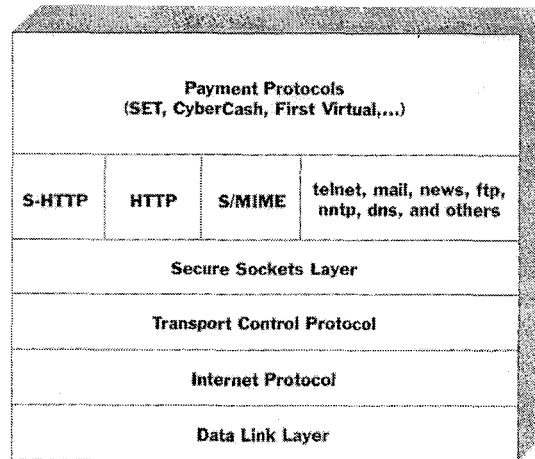


Figure 4.5. Protocol Stack for Internet Communications.

(c) Firewall

Firewalls have been used to protect internal computer systems from outside attacks as well as from unauthorized inside users. Building a firewall between digital corporate assets and untrusted networks is essential to prevent security break-ins through vulnerabilities in the OS. Firewall is the first line of defense against malicious users, placed between the computer network to be protected and the network that is considered to be a security threat.

Though firewalls are typically used to isolate a company's local area networks (LANs) from the Internet, firewalls are also used to partition, isolate, and control access between internal corporate networks. If configured properly, firewalls can prevent most of the scattershot attacks/probes through well-known network scanning tools.

V. THE FEASIBILITY STUDY

5.1 Economic Feasibility Study

To make the feasibility study of a Stock Trading via the Internet system, we have to gather much information about the existing system, the new system, the expanding branch in the future, etc. In this section, the first method that will be used to make a comparison is the tangible and intangible benefit that the new system gains more than those of the existing system. Then, an engineering economic and financial management method will be used to analyze the investment worth. We also make a comparison of the new system with DO NOTHING.

The processes of analyzing are as follows:

- (1) Defining both tangible and intangible benefits of the system.
- (2) Studying the cost of the proposed system implementation.
- (3) Estimate the income of the proposed system.
- (4) Collecting the cost and income of the expanding branch system.
- (5) Making benefit to cost ratio.
- (6) Comparing the benefit to cost ratio between the expanding branch and implementing this system.
- (7) Comparing the benefit to cost ratio between DO NOTHING and implementing this system.

5.2 Tangible and Intangible Benefits

(a) Tangible benefits

- (1) Expanding the business channel of stock trading.
- (2) Having more income from the new and the existing customers.
- (3) Cost saving on investment when they want to expand the branches.

(b) Intangible benefits

- (1) Customer satisfactions because all stock information can be retrieved and traded from anywhere in the world.
- (2) Improve the service
- (3) Advertisement

Although this new system can generate many benefits and advantages even if the cost of installation is not high.

5.3 Net Present Worth Analysis and Benefit to Cost Ratio

This project will be implemented for expanding the channel of stock trading via the Internet. This project can get more revenue from the new and the existing customers. Anyway, the Stock Trading via the Internet will not replace the existing system but will be added on to the feature that is similar to the expanding branches. We will firstly make a Net Present Worth Analysis and Benefit to Cost ratio to make comparisons between this project and investing a new branch.

The inflation rates of Thailand from the Thai Farmers Bank Public Company Limited for the last four years are as shown below:

Year 1995: 5.5%

Year 1996: 5.6%

Year 1997: 7.5%

Year 1998: 7.7%

Forecasting method is the most suitable for estimating the inflation rate of the next year, and Moving Average is used as it is not so responsive to demand fluctuations.

The formula of moving average can be computed as follows:

$$MA_n = \frac{\sum_{i=1}^n D_i}{n}$$

Where

n = the number of periods in the moving average

D_i = the demand in period i

$$\begin{aligned} MA_4 &= \frac{\sum_{i=1}^4 D_i}{4} \\ &= [5.5\% + 5.7\% + 7.5\% + 7.7\%]/4 \\ &= 6.6\% \end{aligned}$$

So we will use 6.6 % as the inflation rate in Thailand for five years.

The records of the interest rate of Thailand since 1995 are as shown below:

Year 1995: 8.2%

Year 1996: 8.9%

Year 1997: 10.5%

Year 1998: 8.2%

Because Thailand has been facing the economic crisis and the interest rate has now dropped to 4.0% in the third quarter, that is the lowest rate that has ever been since 1995, we cannot ignore it. So I also include the interest rate of this year in the calculation.

Year 1999: 4.0%

$$\begin{aligned} MA_5 &= \frac{\sum_{i=1}^5 D_i}{5} \\ &= [8.2\% + 8.9\% + 10.5\% + 8.2\% + 4.0\%]/5 \end{aligned}$$

$$= 7.96 \%$$

So we will use 7.96 % as the interest rate in Thailand for five years.

$$\begin{aligned} i_r &= \text{interest rate} \\ &= 7.96 \% \text{ per annum.} \end{aligned}$$

For the labor cost, we assume that the salary will increase at 10% (inflated rate) each year.

Incomes and expenses of the expanding branch:

Income:

$$\begin{aligned} &\text{Total trade value} \\ &= 4,000,000,000 \text{ per day} \\ &\text{Commission (0.5\%)} \\ &= 4,000,000,000 \times 0.5\% \\ &= 20,000,000 \text{ baht / day} \\ &\text{They are 27 brokers, so the income per broker:} \\ &= 20,000,000 / 27 \\ &= 740,740.74 \text{ baht / day} \end{aligned}$$

We assume that one branch of broker get 10% of the total commission

Annual income of the expanding branch:

$$\begin{aligned} &= 740,740.74 \text{ baht} \times 0.1 \times 22 \text{ days} \times 12 \text{ months} \\ &= 19,555,555.56 \text{ baht per annum} \end{aligned}$$

As the time value of money must be considered, the inflation must be added to the estimate the income of the next four years. (The inflation rate = 6.6 %)

For the second year:

$$= 19,555,555.56 \text{ baht} \times 1.066$$

$$= 20,846,222.22 \text{ baht}$$

For the third year:

$$= 20,846,222.22 \text{ baht} \times 1.066$$

$$= 22,222,072.89 \text{ baht}$$

For the fourth year:

$$= 22,222,072.89 \text{ baht} \times 1.066$$

$$= 23,688,729.70 \text{ baht}$$

For the fifth year:

$$= 23,688,729.70 \text{ baht} \times 1.066$$

$$= 25,252,185.86 \text{ baht}$$

Cost:

- (a) The initial cost : the cost of setting up the new branch included moving sign board, decoration & equipment, and computer branch system are assume as follows:-

$$\text{Moving sign board} = 3,000,000 \text{ baht}$$

$$\text{Decoration \& equipment} = 2,000,000 \text{ baht}$$

$$\text{Trading Software} = 2,000,000 \text{ baht}$$

$$\text{Software for stock analysis} = 2,000,000 \text{ baht}$$

$$\text{Computer Hardware} = 1,500,000 \text{ baht}$$

$$\text{PC (30 PCs)} = 30 \times 50,000$$

$$= 1,500,000 \text{ baht}$$

Networking & Communication accessories

$$= 2,000,000 \text{ baht}$$

$$\text{Total initial cost} = 14,000,000 \text{ baht}$$

(b) The annual cost :

(1) Monthly rental cost

$$= 170,000 \text{ baht/ month}$$

Annual rental cost:

$$= 170,000 \times 12 \text{ months per year}$$

$$= 2,040,000 \text{ baht in the first year}$$

For the second year:

$$= 2,040,000 \times 1.066$$

$$= 2,174,640 \text{ baht}$$

For the third year:

$$= 2,174,640 \times 1.066$$

$$= 2,318,166.24 \text{ baht}$$

For the fourth year:

$$= 2,318,166.24 \times 1.066$$

$$= 2,471,165.21 \text{ baht}$$

For the fifth year:

$$= 2,471,165.21 \times 1.066$$

$$= 2,634,262.12 \text{ baht}$$

(2) The overhead cost (such as electronic, water, telephone) per month:

$$= 200,000 \text{ baht}$$

Annual overhead cost:

$$= 200,000 \times 12 \text{ months per year}$$

$$= 2,400,000 \text{ baht in the first year}$$

For the second year:

$$= 2,400,000 \times 1.066$$

$$= 2,558,400 \text{ baht}$$

For the third year:

$$= 2,558,400 \times 1.066$$

$$= 2,727,254.40 \text{ baht}$$

For the fourth year:

$$= 2,727,254.40 \times 1.066$$

$$= 2,907,253.19 \text{ baht}$$

For the fifth year:

$$= 2,907,253.19 \times 1.066$$

$$= 3,099,131.90 \text{ baht}$$

(3) Maintenance cost for computer system

Annual maintenance cost:

$$= 700,000 \text{ baht in the first year}$$

For the second year:

$$= 700,000 \times 1.066$$

$$= 746,200 \text{ baht}$$

For the third year:

$$= 746,200 \times 1.066$$

$$= 795,449.20 \text{ baht}$$

For the fourth year:

$$= 795,449.20 \times 1.066$$

$$= 847,948.85 \text{ baht}$$

For the fifth year:

$$= 847,948.85 \times 1.066$$

$$= 903,913.47 \text{ baht}$$

(4) 15 Staffs will be hired to operate.

(Assume the average salary includes other benefits per person is 30,000 baht)

Expense per month

$$= 30,000 \times 15$$

$$= 450,000 \text{ bath per month}$$

$$\text{Expense per annual} = 450,000 \times 12$$

$$= 5,400,000 \text{ bath in the first year}$$

The salary is assumed to increase at the constant rate of 10% each year for five years.

For the second year:

$$= 5,400,000 \times 1.1$$

$$= 5,940,000 \text{ baht}$$

For the third year:

$$= 5,940,000.00 \times 1.1$$

$$= 6,534,000 \text{ baht}$$

For the fourth year:

$$= 6,534,000.00 \times 1.1$$

$$= 7,187,400 \text{ baht}$$

For the fifth year:

$$= 7,187,400.00 \times 1.1$$

$$= 7,906,140 \text{ baht}$$

Find the Net Present Worth:

$$P = F(1+i)^n$$

The NPW of the total income:

$$\begin{aligned}
 &= \text{The summation of the NPW of the income of each year.} \\
 &= 19,555,555.56 + 20,846,222.22 / (1+0.08)^1 + \\
 &\quad 22,222,072.89 / (1+0.08)^2 + 23,688,729.70 / (1+0.08)^3 + \\
 &\quad 25,252,185.86 / (1+0.08)^4 \\
 &= 95,275,446.76 \text{ baht}
 \end{aligned}$$

The NPW of the total cost:

$$\begin{aligned}
 &= 24,540,000.00 + 11,419,240.00 / (1+0.08)^1 + \\
 &\quad 12,374,869.84 / (1+0.08)^2 + 13,413,767.25 / (1+0.08)^3 + \\
 &\quad 14,543,447.49 / (1+0.08)^4 \\
 &= 67,060,975.66 \text{ baht}
 \end{aligned}$$

Benefit to Cost Ratio of the Expanding Branch System:

$$\begin{aligned}
 &= \text{NPW of the Total Income} / \text{NPW of the Total Cost} \\
 &= 95,275,446.76 / 67,060,975.66 \\
 &= 1.42
 \end{aligned}$$

The NPW of the total profit for five years:

$$\begin{aligned}
 &= \text{The summation of the NPW of the net profit of each year.} \\
 &= -4,984,444.44 + 9,426,982.22 / (1+0.08)^1 + \\
 &\quad 9,847,203.05 / (1+0.08)^2 + 10,274,962.45 / (1+0.08)^3 + \\
 &\quad 10,708,738.37 / (1+0.08)^4 \\
 &= 28,214,471.10 \text{ baht.}
 \end{aligned}$$

All the calculations of incomes and expenses of the expanding branch system have been clearly illustrated in Table 5.1.

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Incomes and Expense of a Stock Trading via the Internet

Income: By forecasting, A Stock Trading via the Internet can increase the volume of trading 5% in the first year and increase the service performance average by 10% every year. This means that the broker can work efficiently although the volume of the daily trading has increased to 10% more every year after the first year.

Income:

$$= 740,740.74 \times 0.05 \times 22 \text{ Days} \times 12 \text{ months}$$

$$= 9,777,777.78 \text{ baht per annum}$$

The commission can be increased 10% more in every year

For the second year:

$$= 9,777,777.78 \text{ baht} \times 1.10 \times 1.066$$

$$= 11,465,422.22 \text{ baht}$$

For the third year:

$$= 11,465,422.22 \text{ baht} \times 1.10 \times 1.066$$

$$= 13,444,354.10 \text{ baht}$$

For the fourth year:

$$= 13,444,354.10 \text{ baht} \times 1.10 \times 1.066$$

$$= 15,764,849.62 \text{ baht}$$

For the fifth year:

$$= 15,764,849.62 \text{ baht} \times 1.10 \times 1.066$$

$$= 18,485,862.66 \text{ baht}$$

Cost of a Stock Trading via the Internet system:

(a) The Initial cost

(1) Web Server (one more for back up)

$$= 2 \times 500,000$$

$$= 1,000,000 \text{ baht}$$

(2) Database Server (one more for backup)

$$= 2 \times 500,000$$

$$= 1,000,000 \text{ baht}$$

(3) Mail Server = 500,000 baht

(4) PC for Firewall = 150,000 baht

(5) PC = 5 x 50,000

$$= 250,000 \text{ baht}$$

(1 for Database Admin, 1 for Web Admin, 1 for Networking Admin)

(6) Router = 500,000 baht

(7) Modem = 10,000 baht

(8) Windows NT = 5 x 75,000

$$= 375,000 \text{ baht}$$

(2 for Web Server, 1 for Database Server, 1 for Mail Server)

(9) SQL Server 7.0 = 2 x 200,000

$$= 400,000 \text{ baht}$$

(10) Firewall Software = 50,000 baht

(11) Visual Studio 6.0 = 100,000 baht

(12) Leased Line = 10,000 baht

(13) ISP = 81,800 baht

(14) Development Cost: We will hire some software house to develop the system, which will be followed by our design. The costs of develop are as follows:

Database Administration Cost:

$$= 22 \text{ days} \times 8 \text{ hours} \times 800 \text{ baht}$$

$$= 140,800 \text{ baht}$$

Business components to run on the Server:

$$= 22 \text{ days} \times 8 \text{ hours} \times 800 \text{ baht}$$

$$= 140,800 \text{ baht}$$

Screen Interface 15 screens:

$$= 15 \text{ screens} \times 5 \text{ days} \times 8 \text{ hours} \times 800 \text{ baht}$$

$$= 480,000 \text{ baht}$$

Total Development Cost

$$= 140,800 + 140,800 + 480,000 \text{ baht}$$

$$= 761,600 \text{ baht}$$

Total Initial Cost

$$= 1,000,000 + 1,000,000 + 500,000 + 150,000 + 250,000 +$$

$$500,000 + 10,000 + 100,000 + 375,000 + 400,000 +$$

$$50,000 + 100,000 + 10,000 + 81,800 + 761,600$$

$$= 5,288,400 \text{ baht}$$

(b) The annual cost:

(1) Leased Line charge

$$= 72,000 \text{ baht / year}$$

For the second year:

$$= 72,000 \text{ baht} \times 1.066$$

$$= 76,752 \text{ baht}$$

For the third year:

$$= 76,752 \text{ baht} \times 1.066$$

$$= 81,817.63 \text{ baht}$$

For the fourth year:

$$= 81,817.63 \text{ baht} \times 1.066$$

$$= 87,217.60 \text{ baht}$$

For the fifth year:

$$= 87,217.60 \text{ baht} \times 1.066$$

$$= 92,973.96 \text{ baht}$$

(2) ISP charge

$$= 834,000 \text{ baht / year}$$

For the second year:

$$= 834,000 \text{ baht} \times 1.066$$

$$= 889,044 \text{ baht}$$

For the third year:

$$= 889,044 \text{ baht} \times 1.066$$

$$= 947,720.90 \text{ baht}$$

For the fourth year:

$$= 947,720.90 \text{ baht} \times 1.066$$

$$= 1,010,270.48 \text{ baht}$$

For the fifth year:

$$= 1,010,270.48 \text{ baht} \times 1.066$$

$$= 1,076,948.34 \text{ baht}$$

(3) Maintenance (i.g., upgrade hardware, speed of connection)

$$= 300,000 \text{ baht per annum}$$

For the second year:

$$= 300,000 \text{ baht} \times 1.066$$

$$= 319,800 \text{ baht}$$

For the third year:

$$= 319,800 \text{ baht} \times 1.066$$

$$= 340,906.80 \text{ baht}$$

For the fourth year:

$$= 340,906.80 \text{ baht} \times 1.066$$

$$= 363,406.65 \text{ baht}$$

For the fifth year:

$$= 363,406.65 \text{ baht} \times 1.066$$

$$= 387,391.49 \text{ baht}$$

(4) Administrators:

We will hire five staffs of administrator

Total salary per annum:

$$= 5 \times 50,000 \times 12$$

$$= 3,000,000.00 \text{ bath}$$

The salary is assumed to increase at the constant rate of 10% each year for five years.

For the second year:

$$= 3,000,000 \text{ baht} \times 1.1$$

$$= 3,300,000 \text{ baht}$$

For the third year:

$$= 3,300,000 \text{ baht} \times 1.1$$

$$= 3,630,000 \text{ baht}$$

For the fourth year:

$$= 3,630,000 \text{ baht} \times 1.1$$

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$$= 3,993,000 \text{ baht}$$

For the fifth year:

$$= 3,993,000 \text{ baht} \times 1.1$$

$$= 4,392,300 \text{ baht}$$

Find the Net Present Worth:

$$P = F(1+i)^n$$

The NPW of the total income:

$$= \text{The summation of the NPW of the income each year.}$$

$$\begin{aligned} &= 9,777,777.78 + 11,465,422.22 / (1+0.08)^1 + \\ &\quad 13,444,354.10 / (1+0.08)^2 + 15,764,849.62 / (1+0.08)^3 + \\ &\quad 18,485,862.66 / (1+0.08)^4 \\ &= 58,022,582.95 \text{ baht} \end{aligned}$$

The NPW of the total cost:

$$\begin{aligned} &= 9,494,400.00 + 4,585,596.00 / (1+0.08)^1 + \\ &\quad 5,000,445.34 / (1+0.08)^2 + 5,453,894.73 / (1+0.08)^3 + \\ &\quad 5,949,613.78 / (1+0.08)^4 \\ &= 26,730,019.34 \text{ baht} \end{aligned}$$

Benefit to Cost Ratio of a Stock Trading via the Internet System:

$$= \text{NPW of the total income} / \text{NPW of the total cost}$$

$$= 58,022,582.95 / 26,730,019.34$$

$$= 2.17$$

The NPW of the total profit for five years:

$$= \text{The summation of the NPW of the net profit of each year.}$$

$$\begin{aligned} &= 283,377.78 + 6,879,826.22 / (1+0.08)^1 + \\ &\quad 8,443,908.76 / (1+0.08)^2 + 10,310,954.89 / (1+0.08)^3 + \end{aligned}$$

$$12,536,248.88 / (1 + 0.08)^4$$

$$= 31,292,563.61 \text{ baht.}$$

All the calculations of incomes and expenses of a Stock Trading via the Internet system have been clearly illustrated in Table 5.2.

NPW of the net profit of a Stock Trading via the Internet System

$$= 31,292,563.61 \text{ baht.}$$

NPW of the net profit of an Expanding New Branch

$$= 28,214,471.10 \text{ baht}$$

Compare NPW_(Stock Trading the via Internet) with the NPW_(Expanding New Branch)

$$= \text{NPW}_{(\text{Stock Trading the via Internet})} - \text{NPW}_{(\text{Expanding New Branch})}$$

$$= 31,292,563.61 - 28,214,471.10$$

$$= 3,078,092.51$$

As the result, we will see that the Benefit to Cost ratio of both systems is more than 1.00 which means both of these systems is worth investing. But when we consider the NPW of the total profit for a five year project, a Stock Trading via the Internet makes a profit of 3,078,092.51 baht more than that of an expanding new branch. According to this NPW analysis, a Stock Trading via the Internet should be the worthwhile investment.

The decision of whether or not a Stock Trading via the Internet will be implemented is not only to make a comparison in NPW, Benefit to Cost Ratio with the expanding branch system, but also compared with the DO NOTHING. Considering the investment on a Stock Trading via the Internet, if the broker firm continues its existing system and saves the money supposed to be invested in the bank, it will get an interest each year. The change in time value of money will be illustrated in Table 5.3.

In the first year, the money saved in the bank is 9,494,400.00 baht. Four years later, the 9,494,400.00 baht includes 7.96% interest rate compounding in annually will become 12,897,900.68 baht.

P = Present Value

F = Future value

$F_1 = P + P_1$

$F_i = P (1 + i)^n$

$F_4 = 9,494,400.00 (1 + 0.0796)^4$
 $= 12,897,900.68 \text{ baht}$

For the cost in the second year, third year, fourth year and the fifth year:

$F_{m2} = 4,585,596.00 (1 + 0.0796)^3$
 $= 5,770,114.32 \text{ baht}$

$F_{m3} = 5,000,445.34 (1 + 0.0796)^2$
 $= 5,828,199.86 \text{ baht.}$

$F_{m4} = 5,453,894.73 (1 + 0.0796)^1$
 $= 5,888,024.75 \text{ baht.}$

$F_{m5} = 5,949,613.78 \text{ baht.}$

Total saving money in the fifth year will be equal to the summation of the future value

$= 12,897,900.68 + 5,770,114.32 + 5,828,199.86 + 5,888,024.75 +$
 $5,949,613.78$

$$= 36,333,853.38 \text{ baht}$$

The future value of money must be calculated back to the present value so that it can be compared with the NPW of a Stock Trading via the Internet project.

$$\begin{aligned} P &= F / (1 + i)^n \\ &= 36,333,853.38 / (1 + 0.0796)^4 \\ &= 26,746,068.70 \text{ baht.} \end{aligned}$$

NPW of the net profit of a Stock Trading via the Internet

$$= 31,292,563.61 \text{ baht.}$$

Compare $NPW_{(\text{Stock Trading via the Internet})}$ with the $NPW_{(\text{Do Nothing})}$

$$\begin{aligned} &= NPW_{(\text{Stock Trading via the Internet})} - NPW_{(\text{Do Nothing})} \\ &= 31,292,563.61 - 26,746,068.70 \\ &= 4,546,494.91 \end{aligned}$$

A Stock Trading via the Internet makes a profit of 4,546,494.91 baht more than Do Nothing. According to this NPW analysis, a Stock Trading via the Internet should be the worthwhile investment.

Table 5.1. Incomes and Expenses of the Expanding Branch.

inflation rate: 6.6% interest rate: 7.96%

	Year 1	Year 2	Year 3	Year 4	Year 5
Income from commission	19,555,555.56	20,846,222.22	22,222,072.89	23,688,729.70	25,252,185.86
Initial cost	-14,000,000.00				
Cost of rental building	-2,040,000.00	-2,174,640.00	-2,318,166.24	-2,471,165.21	-2,634,262.12
Cost of overhead	-2,400,000.00	-2,558,400.00	-2,727,254.40	-2,907,253.19	-3,099,131.90
Cost of maintenance (10% of software & hardware)	-700,000.00	-746,200.00	-795,449.20	-847,948.85	-903,913.47
Labor cost for fifteen staff members (salary of 30,000 baht)	-	-5,940,000.00	-6,534,000.00	-7,187,400.00	-7,906,140.00
Total cost per year	-24,540,000.00	-11,419,240.00	-12,374,869.84	-13,413,767.25	-14,543,447.49
Net Profit	-4,984,444.44	9,426,982.22	9,847,203.05	10,274,962.45	10,708,738.37
Net Present Worth for five years	NPW:				28,214,471.10

NPW of Total Income: 95,275,446.76 Benefit to Cost Ratio: 1.42

NPW of Total Cost: -67,060,975.66

Table 5.2. Incomes and Expenses of a Stock Trading via the Internet.

inflation rate: 6.6% interest rate: 7.96%

	Year 1	Year 2	Year 3	Year 4	Year 5
Incoming from commission	9,777,777.78	11,465,422.22	13,444,354.10	15,764,849.62	18,485,862.66
Initial cost (first year)	-5,288,400.00				
Cost of Leased line	-72,000.00	-76,752.00	-81,817.63	-87,217.60	-92,973.96
Cost of ISP charge	-834,000.00	-889,044.00	-947,720.90	-1,010,270.48	-1,076,948.34
Maintenance Cost	-300,000.00	-319,800.00	-340,906.80	-363,406.65	-387,391.49
Labor cost for five administrators	-3,000,000.00	-3,300,000.00	-3,630,000.00	-3,993,000.00	-4,392,300.00
Total cost per year	-9,494,400.00	-4,585,596.00	-5,000,445.34	-5,453,894.73	-5,949,613.78
Net Profit	283,377.78	6,879,826.22	8,443,908.76	10,310,954.89	12,536,248.88
Net Present Worth for five years				NPW:	31,292,563.61

NPW of Total Incoming: 58,022,582.95

NPW of Total Cost: -26,730,019.34

Benefit to Cost Ratio: 2.17

Table 5.3. Save Money in the Bank and Getting an Interest of 7.96% Each Year.

interest rate: 7.96%

	Year 1	Year 2	Year 3	Year 4	Year 5
Saving 9,494,400 baht in Bank	9,494,400.00	10,250,154.24	11,066,066.52	11,946,925.41	12,897,900.68
Save cost of each year					
Year 2		4,585,596.00	4,950,609.44	5,344,677.95	5,770,114.32
Year 3			5,000,445.34	5,398,480.78	5,828,199.86
Year 4				5,453,894.73	5,888,024.75
Year 5					5,949,613.78
Total saving money at year 5					36,333,853.38
NPW: 26,746,068.70					

VI. IMPLEMENTATION

6.1 Development

After we finished the feasibility study and found that our proposed project is worthwhile investing, has a possibility to be implemented, and has more advantages, then we will pass our designed system (from chapter 4) to the development teams for further development.

6.2 Testing

After the development teams finished developing the system, testing will be performed. The objective of testing is to determine whether the proposed system programs correctly handle valid and invalid transactions. The tester designs both valid and invalid transactions or test data to process through the system. If the application software properly processed the test data, the tester compares the actual results with what the results should be and examines the error listing. Test data should test all possible types of transactions including those that should trigger a response from programmed controls, such as range and limit checks.

Several types or levels of tests are usually completed before a system can be implemented. From the users' point of view, three of these tests are the most important.

- (a) The module test verifies each module can work properly. The development team conducts these tests first.
- (b) System test verifies the new system when every module works together.
- (c) The acceptance test is a user-directed test of the complete system in a test environment. The purpose is to determine from the user's

perspective whether all components of the new system are satisfactory.

- (d) Operations test or environmental test by running a system in the actual trading environment: this final test determines whether the new system can run completely in actual environment without any problem.

6.3 Implementation

After the project team has accepted the test results of all data and programs, the implementation will follow these steps:

- (a) Open the small group of customers to view orders and market the information only.
- (b) Open the same group of customers to have a full trading stock. After these, customers get familiar with this system in query order and marketing information then we open the full feature of the trading to them.
- (b) Launch the system. After the small group of customers we selected can trade smoothly without any problem, the system will be launched to the public.

6.4 System Evaluation

System evaluation must be performed when the new system has been in operation long enough. Usually post-implementation takes approximately six months after the new system has operated. It evaluates the new system to see if it has indeed satisfied the goals and realized the expected benefits.

6.5 Maintenance

Maintenance must be performed to eliminate errors in the system during its working life and to tune the system to any variations in its working environment for the system to continuously improve.



VII. CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

The results of the analyses of the feasibility study of a Stock Trading via the Internet system in Thailand are positive. According to the information gathered, this system gains more of both the advantages and the benefit in comparison to the expanding branch and the existing system.

The benefit to cost ratio and Net Present Worth analyses by engineering economic and financial analysis is used to analyze and support that this system is a worthwhile investment.

This system can be a new channel of stock trading without investing in expanding the branches. It can save a lot of expenses and also gain more benefit.

7.2 Recommendations

The rapidly increasing number of the Internet users affect all kinds of business, and also on the stock trading market. To make the business able to survive in the competitive world, they need to develop the Web page. The brokers that provide the stock trading via the Internet gains more revenue from customers and make them competitors, even become the leader in the market. So I strongly recommend this system to be implemented soon.



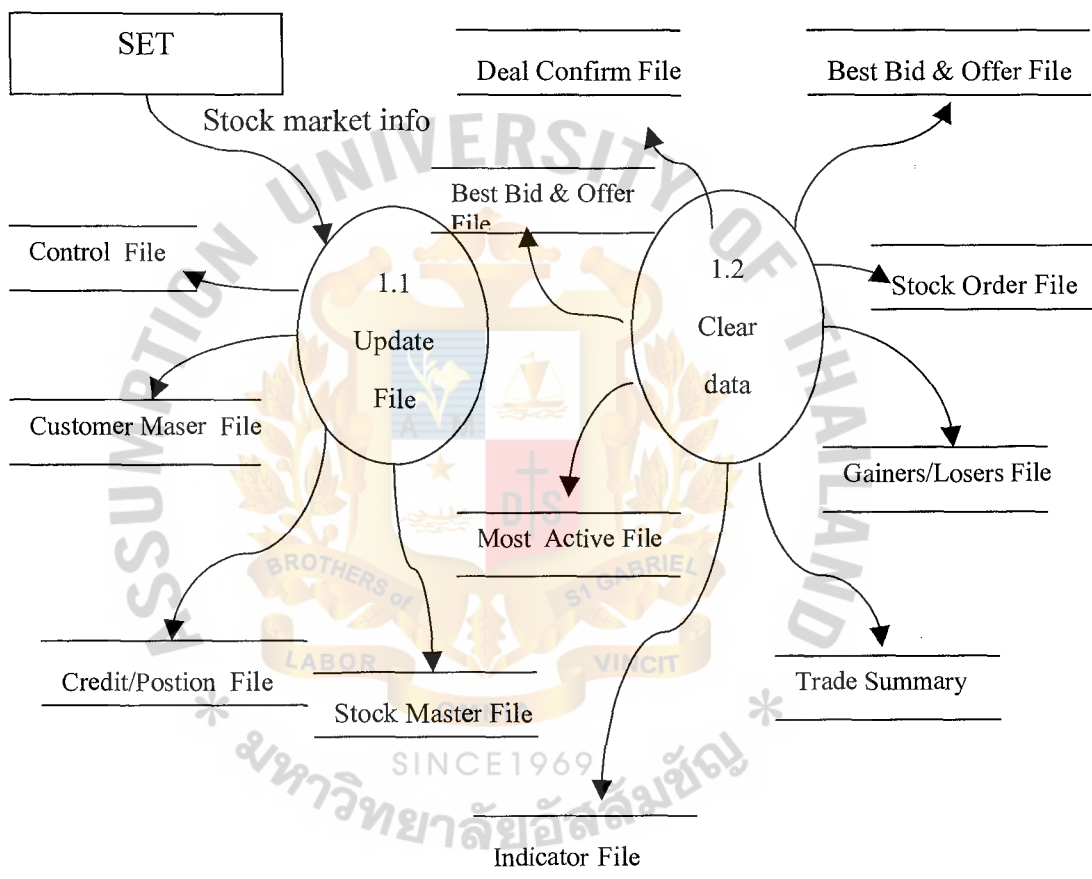


Figure A.1. DFD Level 1 of Process 1.0 Start Up.

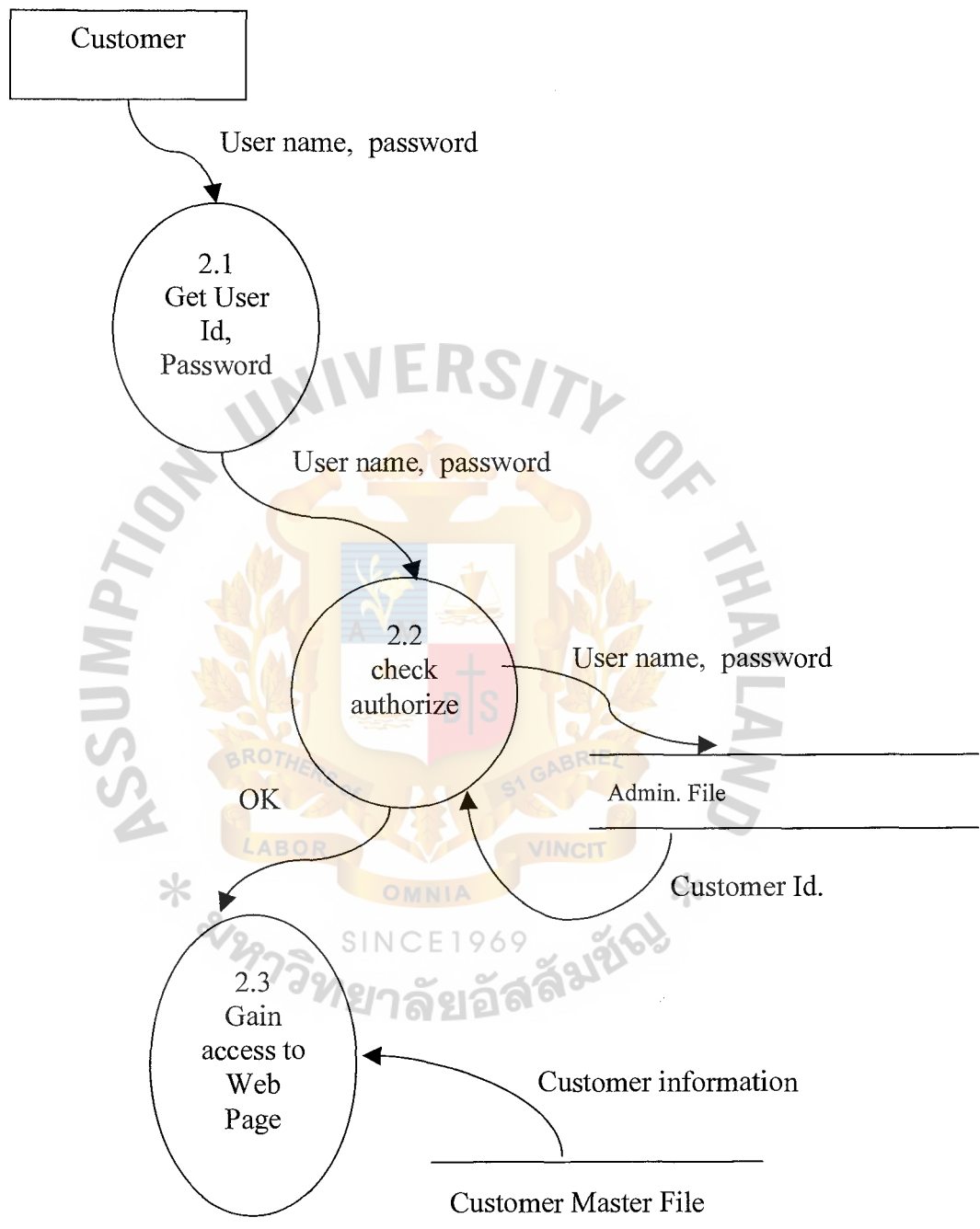


Figure A.2. DFD Level 1 of Process 2.0 Gain Access to Web Page.

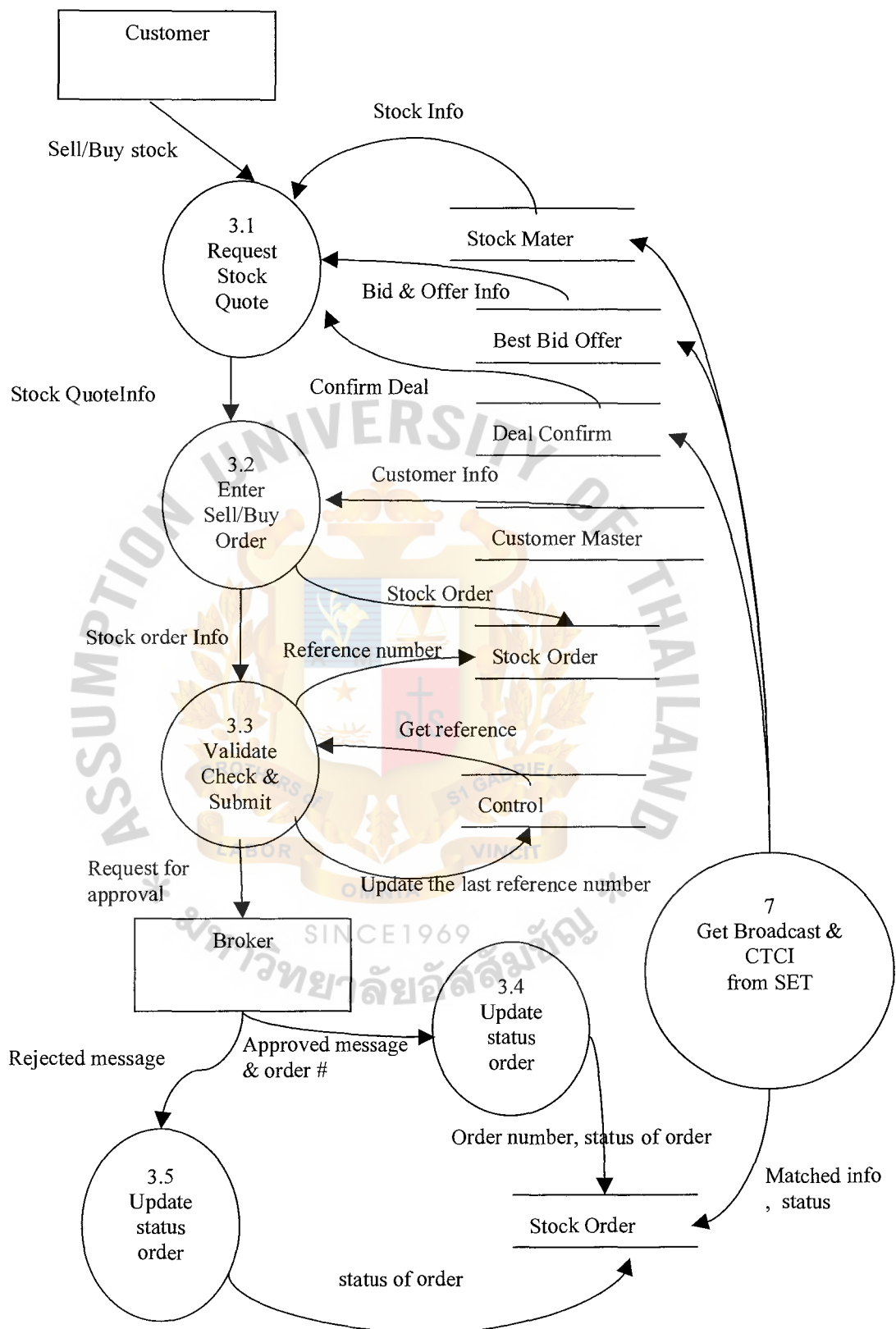


Figure A.3. DFD Level 1 of Process 3.0 Enter Order.

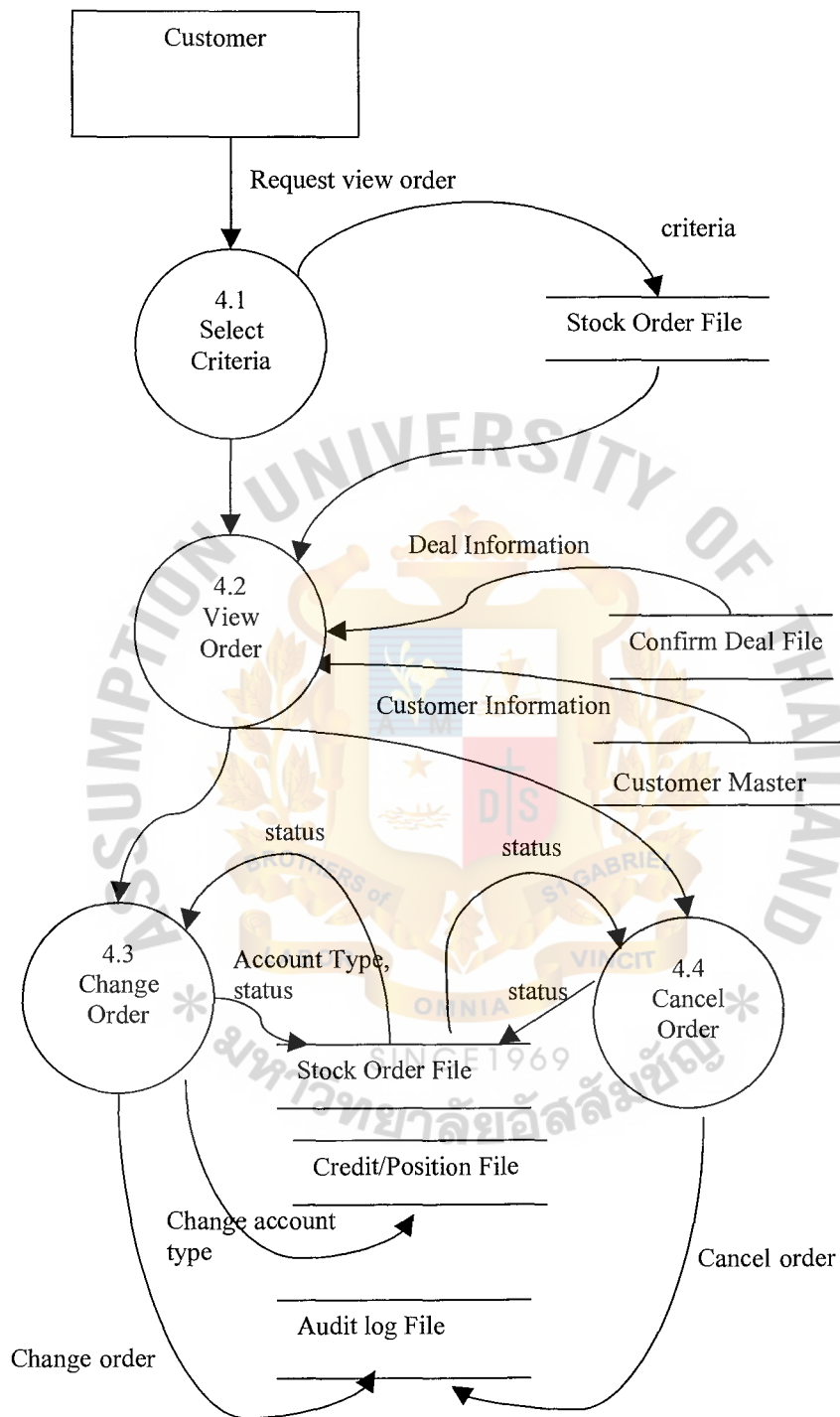


Figure A.4. DFD Level 1 of Process 4.0 View Order.

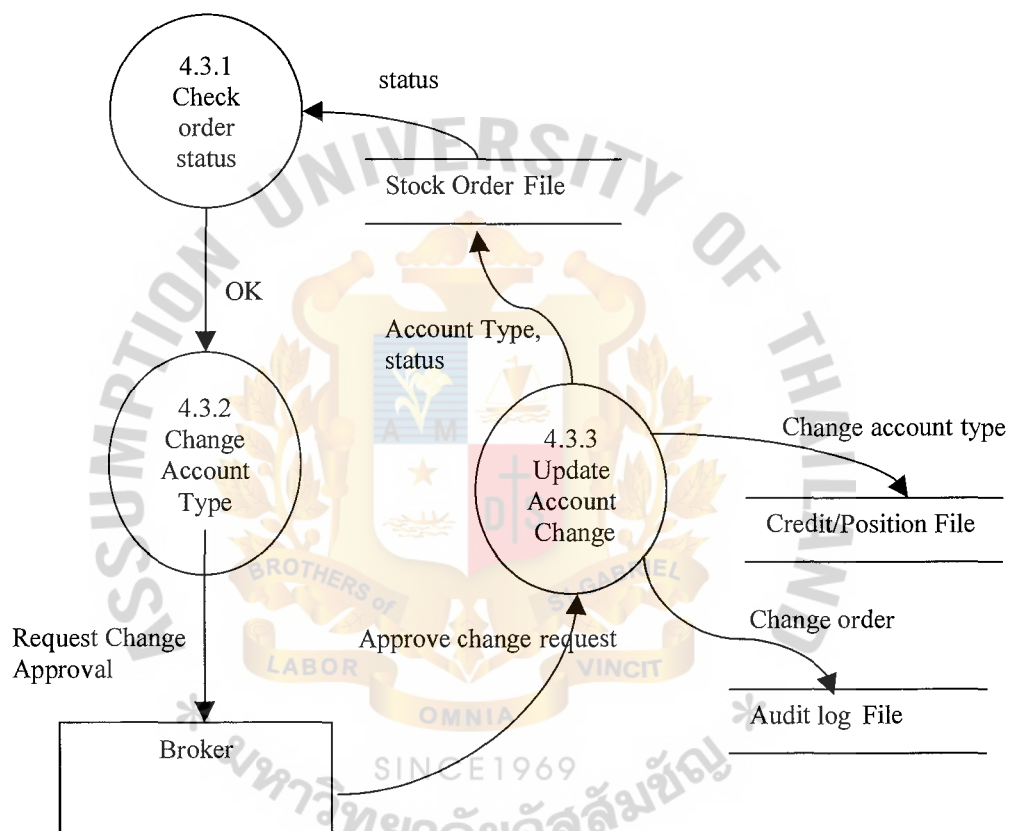


Figure A.5. DFD Level 2 of Process 4.3 Change Order.

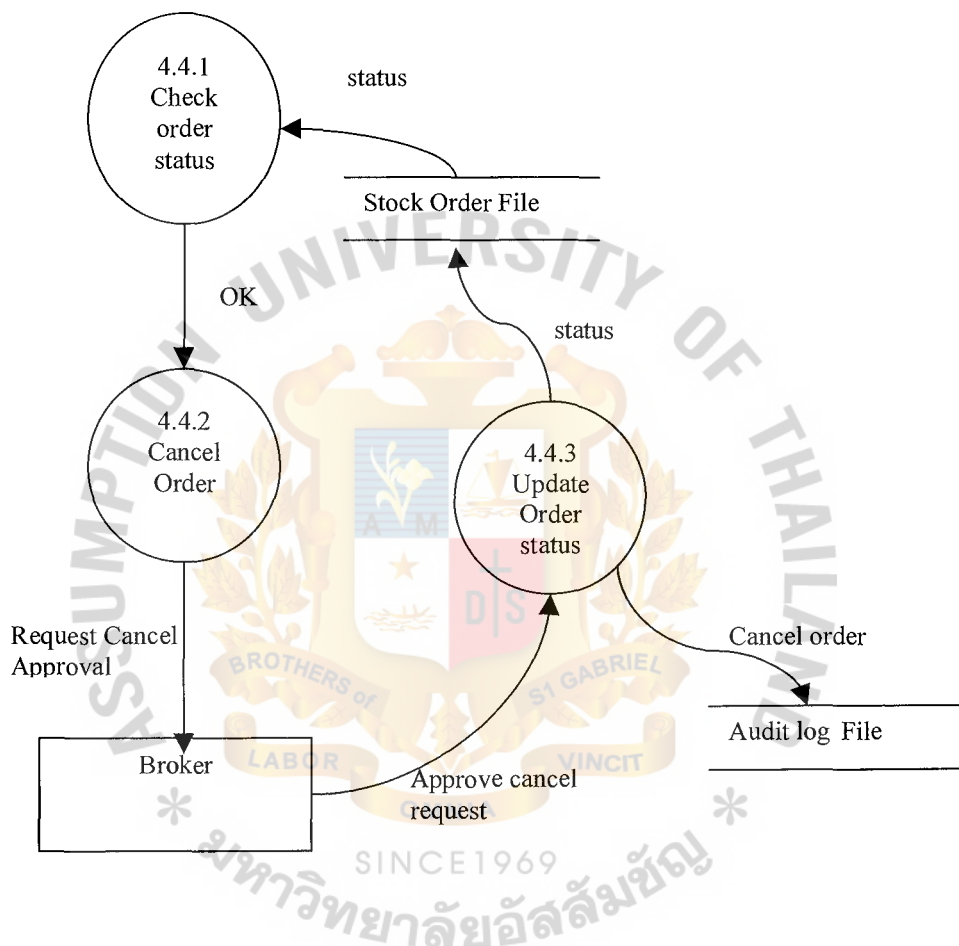


Figure A.6. DFD Level 2 of Process 4.4 Cancel Order.

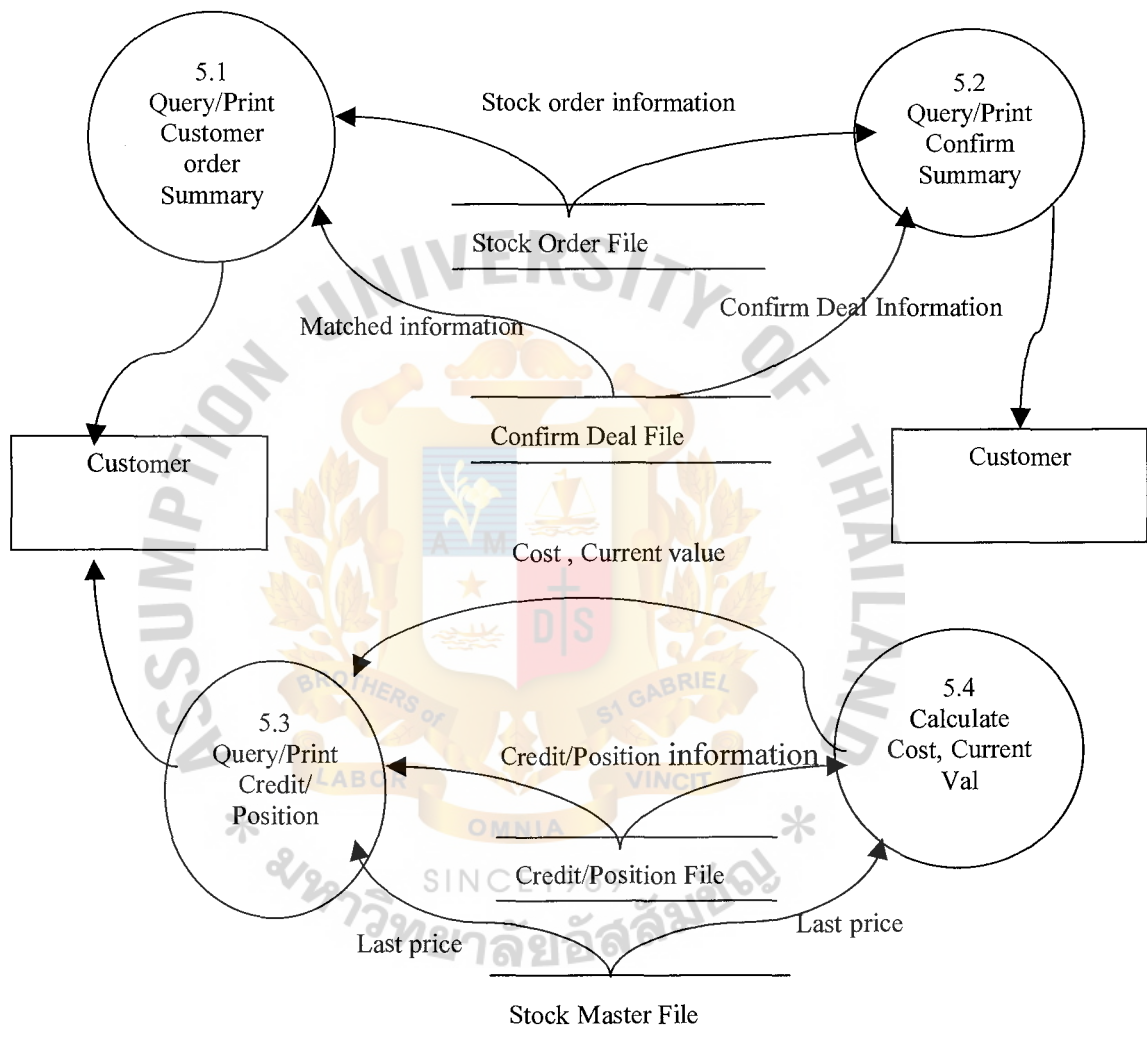


Figure A.7. DFD Level 1 of Process 5.0 Query/Print Order Information.

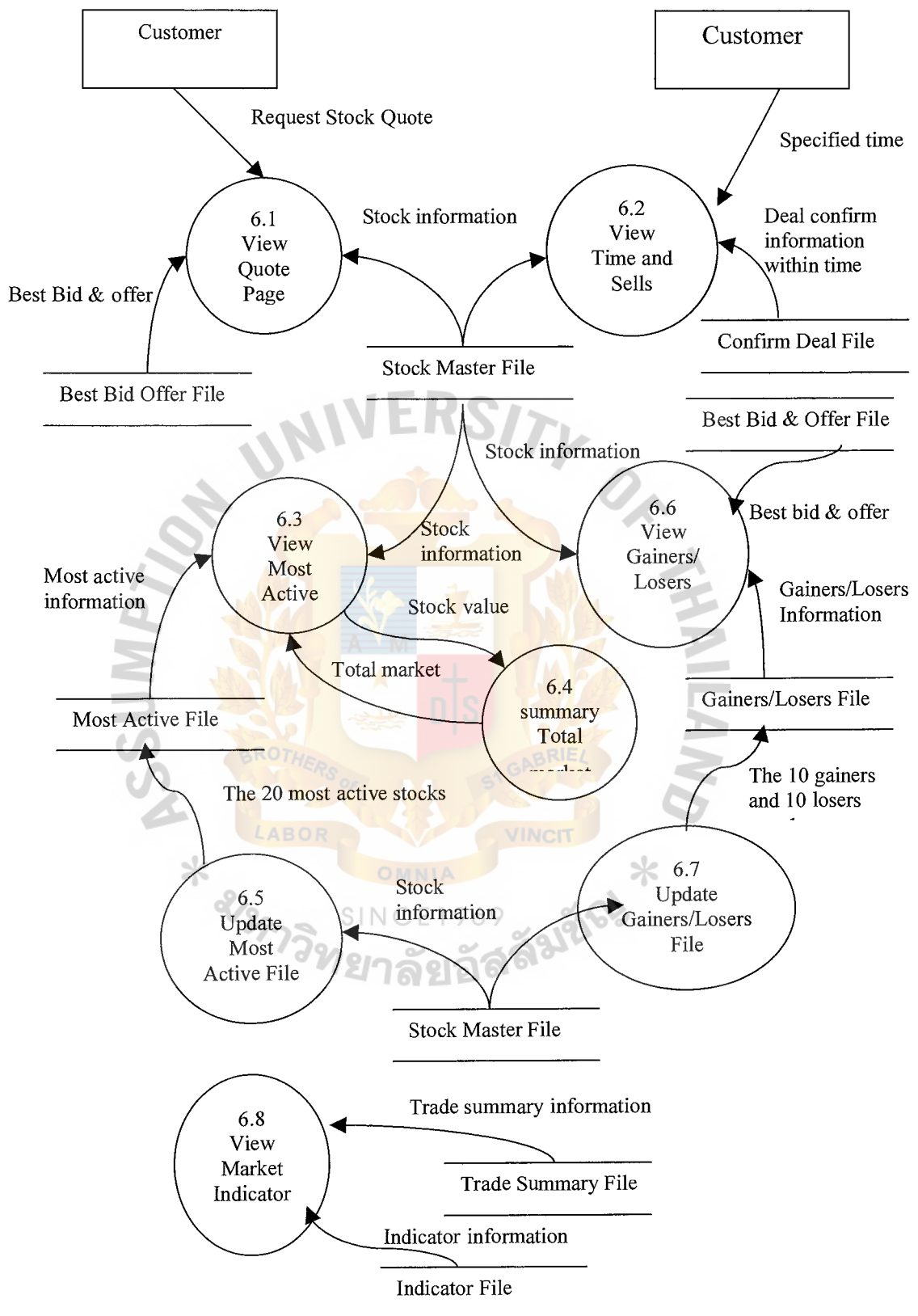


Figure A.8. DFD Level 1 of Process 6.0 View Market Information.

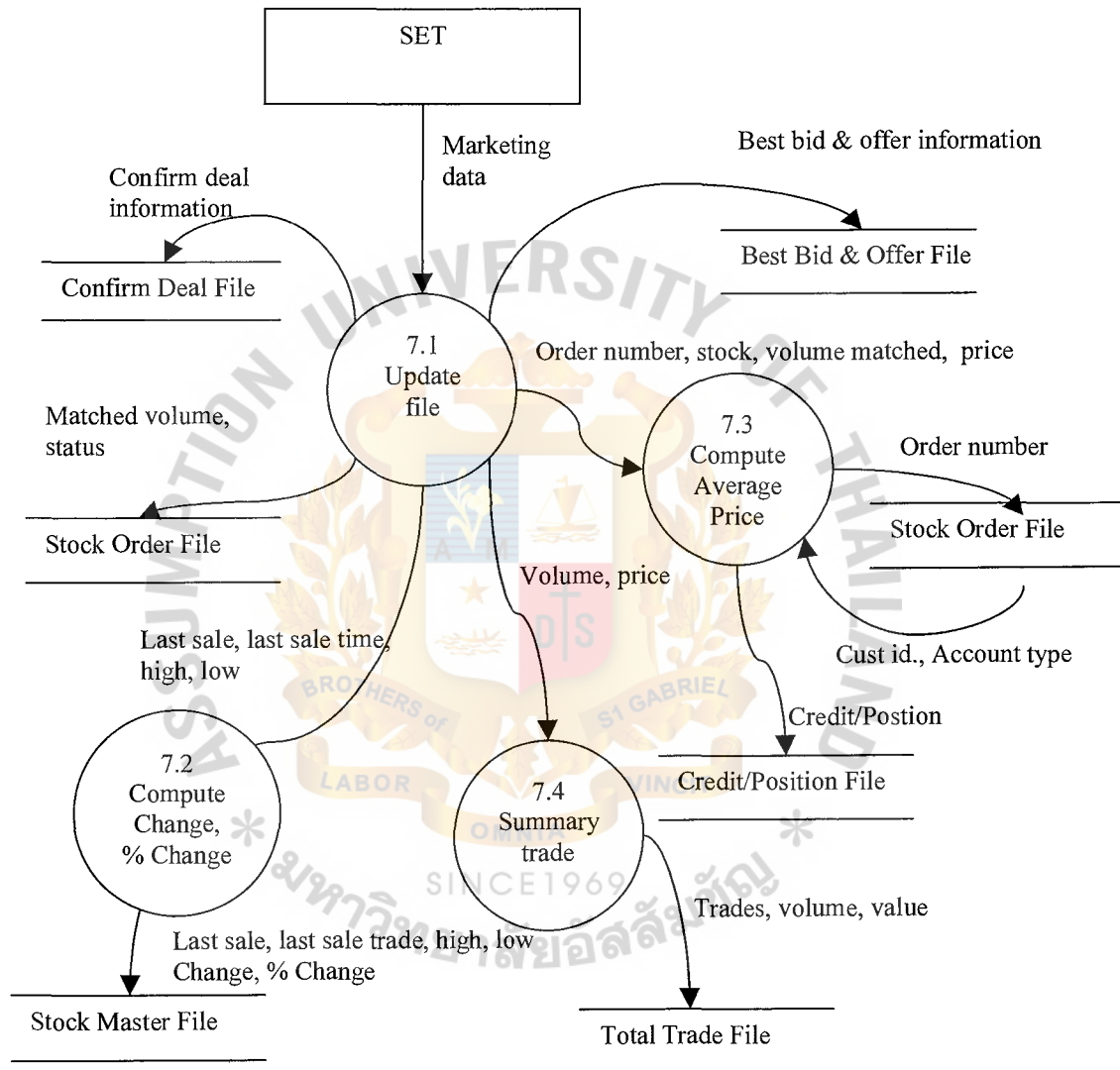


Figure A.9. DFD Level 1 of Process 7.0 Broadcast and CTCL.

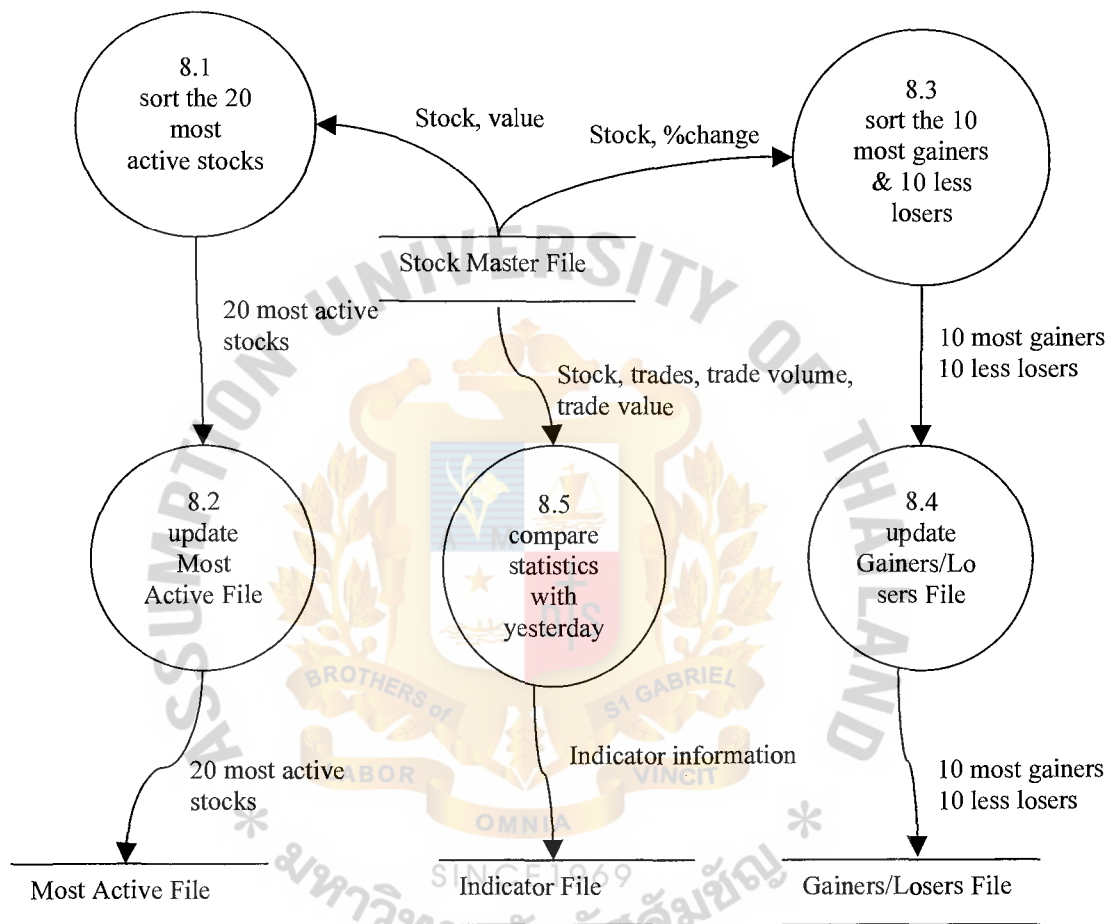


Figure A.10. DFD Level 1 of Process 8.0 Automatic Update Statistics.



APPENDIX B
FILE LAYOUT

Table B.1. Customer Master File.

Index Key: Cust. ID

Field Name	Type	Size	Remark
Cust. ID	Character	10	
Cust. Name	Character	30	
Cust. Surname	Character	30	
Address1	Character	50	
Address2	Character	50	
Zip Code	Character	5	
Telephone1	Character	15	
Telephone2	Character	15	
E-Mail Address	Character	30	
Cash Account ID	Character	10	
Credit Account ID	Character	10	
Broker ID	Character	10	

Table B.2. Stock Master File.

Index Key: Stock

Field Name	Type	Size	Remark
Stock	Character	8	
Name	Character	50	
Last Sale	Numeric	14,5	
Last Sale Time	Time	HH:MM:SS	
Previous Close	Numeric	14,5	
Change	Numeric	14,5	

Table B.2. Stock Master File. (Continued)

Field Name	Type	Size	Remark
Percent Change	Numeric	14,5	
High	Numeric	14,5	
Low	Numeric	14,5	
Open Price	Numeric	14,5	
Floor	Numeric	14,5	
Ceiling	Numeric	14,5	
Trades	Numeric	14,5	
Trade Volume	Numeric	14,5	
Trade Value	Numeric	14,5	
Flag	Character	1	

Table B.3. Administration File. Index Key: User Name + Password

Field Name	Type	Size	Remark
User Name	Character	10	
Password	Character	10	
Cust ID	Character	10	

Table B.4. Control File.

Field Name	Type	Size	Remark
Date	Date	MM/DD/YYYY	
Reference Number	Character	8	

Table B.4. Control File. (Continued)

Field Name	Type	Size	Remark
Auto Update in	Numeric	14,5	time to automatic update statistic

Table B.5. Audit Log File.

Index Key: Trans. Number

Field Name	Type	Size	Remark
Trans. Number	Character	10	
Date	Date	MM/DD/YY	
Time	Time	HH:MM:SS	
Order Number	Character	8	
Type of Trans.	Character	1	
Old Acct Type	Character	1	
New Acct Type	Character	1	

Table B.6. Stock Order File.

Index Key: Cust ID + Order No.

Field Name	Type	Size	Remark
Reference Number	Character	8	
Order Number	Character	8	
Cust ID	Character	10	
Cust Acct Type	Character	1	
Date	Date	MM/DD/YYYY	

Table B.6. Stock Order File. (Continued)

Field Name	Type	Size	Remark
Time	Time	HH:MM:SS	
Side	Character	1	
Stock	Character	8	
Price	Numeric	14,5	
Volume	Numeric	14,5	
Matched	Numeric	14,5	
Order Type	Character	1	
Condition	Character	1	
Status	Character	1	

Table B.7. Deal Confirm File. Index Key: Confirm # + Stock + Time

Field Name	Type	Size	Remark
Confirm Number	Character	8	
Order Number	Character	8	
Date	Date	MM/DD/YYYY	
Time	Time	HH:MM:SS	
Stock	Character	8	
Price	Numeric	14,5	
Volume	Numeric	14,5	
Value	Numeric	14,5	

Table B.8. Credit/Position File.

Index Key: Cust ID + Cust Acct Type

Field Name	Type	Size	Remark
Cust ID	Character	10	
Cust Acct Type	Character	1	
Stock	Character	8	
Volume	Numeric	14,5	
Average Price	Numeric	14,5	

Table B.9. Trade Summary File.

Field Name	Type	Size	Remark
Ttl Trades	Numeric	14,5	
Ttl Volume	Numeric	14,5	
Ttl Value	Numeric	14,5	

Table B.10. Best Bid Offer File.

Index Key: Stock

Field Name	Type	Size	Remark
Time	Time	HH:MM:SS	
Stock	Character	8	
Bid Volume 1 to 3	Array [1..3] of Numeric	14,5	
Bid Price 1 to 3	Array [1..3] of Numeric	14,5	
Offer Volume 1 to 3	Array [1..3] of Numeric	14,5	
Offer Price 1 to 3	Array [1..3] of Numeric	14,5	

Table B.11. Most Active File.

Field Name	Type	Size	Remark
Stock1	Character	8	
Stock2	Character	8	
Stock3	Character	8	
Stock4	Character	8	
Stock5	Character	8	
Stock6	Character	8	
Stock7	Character	8	
Stock8	Character	8	
Stock9	Character	8	
Stock10	Character	8	
Stock11	Character	8	
Stock12	Character	8	
Stock13	Character	8	
Stock14	Character	8	
Stock15	Character	8	
Stock16	Character	8	
Stock17	Character	8	
Stock18	Character	8	
Stock19	Character	8	
Stock20	Character	8	
Last Update Time	Time	HH:MM:SS	

Table B.12. Gainers/Losers File.

Field Name	Type	Size	Remark
Gain1	Character	8	
Gain2	Character	8	
Gain3	Character	8	
Gain4	Character	8	
Gain5	Character	8	
Gain6	Character	8	
Gain7	Character	8	
Gain8	Character	8	
Gain9	Character	8	
Gain10	Character	8	
Loss1	Character	8	
Loss2	Character	8	
Loss3	Character	8	
Loss4	Character	8	
Loss5	Character	8	
Loss6	Character	8	
Loss7	Character	8	
Loss8	Character	8	
Loss9	Character	8	
Loss10	Character	8	
Last Update Time	Time	HH:MM:SS	

Table B.13. Indicator File.

Field Name	Type	Size	Remark
Date	Date	MM/DD/YYYY	
Time	Time	HH:MM:SS	
Stock Advance	Numeric	14,5	
Stock Decline	Numeric	14,5	
Stock Unchange	Numeric	14,5	
Volume Up	Numeric	14,5	
Volume Down	Numeric	14,5	
Volume UnChange	Numeric	14,5	
Value Up	Numeric	14,5	
Value Down	Numeric	14,5	
Value UnChange	Numeric	14,5	



The first screen needs users to identify user name and password before gaining access to the system.

(1) Logon Screen

User Name & Password: A user name is assigned to each user to use the system. Based on that “User Name” a “Password” is assigned and a set of privileges is authorized for that user.

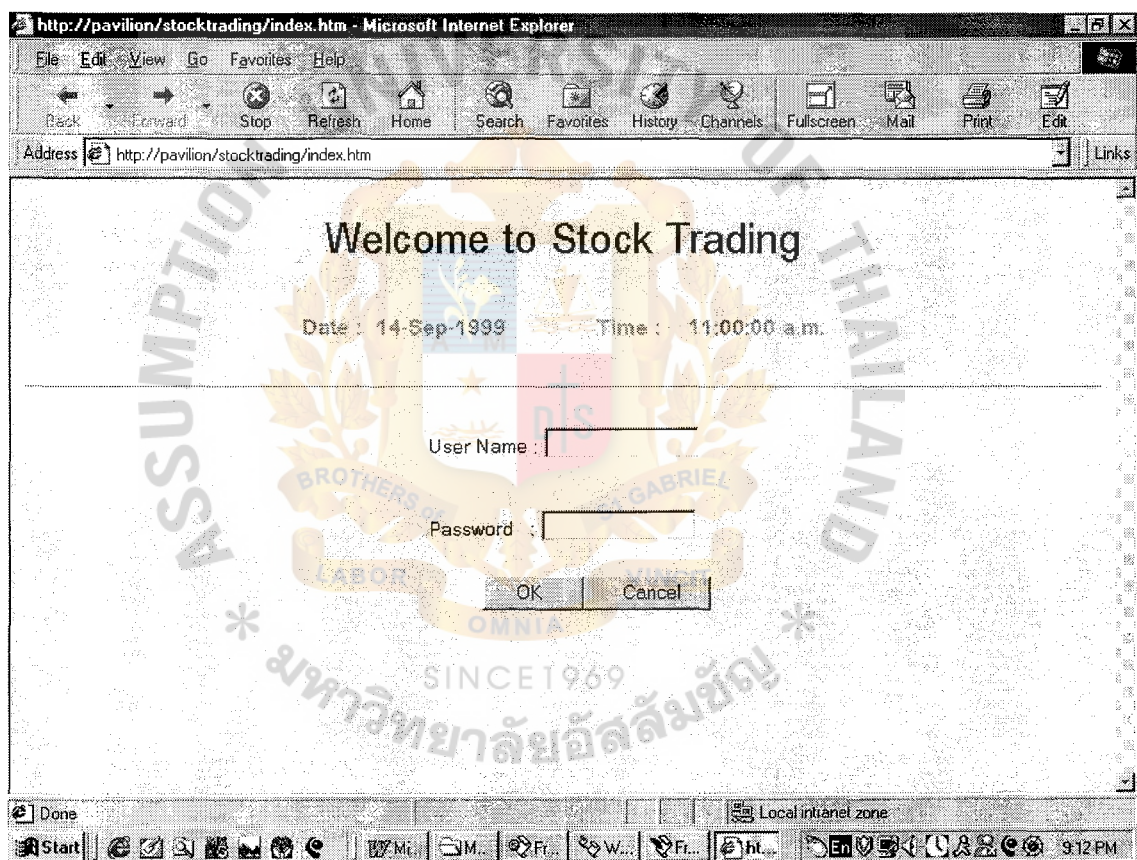


Figure C.1. Log On Screen.

There are five main functions for the user menu in Figure C.2.

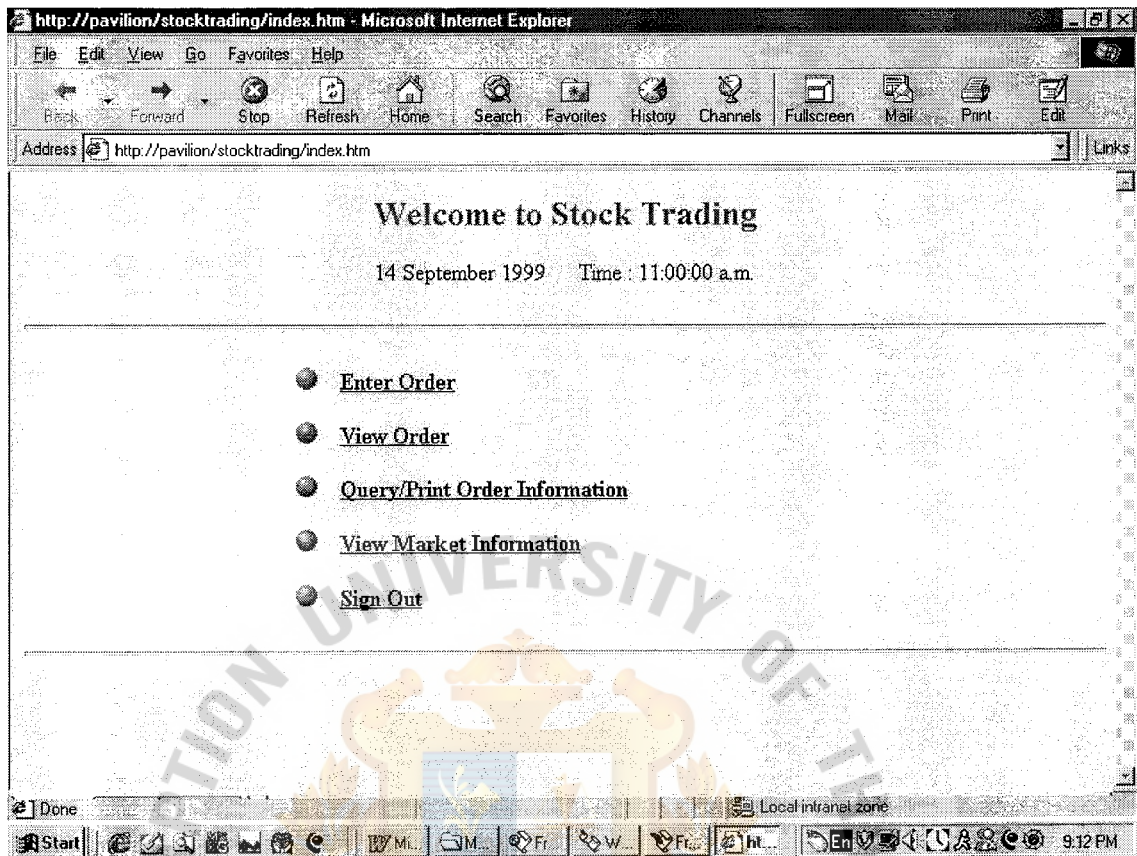


Figure C.2. Menu Screen.

(2) The Order Entry

The order entry screen lets the user enter buy and sell orders as shown in Figure C.3.

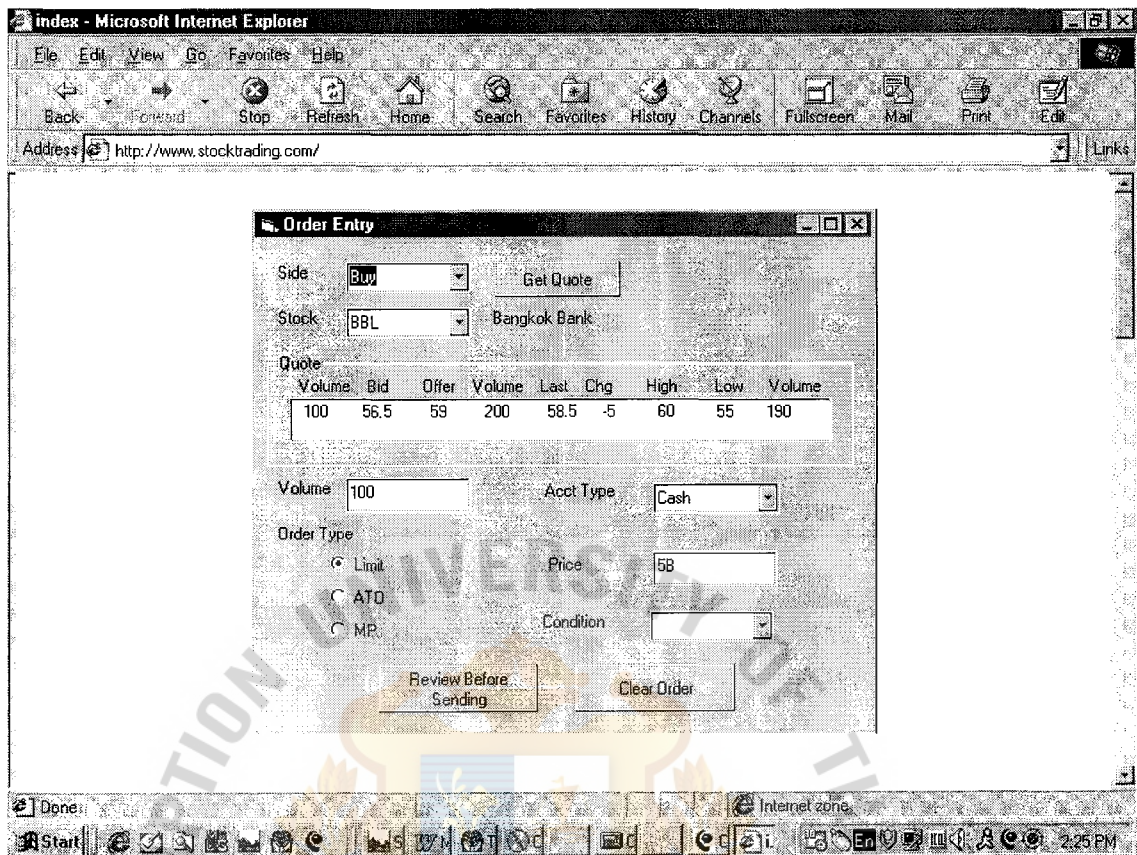


Figure C.3. Order Entry.

The user enters a buy/sell code, the stock symbol and can get the stock information by clicking the Get Quote button. The system will display the stock information as shown in Figure C.4.

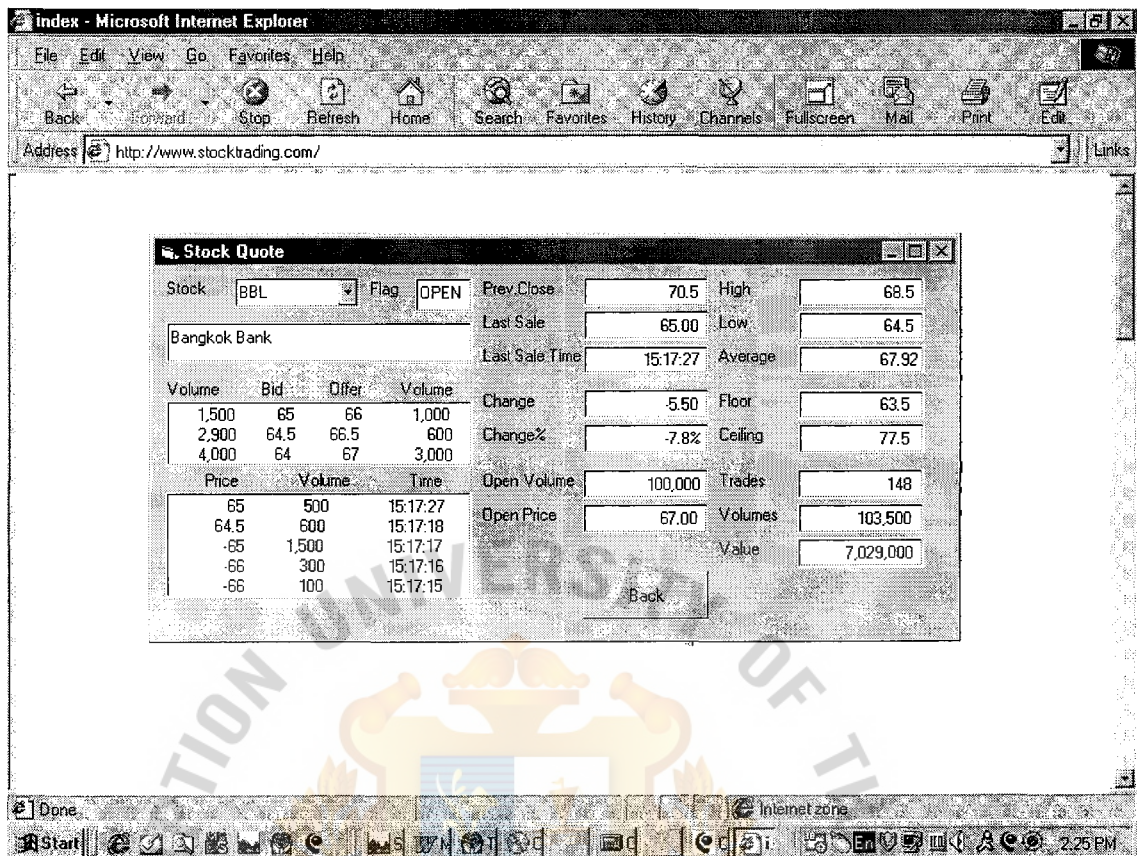


Figure C.4. Stock Quote.

After the user views the stock quote information, he/she can go back to the order screen to enter the volume, Order type, Price, Account Type and condition.

The order type has 3 options for the user to select.

- (a) For Limit Orders, the user needs to specify the price that he/she wants to trade. A buy limit order specifies the maximum price the customer will pay. A sell limit order specifies the minimum price at which the customer will sell. The stock can only be traded at prices equal to or “better” than the price on the order.

- (b) At The Open Price (ATO) is only accepted during the “pre-open” period. These orders can be traded only at the opening price of the security on the day the order is received.
- (c) Market Price Orders (MP) are orders without a price. A market price order is sent when the customer wants the order to be matched as soon as possible and is willing to accept the best available price(s) in the market without specifying a limit.

Normally, the condition of order is defaulted to be “None”. Anyway user can put the condition of order in 2 types as follows:

- (a) FOK (Fill Or Kill): The number of shares available in the AOM Order Book is added up to determine whether or not the entire order can be filled when it is entered. If the entire order cannot be filled, the entire order is canceled back to the user. The order may be matched against multiple orders at prices equal to or better than the price on the order. Fill or Kill orders are not accepted during the “pre-open” period.
- (b) IOC (Immediate or Cancel): The order is matched against as many shares as possible from the AOM Order Book immediately after entry. Any remaining quantity is canceled back to the member firm. Immediate or Cancel orders are not accepted during the “pre-open” period.

This condition is defaulted to be “None”.

After an order is entered, the system needs user to review the order before sending. When the user review and confirm to send the order, the

system will give the reference number to him/her for future reference as shown in Figure C.5.



Figure C.5. Review an Order.

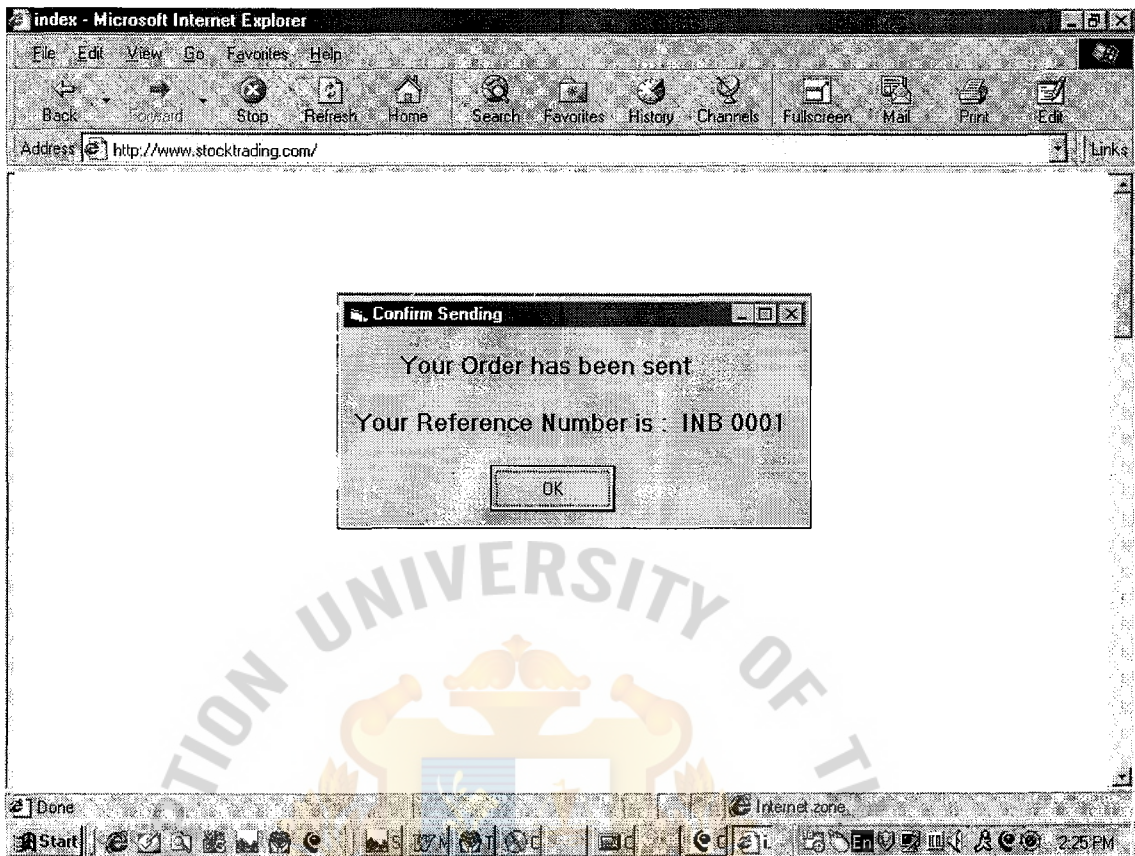


Figure C.6. Confirm Sending.

After an order is confirmed and sent to the market officer, if the order gets an approval, it will be sent to the trading system. As orders are matched by the trading system, a last sale message is broadcast to all market participants informing them of the trade. An additional message is sent to the buyer and the seller involved in the trade (or deal) advising them in more detail of the transaction. If the trading system or the market officer rejects an order (due to invalid terms, market closed, etc.), a rejection message is transmitted back to the user of the rejection and the reason.

(3) View Orders

The view order form displays all of the orders placed on the current day, view the status of those orders, edit or cancel orders. Orders are displayed in a scrollable list in LIFO (Last In/First Out) order.

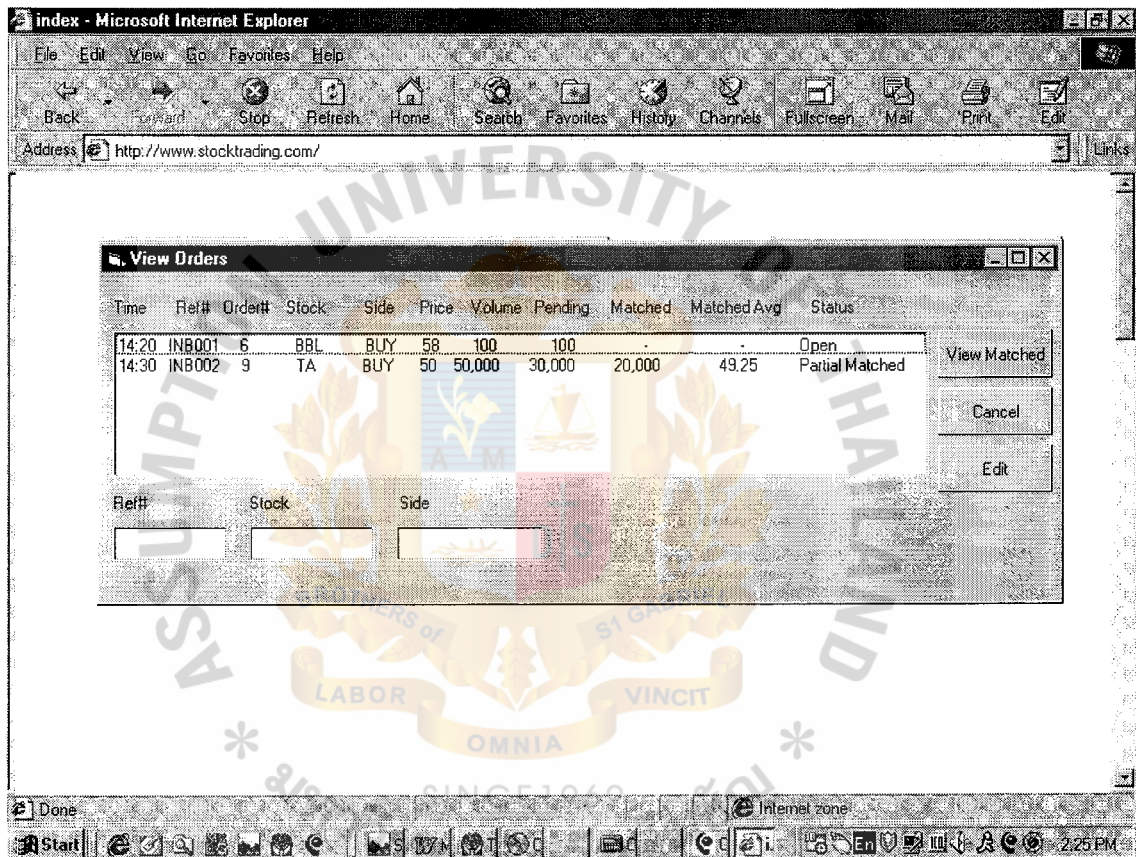


Figure C.7. View Orders.

This screen allows user to select the criteria by which orders are sorted by reference number, stock code or side.

Time: The actual time the order was placed.

Reference number: The reference number that system give to the user when he/she enters the order.

Order number: The order number that broker system gives to the user when the order has been received.

Stock: Stock Symbol.

Side: Indicator for “Buy” or “Sell” transaction.

Price: The price at which the order was placed.

Volume: The order volume of stock associate with the order.

Pending: The order volume that is not currently matched. This volume can be cancelled or edited.

Matched: The volume of shares currently matched in this order.

Matched average: The average price of shares of the stock that were fully or partially matched in this order

Status: Provide the user with information concerning the processing of the order. The message status may have one of the following statuses:

- (a) Pending Broker Approved
- (b) Pending SET Approved
- (c) Cancel
- (d) Open
- (e) Partial Matched
- (f) Fully Matched

The user can view matched information of the record that has the “Partial Matched” or “Fully Matched” status as shown in Figure C.8.

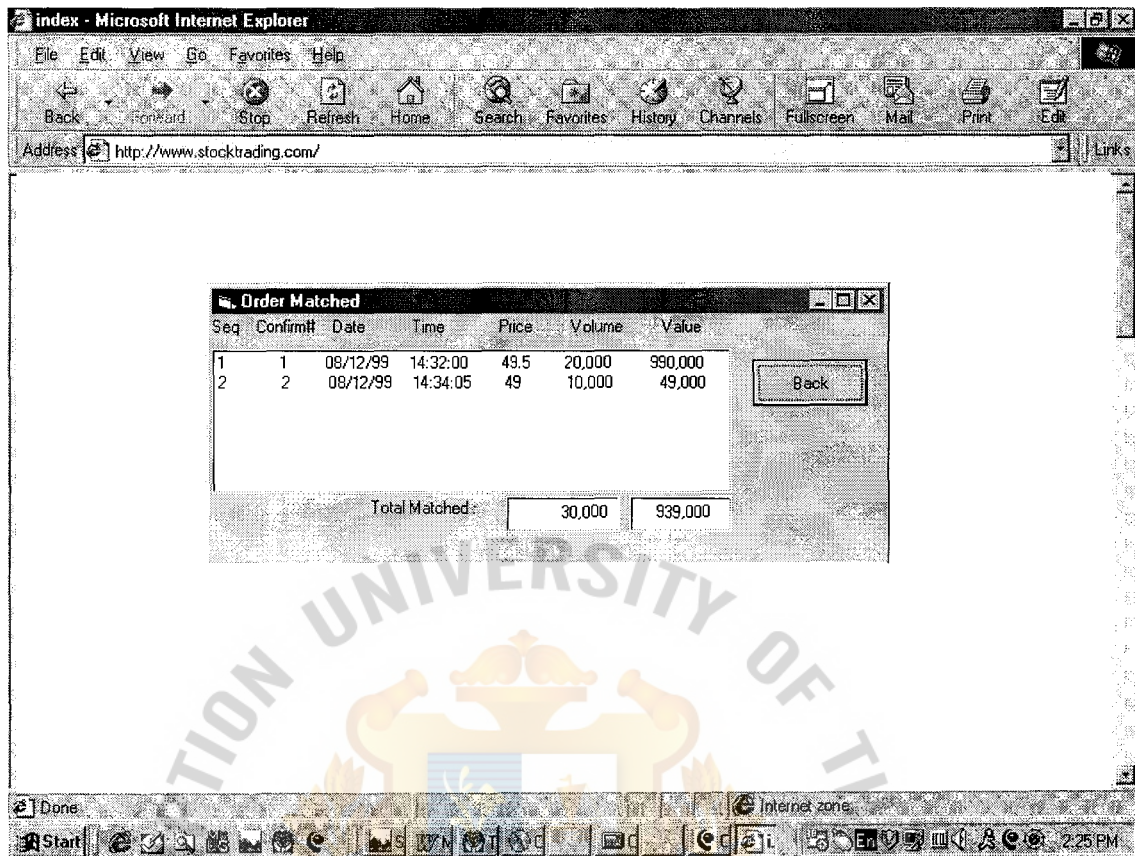


Figure C.8. Matched Order.

After viewing an order, only the un-executed portion of an order can be canceled or changed.

(4) Query/Report Order Information

User can query or print the daily trading information.

(a) Customer Order Summary

Customer can query or print the orders that he/she placed on the current day.

index - Microsoft Internet Explorer

File Edit View Go Favorites Help

Back Forward Stop Refresh Home Search Favorites History Channels Fullscreen Mail Print Edit

Address <http://www.stocktrading.com/> Links

Order#	Side	Stock	Volume	Price	Matched	Price
2	B	BBL	300	50	300	50
3	B	BBL	500	50		
4	B	BBL	500	50	200	50
5	B	BBL	500	50		
TOTAL BOUGHT (BBL)					500/	50.00
20	S	BBL	100	31	100	31
21	S	BBL	100	31		
TOTAL SOLD (BBL)					100/	31.00
6	B	DS	100	1	100	1
7	B	DS	100	1		
8	B	DS	100	1	100	1
9	B	DS	100	1		
10	B	DS	100	1	100	1
11	B	DS	100	1		
12	B	DS	100	1	100	1
13	B	DS	100	1		
TOTAL BOUGHT (DS)					400/	1.00

Print Close

Done Internet zone

Start 2:25 PM

Figure C.9. Customer Order Summary.

(b) Confirm Summary

This screen shows the trading of only orders that are matched already. User can know the total bought, total sold and the net amount that he/she has to pay for trading as shown in figure C.10

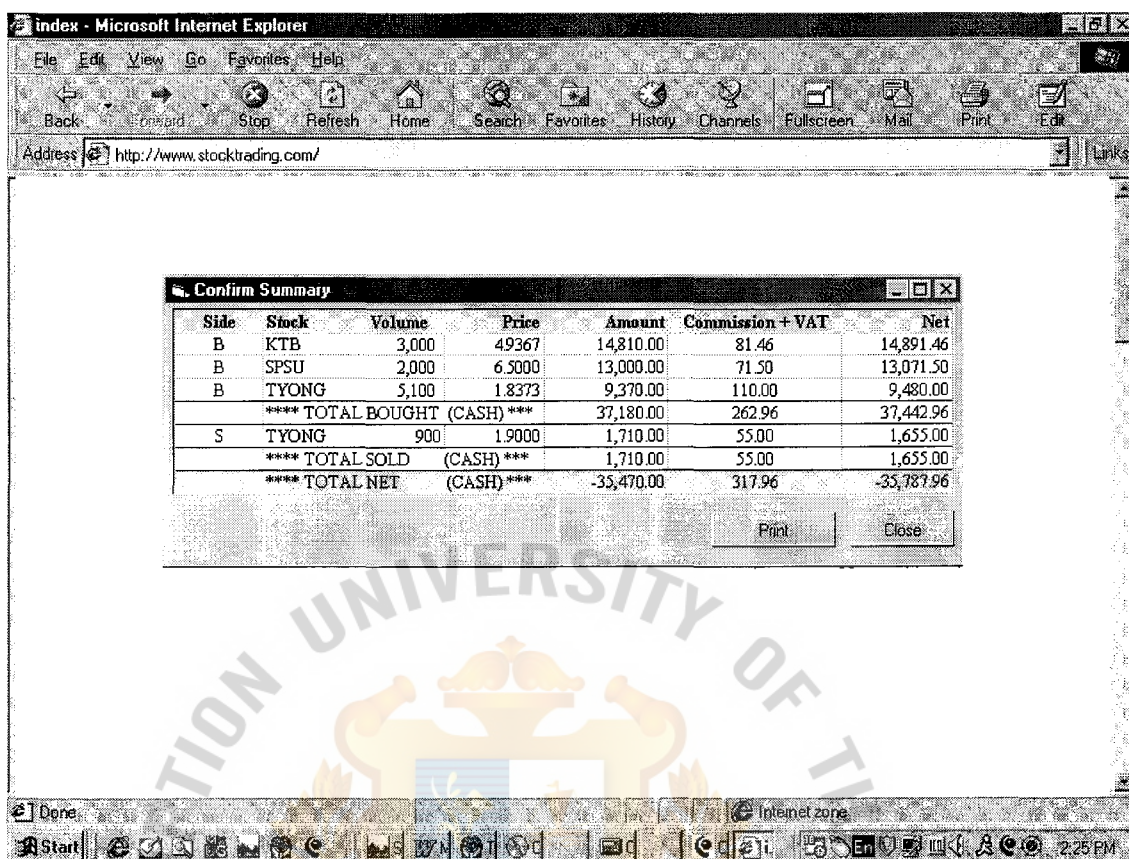


Figure C.10. Confirm Summary.

(c) Credit/Position

This display shows the stocks customer has in each account as shown in Figure C.11.

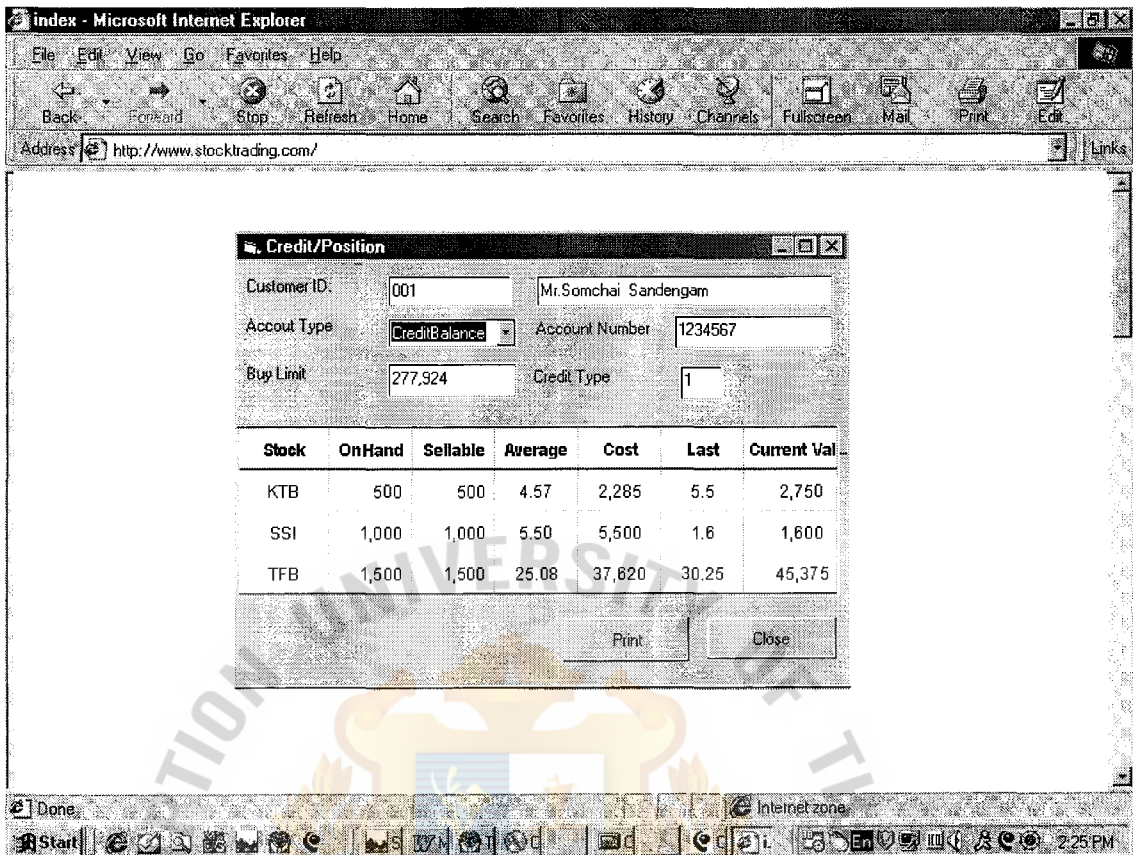


Figure C.11. Credit / Position.

The system allows user to select Account Type (Cash, Credit Balance) then the Credit/Position screen will display all stocks in that account.

Buy Limit: Credit limit for customer to buy the stock

OnHand: Volume of stock that customer owns in that account type

Sellable: Volume of stock that customer can sell without short sales

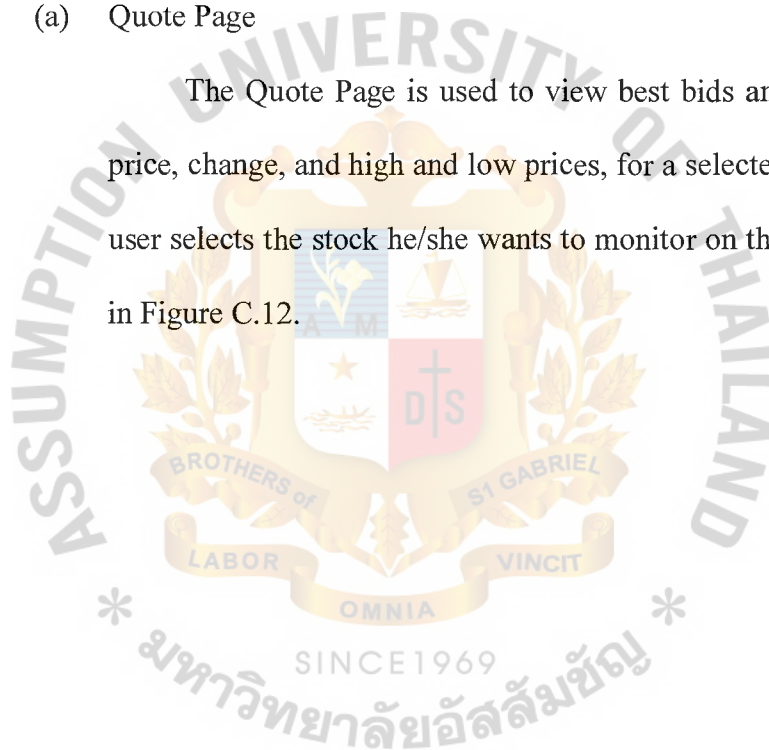
(Sellable = Start today + Matched buy today – Open sale volume – Matched sale today)

Average:	The average price of buying stock
Cost:	The cost of buying stock. Calculated by $\text{OnHand} * \text{Average}$
Last:	The Last Price
Current Val:	Current value, calculate by $\text{OnHand} * \text{Last Price}$

(5) View Market Information

(a) Quote Page

The Quote Page is used to view best bids and offers, last sales price, change, and high and low prices, for a selected list of stock. The user selects the stock he/she wants to monitor on the display as shown in Figure C.12.



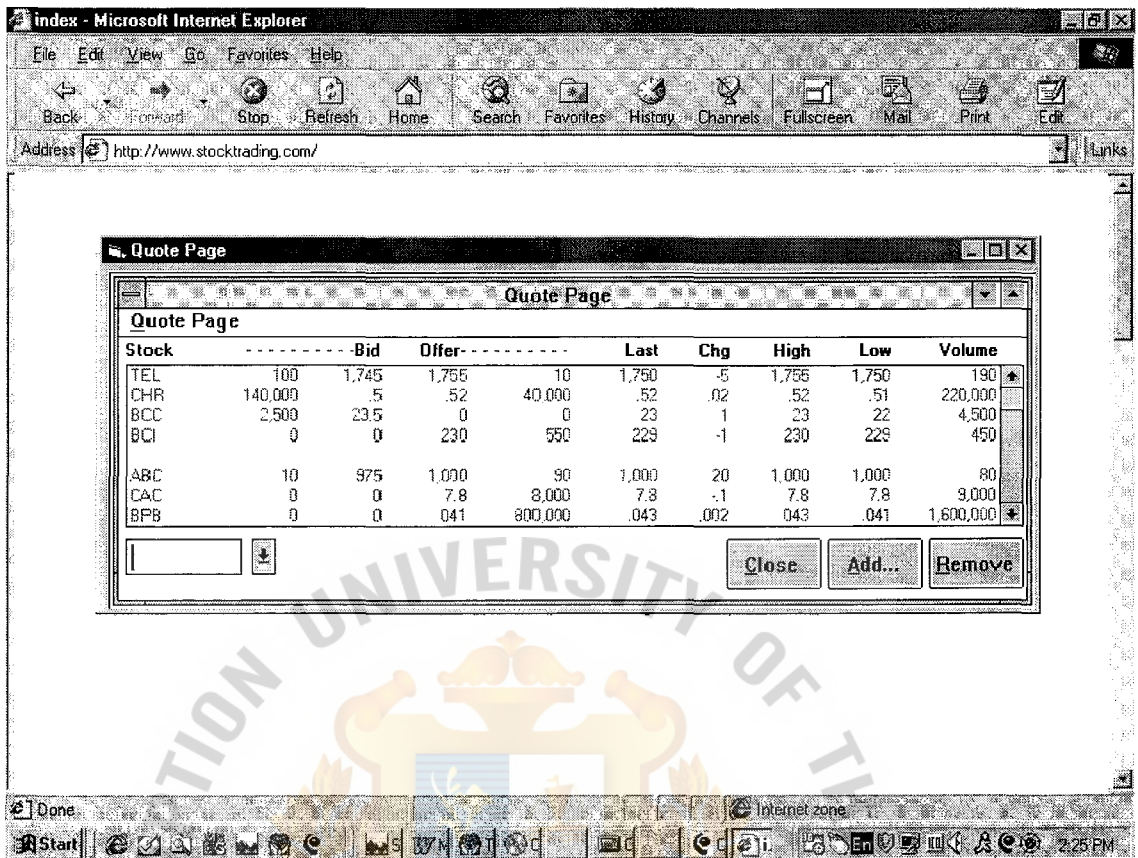


Figure C.12. Quote Page.

(b) Time and Sells

The Time and Sells display shows all trades for a stock within user specified time parameters as shown in Figure C.13.

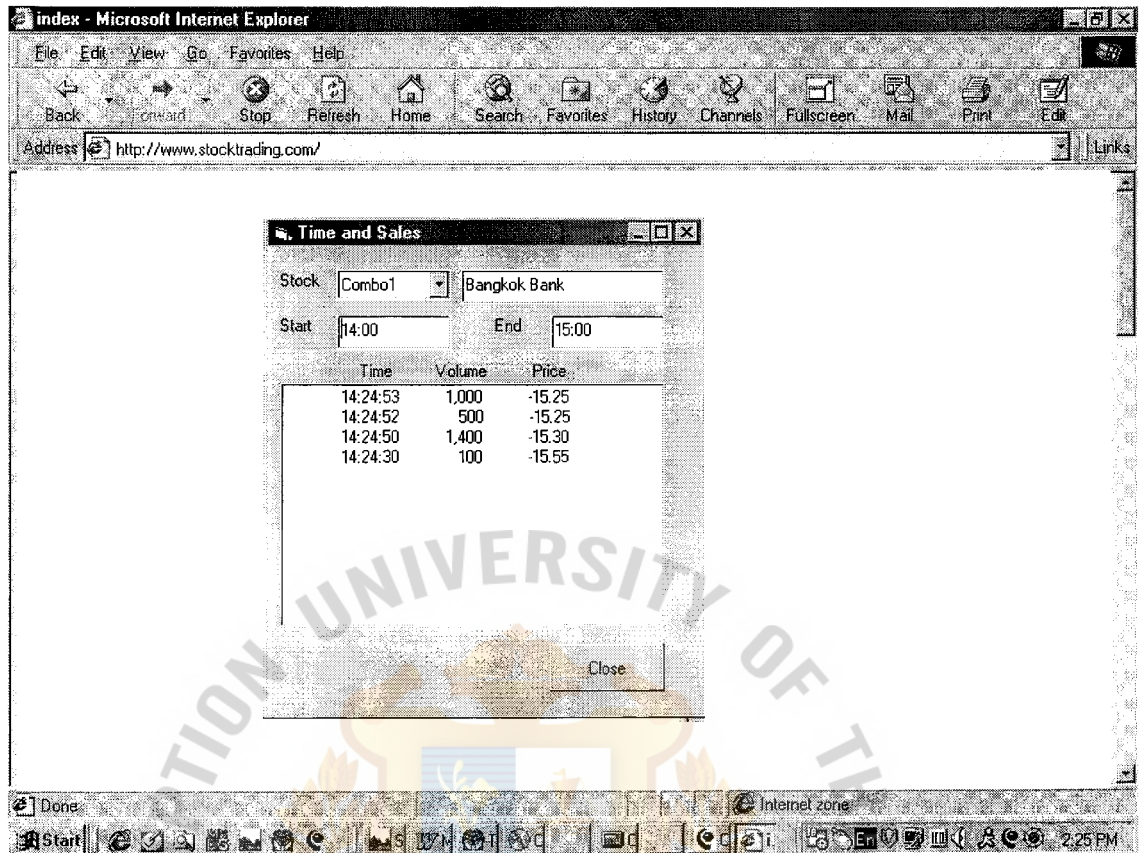


Figure C.13. Time and Sells.

The parameters presented in this figure are discussed below:

Start: The Time start

End: The Time End

Stock: Stock symbol

Volume: Number of shares of the stock traded with this transaction.

Price: Price at which this trade was conducted

Time: Actual time the trade took place.

(c) Most Actives

The Most Active display shows the 20 most active stocks in the market, the value leaders as shown in Figure C.14. The issues are sorted on value and presented in descending order.

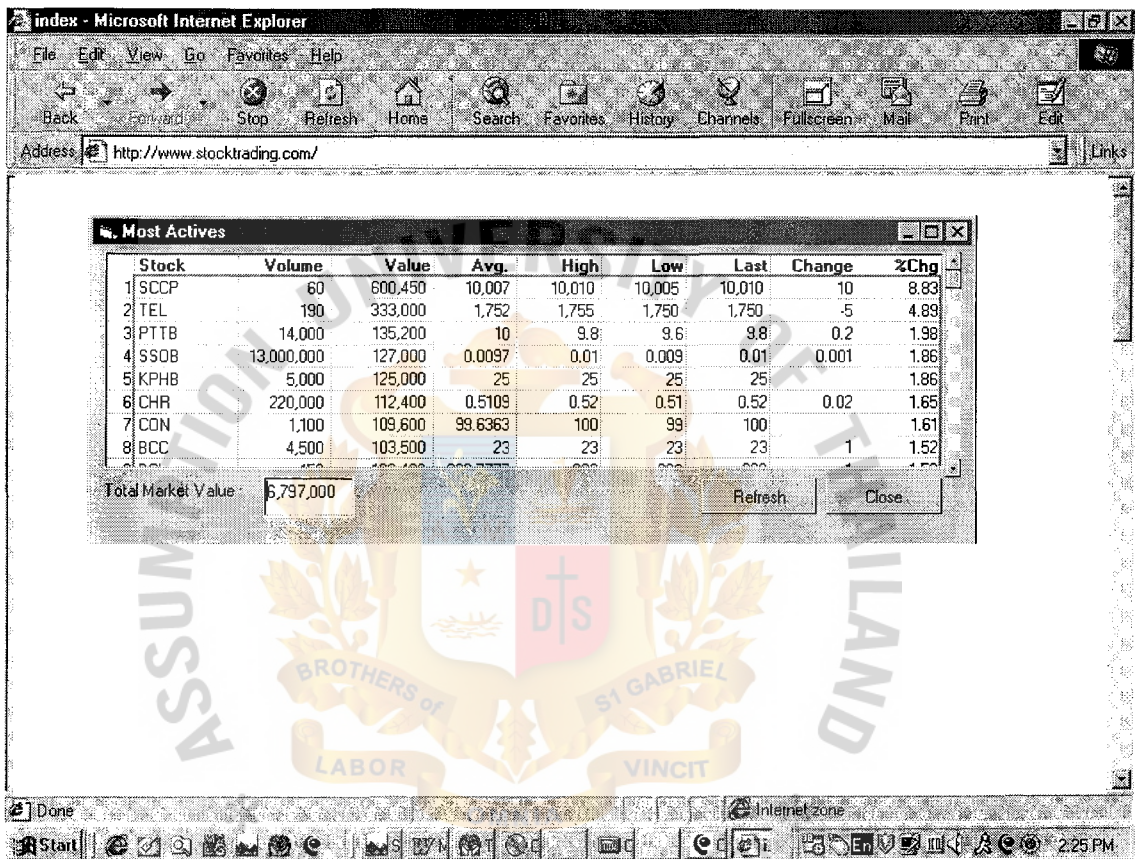


Figure C.14. Most Actives.

The parameters presented in this figure are discussed below:

Stock: Stock symbol

Volume: Volume traded during the current trading day

Value: This is the key entry for the stock symbol. This entry represents the total value of all issues traded during the current trading day

Avg.: The average value of the issue based on opening price and trade activity for the current day. Calculated by dividing the value by the volume.

High: The highest price at which the issue was traded during the current trading day. If no trades are registered for the current day this value will be blank.

Low: The lowest price at which the issue was traded during the current trading day. If no trades are registered for the current day this value will be blank.

Last: Represents the price of a single share of the issue as of the last trade.

Change: The amount in Baht the issue has changed, based on the current trade and the trade previous to the current trade. (Calculated by subtracting the next to last trade from the last trade).

Change %: The change calculated above expressed as a percentage of the trade before last.

(d) Gainers and Losers

The Gainers and Losers display show the 10 stocks with the largest percentage gain in price and largest percentage loss in price as compared to their previous closing prices as shown in Figure C.15.

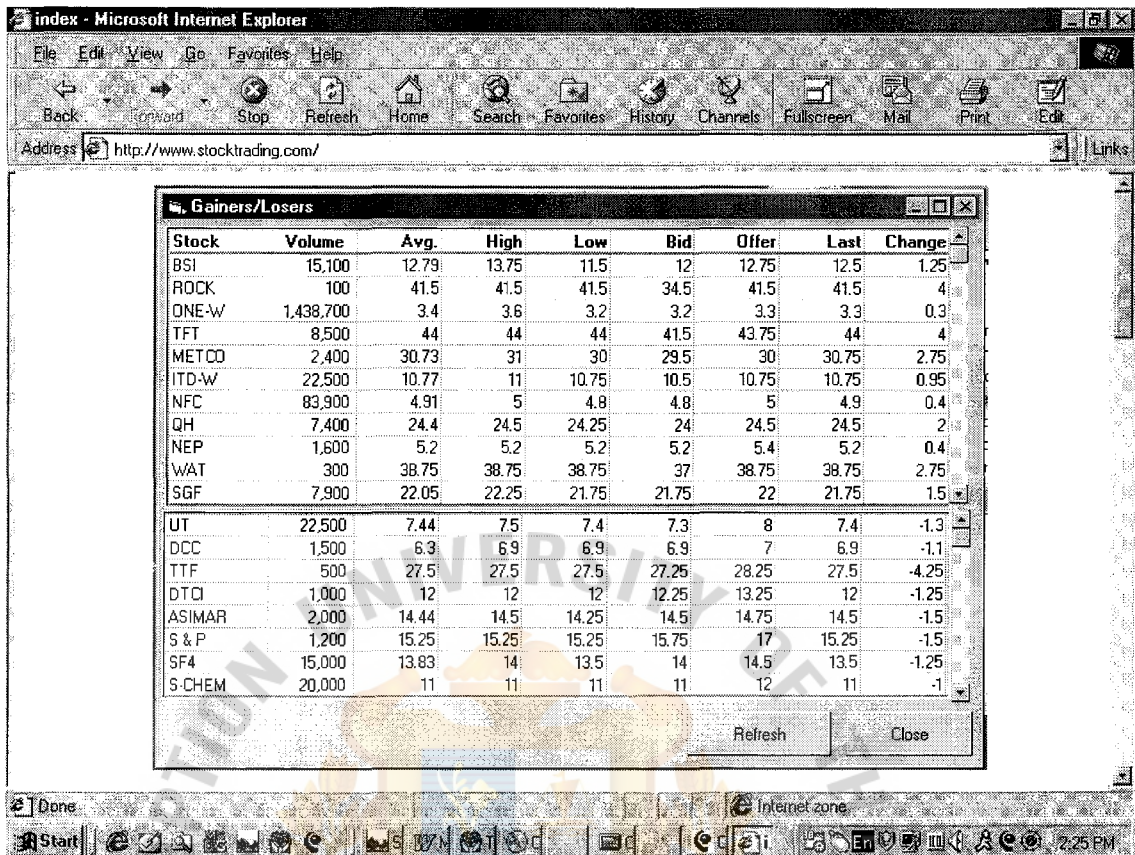


Figure C.15. Gainers and Losers.

The parameters presented in this figure are discussed below:

Stock: Stock symbol

Volume: Volume traded during the current trading day

Avg.: The average value of the issue based on opening price and trade activity for the current day. Calculated by dividing the value by the volume.

High: The highest price at which the issue was traded during the current trading day. If no trades are

registered for the current day this value will be blank.

Low: The lowest price at which the issue was traded during the current trading day. If no trades are registered for the current day this value will be blank.

Bid: Current best asked price

Offer: Current best offer price

Last: Represents the price of a single share of the issue as of the last trade.

Change: The amount in Baht the issue has changed based on the current trade and the trade previous to the current trade. (Calculated by subtracting the next to last trade from the last trade).

Change %: The change calculated above expressed as a percentage of the trade before last.

(e) Total Market Indicators

Market Indicators provides a graphical view of SET market performance. The SET index, Change (in Baht) since the start of the trading day, and change expressed as a percent are provided as shown in Figure C.16.

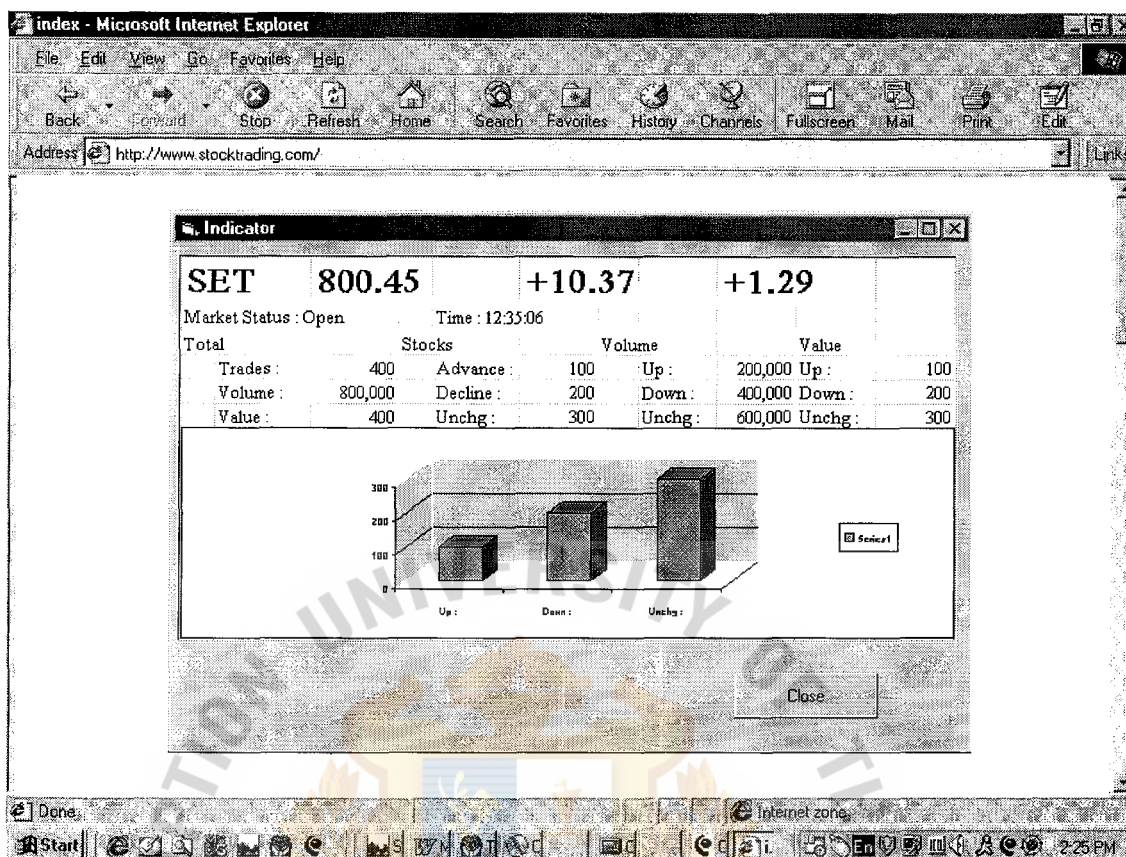


Figure C.16. Market Indicator.

The parameters presented in this figure are discussed below:

Market Status: Provides market opening, closing and status information.

Time: The time at which the status information is valid.

Totals Trade: Total number of trades performed by SET since the beginning of the trading day.

Total Volume: Total number of shares traded through SET

Total Value: Cumulative value of all shares traded through SET

Stocks Advance, Decline, Unchanged: Total number of different issues traded at increased, decreased or unchanged value.

Volume Up, Down, Unchanged: Issues experiencing an increase, decrease, or no change in the number of shares traded.

Value Up, Down, Unchanged: Issues experiencing an increase, decrease or no change in the total value of the traded shares.



St. Gabriel's Library