

Design and Implementation of a Stock Market Monitoring System: A Case Study of the Nigerian Stock Exchange

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Abstract

The stock market is seen as an everyday part of life in any economy is it developed or third world countries. As the world is gradually moving to the information age which a major characteristic of this age is speed; speed in sending messages, speed in healthcare delivery, speed in banking, there is a need for investors to be able to monitor their investments with speed. In this work, we introduce P-Stock, an application for monitoring the activities that go on in the stock market. It tracks stock market activities as well as using the data that has been pooled to calculate the values of stock in an investor's portfolio all in real-time. It is hoped that this will help new investors in monitoring their investments firsthand without need for their brokers.

Keywords: Stock; stock market; stock monitoring; portfolio; Nigeria.

1. Introduction

The initial offering of stocks and bonds to investors is done in the primary market and subsequent trading is done in the secondary market. A stock exchange is often the most important component of a stock market. Supply and demand in stock markets is driven by various factors that, as in all free markets, affect the price of stocks. The stock exchange helps companies generate capital. As a primary market, it provides an avenue for them to sell new shares and bonds to investors. The companies can then use the proceeds from these sales to expand their businesses, develop new products, buy new equipment etc. Nwaiwu (2004) says that the stock market also provides a means for investors to trade in the shares of companies they own among themselves. In other words, it serves as a secondary market. For example, a person who bought the shares of a company at a particular price may sell it to another investor. The investors are the ones who profit from this type of trade – companies do not. The stock exchange also has the function of upholding rules and regulations so that shady people do not cheat investors of their hard earned money. It gives investors security. There is usually no compulsion to issue stock via the stock exchange itself, nor must stock be subsequently traded on the exchange. Such trading is said to be off exchange or over-the-counter. This is the usual way that derivatives and bonds are traded. Increasingly, stock exchanges are part of a global market for securities.

Nyong (1997) said that the stock market is viewed as a complex institution imbued with inherent mechanism

through which long-term funds of the major sectors of the economy comprising households, firms, and government are mobilized, harnessed and made available to various sectors of the economy. The rate at which the values of stocks and bonds for stocks rise and fall can be very hard to follow for various investors which can lead to the loss of valuable money that can be made through either the sale or buying of shares. While only stock brokers are allowed to trade, it is the investors that tell them what to trade with therefore if the investors do not know what to buy and to sell then it can be hard for them to make money in the stock exchange. In summary the problem is the inability of share holders to see and understand the rise and fall stocks and share prices as it relates to their various investments. The aim of this paper is to develop a prototype of an application that is able to monitor the trading floor of the Nigerian Stock Exchange as well as the stocks and shares in an investor's portfolio.

2. Related Works

The stock market is driven solely by supply and demand. The number of shares of stock available for sale dictates the supply and the number of shares that investors want to buy dictates the demand. It is important to understand that for every share that is purchased, there is someone on the other end selling that share (or vice versa). If people's views of the stock market or individual stocks change (which can be driven by economic fundamentals, consumer confidence, fear of terrorism, or company earnings), the demand for stock changes. This also causes

the prices to change. For example, if people in general believe that the economy is growing, they become more optimistic and want to own more stock. This increases the demand for stock. At the same time, since people are selling less stock, it also decreases the supply of stock for sale. Both of these factors cause the average stock price to rise or vice versa. (Free Financial Advice, 2011)

The stock market can be seen as a big, automated superstore where everyone goes to buy and sell their stock. The main players in the stock market are the exchanges. Exchanges are where the sellers are matched with buyers to both facilitate trading and to help set the price of the shares. Some of the primary exchanges are the NASDAQ (National Association of Securities Dealer Automated Quotation system), the New York Stock Exchange (NYSE), the London Stock Exchange, all of the ECNs (Electronic Communication Networks) and a few other regional exchanges like the American Stock Exchange and the Pacific Stock Exchange. In Nigeria it is the Nigerian Stock Exchange that serves as the primary exchange point. The Exchange started operations in 1961 with 19 securities listed for trading. Today there are 262 securities listed on The Exchange, made up of 11 Government Stocks, 49 Industrial Loan (Debenture/Preference) Stocks and 194 Equity / Ordinary Shares of Companies, all with a total market capitalization of approximately N287.0 billion, as at August 31, 1999 (The Nigerian Stock Exchange, 2011).

2.1 Automation in the Stock Exchange

The automation and speed of the trading mechanism have long been important dimensions of financial market design, and the growth of electronic trading in recent years has intensified the emphasis on these dimensions. If automation and speed reduce transaction costs, they enable more efficient allocation of securities among heterogeneous investors, improve risk-sharing and consumption smoothing, and can raise asset prices (Pastor and Stambaugh, 2003; Acharya and Pedersen, 2005). Automation and trading speed are increasingly important aspects of competition among financial markets (Hendershott and Moulton, 2011). At the end of 2006, the New York Stock Exchange introduced its Hybrid Market, increasing automation and reducing the execution time for market orders from 10 seconds to less than one second. We find that the change raises the cost of immediacy (bid-ask spreads) because of increased adverse selection and reduces the noise in prices, making prices more efficient.

Automation and speed may also enhance price discovery, or how efficiently new information is incorporated into prices (Chordia, Roll, and Subrahmanyam, 2008; Boehmer and Kelley, 2009). More efficient price discovery contributes to better informed financing and investment decisions, benefiting shareholders by facilitating better corporate decisions. However, theoretical models of limit order books and

liquidity provision offer ambiguous predictions regarding the impact of automation and speed. Existing literature compares speed across market structures (Battalio, Hatch, and Jennings, 2003; and Boehmer, 2005) and levels of automation across market structures (Venkataraman, 2001). However, it is difficult to control for all differences across markets. The effect of changing automation and speed within a market is an important and understudied area (Hendershot and Moulton, 2011).

Olujide (2000) stated in his work that despite undergoing reforms at that time the Nigerian Stock Exchange was still using the manual system of exchanging therefore there was still the general feeling that the Nigerian Stock Exchange is still underdeveloped therefore not yet "in a position to contribute effectively to the development needs of the economy". The concept and need for stock market monitoring cannot be overemphasized; this is because the only way to succeed in the stock market is to watch one's investments closely. This is due to the volatility of the market. There have been a number of applications geared to helping investors in the jungle that is the stock market. Some of these applications were built to assist in e-trading, monitoring the stock market; some were even built to predict the stock market. Some of these applications include:

2.1.1 JStock

JStock is free, cross-platform, open source stock-monitoring software. It can create a database of stocks and download and deliver data and charts for these in real time for more than 20 world markets and going back up to 10 years. It can also set-up stock portfolios where it records all transactions and calculates profit or loss. Two features stand out, however, the first is Alerts delivery (SMS, Email, or in the system tray) that are based on user-created "Stock Indicators". The second is a built-in chat function designed to enable users communicate with each other and share information (Freeware Genius, 2009).

2.1.2 Mastock

Mastock is a stock market analysis and portfolio management software solution for the individual investor, built exclusively for Mac OS X. Mastock's analytical tools can be customized to fit a customer's precise need. It has stock portfolio management with tracking and automatic update and also automatic download of latest quote prices from free internet sources (CNET, 2011).

2.1.3 Stock Sector Monitor

Stock Sector Monitor is a desktop personal financial application that allows you to instantly monitor over 200 stock industry sector groups and over 7000 public

companies online. With Stock Sector Monitor you can easily watch daily top gaining and losing stocks in each stock industry sector, see quotes, percentage change, volume and other quotes information, print reports, access news, charts, company financial data on the web and create and maintain your own stock portfolios (CNET, 2011).

2.1.4 OptionsHouse

OptionsHouse is an online stock trading broker that delivers value-priced trades, useful analytical tools and research, and a well designed software trading platform. The fees and the commission structure are simple, and this online stock trading broker provides a number of different investment vehicles. The OptionsHouse culture is committed to ongoing improvements in products, trading tools and customer service (Robb, 2011).

2.1.5 StockPickr

Stock Pickr RT was developed by Investing Network Inc in 2005. Its advantage among other programs is that it can easily determine which stocks must be picked at any given day for possible rewards. The Stock Pickr software provides a short list of stock picks every trading day. The picks are based on companies that have consistently proven to be financially sound and are getting positive price actions as a result of a news item favorably depicting the companies. The StockPickr is a lightweight Windows based application. The latest version is self-updating so users will never have to manually upgrade and all market data is included in the price (Stock Trading Advice, 2011; Koochakzadeh et. al., 2012).

The use of intelligent systems for stock market predictions was discussed in Abraham et al., (2001). The work dealt with the application of hybridized soft computing techniques for automated stock market forecasting and trend analysis. a neural network was used for one day ahead stock forecasting and a neuro-fuzzy system for analyzing the trend of the predicted stock values of the popular Nasdaq-100 index of Nasdaq Stock Market.

This review was carried out to better understand the background and concepts of what is to be embodied in the stock monitoring system. It is worthy of note that until the automation of the Nigerian Stock Exchange, the time of each trade did not necessitate for a system that could efficiently monitor the market. Now that there is the automation of the exchange which has caused the speed of trading to increase there is the need for real time systems that can efficiently monitor each sale in the exchange. The system is going to make use of the cyclic executive architectural pattern based on the fact that it will constantly and continuously repeat a particular task of refreshing the system after a particular time. There will also be the need for an API as the program will have to be

able to connect to the Nigerian Stock Exchange server to provide the details it will need to provide.

3. System Design and Implementation

3.1 Requirement Analysis

User Requirements: the expectations of users when interacting with the proposed system have been identified and highlighted below:

- The system must be able to show the users the information on the stock exchange.
- It should be able to portray graphical information of the data.
- The system should be able to show the data of the portfolio of anybody using the system and what each portfolio is currently worth at the time.
- The system should perform in real time.
- The system should always show the last data on the system except it has been changed.
- The system must be able to connect to the Stock Exchange server.
- The system must be able to get data from the Stock Exchange.
- The system should be able to graphically illustrate the data being shown.
- The system should allow users to register their stock portfolios on the system.
- The system should be able to make specific calculations based on the values given in each portfolio and display the results.
- In the case that there is a change in the price of any stock before the set time the system should automatically refresh itself.
- The system should be able to keep in its database all work done on the system and show these on startup.

3.2 Proposed System Architecture

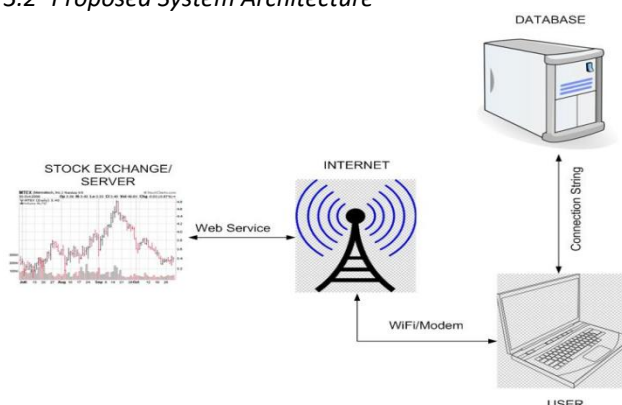


Figure 1: System Architecture

The proposed system layout is depicted in the figure below. As shown in Figure 1, the web server is connected to the internet via an internet connection. The speed of the internet connection determines the speed of service. The server uses the internet connection for two primary

tasks: connect to stock market website using the web services provided by third party users; and respond to user requests.

3.3 Implementation Tools

The system was developed using VB.Net, Microsoft SQL Server (MSSQL Server) and XML. VB.Net is a programming language that can be found on the visual studio 2008 & 2010 development environment. Visual studio is a powerful Integrated Design Environment (IDE) that facilitates the development of functional applications in languages like VB.Net, C/C++/C# and ASP.Net. Visual Basic (VB.Net) was chosen for its ease of use and flexibility of the language. MSSQL Server is a Relational Database Management System (RDBMS) developed by Microsoft Corporation. This was used to host the database of the system and the tables. It was chosen due to the ease of use of the software and the ease at which it integrates with VB.Net. Test XML data was provided by a third party client to be used in the application due to copyrighted infringements and business procedures. This data was used in the application as the data source.

3.4 Program Modules

• Dummy Tables

symbol	volume_of_transac	transaction_amount	description	pubDate
UNITYKAP	113,105,262.00	56,552,631.00	Symbol-UNITYK...	Tue, 17 Apr 2012...
UBA	49,276,334.00	124,856,290.37	Symbol-UBA, vol...	Tue, 17 Apr 2012...
FCMB	48,868,063.00	220,600,745.10	Symbol-FCMB, v...	Tue, 17 Apr 2012...
FIRSTBANK	13,477,564.00	123,627,670.31	Symbol-FIRSTBA...	Tue, 17 Apr 2012...
GUARANTY	10,918,174.00	159,210,290.79	Symbol-GUARAN...	Tue, 17 Apr 2012...
STERILBANK	7,911,987.00	10,138,044.50	Symbol-STERLN...	Tue, 17 Apr 2012...

symbol	security	opening_price	closing_price	gains	percentage
TOTAL	TOTALFINAELF...	132.71	139.34	6.63	5.00
NB	NIGERIAN BRE...	104.00	109.20	5.20	5.00
GUINNESS	Guinness Nige...	232.00	235.25	3.25	1.40
UNILEVER	Unilever Nige...	28.50	29.92	1.42	4.98
NCR	AT AND T GLOB...	14.34	15.05	.71	4.95
ZENITHBANK	ZENITH INTER...	13.02	13.67	.65	4.99

symbol	security	opening_price	closing_price	lose	percentage
BOCGAS	B.O.C GASES NI...	6.50	6.18	-.32	-4.92
AVONCROWN	AVON CROWNC...	4.39	4.18	-.21	-4.78
ETERNAOIL	ETERNA OIL AN...	3.95	3.76	-.19	-4.81
CCNN	Cement Company...	5.16	5.00	-.16	-3.10
VITAFOAM	VITAFOAM NIGE...	3.24	3.08	-.16	-4.94
ACADEMY	ACADEMY PRE...	2.09	1.99	-.10	-4.78

Figure 2: Screenshot of Dummy Tables Form

This is the page that loads all tables that will be used in the home page of the system. This form reads data such as the trade listing, gainers and losers for each market day from the source data which is in the form of an XML (Extensible Markup Language) file.

• The Home Page

This is the form that the user officially sees. It shows basic stock information such as top trades, top gainers and top losers for the market day and also, the values of daily transactions.

Symbol	Volume of Transactions	Transaction Amount	PubDate	Description
UNITYKAP	113,105,262.00	56,552,631.00	Tue, 17 Apr 2012...	Symbol-UNITYK...
UBA	49,276,334.00	124,856,290.37	Tue, 17 Apr 2012...	Symbol-UBA, vol...
FCMB	48,868,063.00	220,600,745.10	Tue, 17 Apr 2012...	Symbol-FCMB, v...
FIRSTBANK	13,477,564.00	123,627,670.31	Tue, 17 Apr 2012...	Symbol-FIRSTBA...
GUARANTY	10,918,174.00	159,210,290.79	Tue, 17 Apr 2012...	Symbol-GUARAN...
STERILBANK	7,911,987.00	10,138,044.50	Tue, 17 Apr 2012...	Symbol-STERLN...

Figure 3: Screenshot of the Home Page showing the Top 10 Trades for the day

• The Market Research Form

This page shows information about each market day in the Nigerian Stock Exchange. This includes the pricelist for all companies in the exchange for that day.

symbol	security	opening_price	closing_price	description	pubDate
AGLEVENT	A.G LEVENTIS...	1.37	1.37	Symbol-AGLEVE...	Sun, 22 Apr 2012...
ACADEMY	ACADEMY PRE...	2.09	1.99	Symbol-ACADEM...	Sun, 22 Apr 2012...
ACCESS	ACCESS BANK...	5.83	5.99	Symbol-ACCESS...	Sun, 22 Apr 2012...
AFRINSURE	AFRICAN ALLIA...	.50	.50	Symbol-AFRINS...	Sun, 22 Apr 2012...
AFROMEDIA	AFROMEDIA PLC	.50	.50	Symbol-AFFROME...	Sun, 22 Apr 2012...
AICO	AICO INSURAN...	.50	.50	Symbol-AICO, S...	Sun, 22 Apr 2012...
AIRSERVICE	AIRLINE SERV...	1.75	1.75	Symbol-AIRSER...	Sun, 22 Apr 2012...
NCR	AT AND T GLOB...	14.34	15.05	Symbol-NCR, S...	Sun, 22 Apr 2012...
AUSTINLAZ	AUSTINLAZ CO...	2.00	2.00	Symbol-AUSTINL...	Sun, 22 Apr 2012...
AVONCROWN	AVON CROWNC...	4.39	4.18	Symbol-AVONCR...	Sun, 22 Apr 2012...
ASHAKACEM	Ashaka Cement	8.01	8.41	Symbol-ASHAKA...	Sun, 22 Apr 2012...
BOCGAS	B.O.C GASES NI...	6.50	6.18	Symbol-BOCGAS...	Sun, 22 Apr 2012...
BERGER	BERGER PAINT...	7.68	7.68	Symbol-BERGER...	Sun, 22 Apr 2012...
CADBURY	CADBURY PLC	11.04	11.30	Symbol-CADBUR...	Sun, 22 Apr 2012...
CAP	CAP PLC	26.00	26.39	Symbol-CAP, Sec...	Sun, 22 Apr 2012...
CAPHOTEL	CAPITAL HOTEL	6.78	6.78	Symbol-CAPHOT...	Sun, 22 Apr 2012...
CHAMS	CHAMS PLC	.50	.50	Symbol-CHAMS, ...	Sun, 22 Apr 2012...
CONOIL	CONOIL PLC	20.96	20.96	Symbol-CONOIL...	Sun, 22 Apr 2012...
CONTINSURE	CONTINENTAL...	.82	.79	Symbol-CONTIN...	Sun, 22 Apr 2012...
CORNERST	CORNERSTONE...	.50	.50	Symbol-CORNER...	Sun, 22 Apr 2012...
CUSTODYINS	CUSTODIAN AN...	1.30	1.36	Symbol-CUSTOD...	Sun, 22 Apr 2012...
CUTIX	CUTIX PLC	1.60	1.60	Symbol-CUTIX, S...	Sun, 22 Apr 2012...
CCNN	Cement Company...	5.16	5.00	Symbol-CCNN, S...	Sun, 22 Apr 2012...
DANGCEM	DANGOTE CEM...	120.00	120.00	Symbol-DANGCE...	Sun, 22 Apr 2012...
DANGLOUR	DANGOTE FLO...	4.50	4.60	Symbol-DANGFL...	Sun, 22 Apr 2012...
DANGSUGAR	DANGOTE SUG...	3.65	3.69	Symbol-DANGSU...	Sun, 22 Apr 2012...
DIAMONDBNK	DIAMOND BANK...	2.47	2.52	Symbol-DIAMON...	Sun, 22 Apr 2012...
DNMEYER	DN MEYER PLC	.77	.77	Symbol-DNMEYE...	Sun, 22 Apr 2012...
ETRANZACT	E-TRANZACT IN...	4.47	4.47	Symbol-ETRANZ...	Sun, 22 Apr 2012...
ETI	ECOBANK TRA...	11.43	11.87	Symbol-ETI, Sec...	Sun, 22 Apr 2012...
EXONCORP	EXONCORP PLC	6.06	6.06	Symbol-EXONCOR...	Sun, 22 Apr 2012...

Figure 4: Screenshot of the Market Research showing the Pricelist for the day

• The Portfolio

This is the page that handles the stock of the user. It makes calculations based on the value of stocks in the investor's portfolio using the price of the stock in that current day.

BUY	Symbol	Security	Date	Opening Price	Closing Price	Units	Broker	Brokerage Commission	Security Levy	Contract Stamp	VAT	Net Value
AGLEVENT	A.G LEVENTIS...	5/10/2012 7:38	1.3700	1.3700	200	OFF	1.27	0.48	0.00	0.00	0.00	41.54
ASHAKACEM	Ashaka Cement	5/11/2012 12:30	9.7000	10.2100	600	REAL	5.28	1.50	0.14	0.00	0.00	175.06
DANGLOUR	DANGOTE FLO...	5/10/2012 11:31	4.4000	4.3000	300	SEER	1.90	0.69	0.05	0.00	0.00	12.91
INTERVIEW	International B...	5/1/2012 5:05 AM	5.9000	5.9000	500	DAVE	5.91	2.15	0.16	0.00	0.00	196.03
MOBIL	MOBIL OIL NIG...	5/21/2012 12:00	145.0000	145.0000	200	SNET	2.37	0.86	0.06	0.00	0.00	78.41
UBA	United Bank For...	5/22/2012 11:44	3.4000	3.5700	300	FREE	1.90	0.69	0.05	0.00	0.00	10.91

SELL	Symbol	Security	Date	Opening Price	Closing Price	Units	Broker	Brokerage Commission	BUY VALUE	NSE LEVY	CSCS	Contract Stamp
AGLEVENT	A.G LEVENTIS...	5/11/2012 12:26	1.3700	1.3700	200	DAVS	1.21	44.0000	0.44	0.11	0.00	0.00
ASHAKACEM	Ashaka Cement	5/11/2012 12:42	9.7000	10.2100	600	das	3.80	138.0000	1.38	0.35	0.00	0.00
INTERVIEW	International B...	5/22/2012 11:56	5.9000	5.9000	500	WIRE	7.70	295.0000	2.95	0.70	0.21	0.00
MOBIL	MOBIL OIL NIG...	5/11/2012 12:28	145.0000	145.0000	200	DESE	1.21	44.0000	0.44	0.11	0.00	0.00

Figure 5: Screenshot of the User's Portfolio

4. Discussion and Conclusion

The importance of a stock market to the economy cannot be over emphasized. It is a channel of success for a new or existing business and for any personal investor. Therefore the success of any company is usually tied to its performance in the stock exchange which also means the success of everyone who has invested in that company. The concept of investing therefore cannot be overlooked because if there is an increase in the value of a company there is most definitely from the company or an increase in the dividends for an individual investor that can be reaped from the sale of its shares. Investing that can be defined as using money to participate in a business venture via the purchase of stocks and bonds in the business gives rise to stock monitoring as an investor has to know the progress of the stocks and bonds in the market. It stands to give the investor the chance to see how each stock progress instead of leaving it to his or her broker. It also helps if the investor does not have to look for dailies. This is what has brought forth the need for an efficient stock monitoring system to see how it progresses so that with the internet each change in stock value can be viewed as it happens in real time.

The aim of this project was to design a prototype for a system that can monitor an individual investor's stock and also give him a general detail of the stock market. It has been able to integrate the basic information as needed for every investor. It can also serve as a valuable tool for any new investor into the stock exchange. it has been found out that stock market monitoring is the way of life for any investor but a new frontier is being opened up in stock market prediction. The next phase of this work is to incorporate some level of intelligence into the system. This will make use of past and present data for predicting future trends in the stock market.

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