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SCHOOL OF COMPUTING AND INFORMATICS

"Technical Trading Support System (TTSS); A Stock Market Analyst Support System"

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Submitted in partial fulfillment of the requirements of Masters of Science in Information System.

Declaration

This project, as presented in this report, is my original work and has not been presented for any other university award.

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This project has been submitted as partial fulfillment of the requirement for Masters of Science in Information System of the University of Nairobi with my approval as the university supervisor

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Abstract

Stock exchanges like the Nairobi Stock Exchange (NSE) release daily, weekly, and other periodic data. This data, if filtered and stored can be of important use for stock market analysis using technical analysis methods. Currently technical analysis tools are being developed due to their perceived added advantage to those analysts who use them over those who don't.

Emphasis has been on moving average based trading systems which are the simplest and most popular trend-following systems among practitioners. According to the (dual) moving average method is one of the few technical trading procedures that is statistically well defined.

Both the Simple Moving Average (SMA) and the Exponential Moving Average (EMA) have been used in the system decision support. The Dual Moving Average Crossover system generates trading signals by identifying when the short-term trend rises above or below the long-term trend

The goal of this project is to develop a Technical Trading Support System (TTSS), an information system that uses selected technical indicators and charts overlay tool that can be used by market analysts and professionals.

The system is developed to enable the users to store the data, to generate charts that aid data visualization, identify trend and enhance analyst decision making process. System analysis, design and development methods are used to analyze, design, document, build and test the system.

Acknowledgment

I would like to thank God by whose strength all this work is possible. I would like to pass my sincere gratitude to my supervisor, I. G Muchemi, for his support and guidance, and to all the academic staff at the School of Computing and Informatics, University of Nairobi for their effort to ensure our success in this course.

My gratitude to all the specialist, stock brokerage firms and market analysts who helped me understand the technical trading rules and availed important information and data required for this project. They also gave genuine and fair criticism of the system during analysis, desighn, development and evaluation stages.

My sincere thanks goes to my family, Faith my wife and Children for their patience. Last but not least to my fellow students during the entire period of this course. I say thanks to all. "Asante Sana"

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List of Abbreviations

CDSC:	Central Depository & Settlement Corporation
DL:	Divergence line,
EMA :	Exponential moving average
EMA 12:	Twelve days Exponential Moving Average
EMA 26:	Twenty six days Exponential Moving Average
MACD:	Moving Average Convergence Divergence
MACDH:	Moving Average Convergence Divergence Histogram
NSE:	Nairobi Stock Exchange
NSE20:	Nairobi Stock Exchange 20 index,
SL:	Signal Line
SMA:	Simple Moving Average,
SMA13:	Thirteen days simple moving average,
SMA20:	Twenty days simple moving average,
SMA200:	Twenty days simple moving average,
SMA50:	Fifty days simple moving average,

Glossary

DFD: A Data Flow Diagram is a graphical representation of the flow of data through an information system. DFDs can also be used for the visualization of data processing

ERD: Entity Relation Modeling is a data modeling technique that creates a graphical representation of the entities and the relationships between entities within an information system.

Fundamental analysis: of a business involves analyzing its financial statements and health, its management and competitive advantages, and its competitors and markets.

Rule-based trading: Rule-based trading is an approach intended to create trading plans using strict and clear-cut rules.

MACD which stands for Moving Average Convergence / Divergence, is a technical analysis indicator shows the difference between a fast and slow exponential moving average (EMA) of closing prices. Since it is based on moving averages, MACD is inherently a lagging indicator

Technical Analysis: "The technical approach to investment is essentially a reflection of the idea that prices move in trends that are determined by the changing attitudes of investors toward a variety of economic, monetary, political, and psychological forces. The art of technical analysis, for it is an art, is to identify a trend reversal at a relatively early stage and ride on that trend until the weight of the evidence shows or proves that the trend has reversed".

Technical System: A technical trading system consists of a set of trading rules that result from parameterizations, and each trading rule generates trading signals (long, short, or out of market) according to their parameter values.

CHAPTER ONE

General Introduction

1.1 Introduction

Technical Trading Support System (TTSS) is an information system that responds to the business needs of Nairobi Stock Exchange (NSE) market analysts or professional. It transforms index and stock prices data released periodically at the NSE to useful information. The data is filtered before being stored in a repository, the analyst can then generate charts, identify trend and establish appropriate investment timing by the use of this system by use of technical indicators.

1.2 Background

The financial markets are dominated by powerful computer systems and driven by the needs of demanding and cost-conscious investors who want the capability to trade rapidly across time zones, currencies and types of securities. In addition, the dramatic increase in the use of the Internet is opening up new avenues of trading opportunity at a rapid pace and therefore increasing the pressure on stock exchange.

The growth of the NSE securities market and the corresponding demand for immediate and accurate information processing have driven the need for improvement of ICT at the stock exchange. NSE, register stock trading companied, Central Depository & Settlement Corporation (CDSC) and regulating bodies have information systems their core functions, e.g., to support online trading and securities ownership management systems.

The transaction processing and operation system at the NSE and individual listed companies generate periodic data that provide scant information on general market trends. These data include (see Appendix A);

- Daily NSE20 index, NSE All index and stock prices that give the daily trading summaries,
- Weekly summary index and stocks data,
- Company reports that include quarterly semiannual and annual reports, and
- Other market statistics and company reports

Analyst and trader, even if will, cannot follow and interpret these voluminous numerica There thus need for tools to store the data, generate visible graphs and charts. Existing to the market provide limited choice of indicators and are not flexible to the user's needs. Inve stock market analysts, technical and professional staff require readily available tool for col this data that is released by the NSE, extracting and visualizing important timely inform from these data to support their trading decisions.

Computerization has increased productivity at the NSE. The introduction of compute trading has done away with the trading floor and trading clerks. But there is need to inc interest and understanding of market trends to increase investor's confidence and participa Tools to assist in visualization and interpretation of the voluminous periodic data released the exchange transaction processing systems.

Investors and analysts need to find market-related information such as scientific analyse stock prices, bond and stock index and public announcements through the internet. There ou to be systems to provide economic and financial information from both fundamental ana and technical analysis of market data. TTSS is one tool that seeks to build on existing tool use technical trading rules.

In this project is aimed at

- Conducting a pilot survey to establish the use of technical trading support tools identify areas that required improvements.
- Design and build a tools for data visualization, chart overlay, identifying market tre and supporting trading decisions,

1.3 Statement of the Problem

The NSE, Companies listed on the NSE, and individual listed companies release dai weekly and other periodic data from the trading at the NSE and company reports and financ statements. Most of this data is not collated or represented in a ways investment managers ar trader can visualize market trends and acquire business intelligence. In this project, tools for: da warehousing, calculating technical analysis benchmarks, visualizing cycles and pattern overlaying graphs, will be developed.

Individual analyst, technical and professional staff in the share investment industry ca increase their returns by analyzing stock exchange index and stock prices data released by th exchange on periodic basis. There is need for tools to support the analyst visualize and extrac important information available in these voluminous data. Technical analysis chart overlay an trading rules if implemented would provide the necessary support system. Therefore, in order to support individual analysts, companies and portfolio managers in data warehousing, extracting business intelligence, calculating technical analysis benchmarks, identifying trends, visualizing trends and overlaying graphs required tools are developed.

1.4 Aim and objectives:

1.4.1 General Objective

To develop easily accessible tools for storing, analyzing and visualizing trends and cycles using technical analysis methods, with a goal to informing and supporting decision making for the market professionals, investment managers and other interested stakeholders.

1.4.2 Specific Objectives

The main focus of this project is to develop tools:

- To establish a database to collate all data frequently released by the NSE on daily weekly and monthly
- To calculate technical analysis indicators necessary for decision making, the concepts of Simple moving average, Exponential moving average, Moving average convergence divergence (MACD) are calculated and necessary charts generated.
- To develop tools for identifying and visualizing existing patterns in the enormous volumes of data.
- To offer the analyst and investment managers' decision support tools with the hope that in the long run it will lead to profitable investment decisions.

1.5 Technical Trading Support System (TTSS)

A technical trading system comprises a set of trading rules that can be used to generate trading signals. In general, a simple trading system has one or two parameters that determine the timing of trading signals. Each rule contained in a trading system is the results of parameterizations. For example, the Dual Moving Average Crossover system with two parameters (a short moving average and a long moving average) may be composed of hundreds of trading rules that can be generated by altering combinations of the two parameters. Among technical trading systems, the most well-known types of systems are moving averages, channels (support and resistance), Bollinger bands, momentum oscillators, and filters. These systems have been widely used by academics, market participants or both, and, with the exception of filter rules, have been prominently featured in well-known books on technical analysis, such as Schwager (1996), Kaufman (1998), and Pring (2002). The trading rules in our system will be based on simple and exponential moving averages.

The final product of this project is an information system referred to as Technical Trading Support System (TTSS) that capture and manages data to produce useful charts and information that support investment managers, market traders, stock brokers, investors, investment analysts and other parties interested in performing market analysis. The aim is to place the interested party at a competitive advantage while trading and investing in the market.

Data for the NSE index and stock prices is filtered from the daily data released from t exchange. Important technical analysis indicators; simple moving averages (SMA), exponen moving averages (EMA), moving average convergence divergence (MACD) and MAC histogram are calculated and stored in a data base. The system enables the user perform char overlay which is an important part in technical trading systems. The user can also view an identify market trend, and acquire buy or sell (go long or go short) decision support for th general market index and also for the individual stocks.

TTSS can be generally classified as knowledge worker system for it is aimed as technical an professional staff in the share investment industry. Its theme is market analysis using technica analysis methods an area that presumes that market behavior is not random but portrays predictable cyclic behavior. It thus focuses on the data analysis as well as generating timel information for decisions on market related issues.

TTSS has been constructed using a web user interface to enhance the chance of a remote user. This would enable organizations, e.g. an investment bank, stockbrokerage film or investment advisers to host it on their web page to enhance on their customer services.

Chapters are arranged such that they follow the system analysis and design procedure. We start with general introductions in chapter one and move to literature review that looks at related work in technical analysis and give the required foundation. The other chapters are, system analysis, system design, system implementation, and finally discussions.

CHAPTER TWO

Literature Review

2.1 Survey Studies

Technical analysis is a forecasting method of price movements using past prices, volume, and open interest. Pring (2002), a leading technical analyst, provides a more specific definition: "The technical approach to investment is essentially a reflection of the idea that prices move in trends that are determined by the changing attitudes of investors toward a variety of economic, monetary, political, and psychological forces. The art of technical analysis, for it is an art, is to identify a trend reversal at a relatively early stage and ride on that trend until the weight of the evidence shows or proves that the trend has reversed."

Technical analysis is a form of analysis which seeks to make judgments about the performance of a share based solely on its historic and current price behavior and without reference to the underlying business, the sector the company's in, or the economy as a whole.

The technician uses charts and computer programs to identify and project price trends. The analysis includes studying price movements and trading volumes to determine patterns such as Head and Shoulder Formations and W Formations. Other indicators include support and resistance levels, and moving averages. In contrast to fundamental analysis, technical analysis does not consider a corporation's financial data.

The concept of trend trading is posited on the belief that trends, whether positive or negative, can be identified early and taken advantage of by astute investors. The study of such trends is called technical analysis. Technical analysts believe in the idea that all relevant information on a security's value is reflected in its market price. And that, over time, price and volume movements create patterns that can reveal the future moves of a security in question, and taken advantage of. This is in contrast to the well established form of security analysis termed fundamental analysis, wherein analysts study financial statements and reports of various firms so as to identify strong performers according to various ratios, and statistics. To a true fundamental analyst, temporal price and volume action may be completely unrelated to fundamental aspects of a security's strength.

Technical Analysis is sometimes erroneously believed to be a relative newcomer among the various philosophies of trading. It is actually one of the oldest. Technical analysis methods

can be traced back to the late 19 century. The idea of market indices that would offer the public with information on business activity in the emerging markets started to emerge. Technical analysis methods have since been used to predict future movements of security prices.

Technical trading rules have been used in financial markets for over a century. Numerous studies have been performed to determine whether such rules can be employed to provide superior investing performance. Considerable research has been conducted on the effectiveness of technical analysis and mechanical trading rules to ascertain the efficiency of the stock and commodity futures markets. By and large, the recent academic literature suggests that technical trading rules are capable of producing valuable economic signals.

In efficient market models, such as the martingale model and random walk models, technical trading profits are not feasible because, by definition, in efficient markets current prices reflect all available information (Fama, 1970) or it is impossible to make risk-adjusted profits net of all transaction costs by trading on the basis of past price history (Jensen (1978)). Ever since the inception of the "random walk" model of stock and futures prices promoted by Samuelson (1965) and Fama (1970), the utility of technical trading systems has been largely discounted on a theoretical basis. Since the random walk model contends that price fluctuations occur randomly, technical systems which rely upon the existence of price trends cannot be profitable in the long run.

Neftci and Policano (1984) examined the efficacy of two mechanical trading rules as applied to gold and Treasury bill futures, and found that such rules could be profitable over certain time periods. Tomek and Querin (1984) studied simulated data to show the existence of trends in a random series of numbers, implying that mechanical trading rules could perform a useful role. However, they found that these trends did not recur with measurable regularity.

Numerous studies in the finance literature have investigated technical analysis to determine its validity as an investment tool. Several of these studies conclude that technical analysis does have merit. Recent empirical studies, including Carter and Van Auken's (1990) survey of U.S. based investment managers and Taylor and Allen's (1992) survey of London based foreign exchange dealers, have confirmed the extensive use of technical analysis models for trading and portfolio management by market professionals.

Financial technical analysts mainly use microcomputer systems relieving chartists of manual chart keeping, a review of technology is provided by Schmerken (1989). However, in Taylor and Allen's (1992) study, forecasting was largely undertaken by a visual inspection of charted historic prices.

From the Technical Analysis literature, works by LeBaron et al. (1995), provided strong support for the technical analysis being able to predict some variability on the financial markets. They tested the two most popular trading rules – Moving Averages and Trading Range Break by utilising the Dow Jones Index from 1897 to 1986.

In more comprehensive study of technical trading rules using 90 years of daily stock prices, Brock, Lakonishok, and LeBaron (1992) found that 26 technical trading rules applied to the Dow Jones Industrial Average significantly outperformed a benchmark of holding cash. Their findings are especially strong since every single one of the trading rules they considered was capable of beating the benchmark. When taken at face value, these results indicate either that the stock market is not efficient even in the weak form although a class of researcher contend this assertion.

Chart pattern studies test the profitability or forecasting ability of visual chart patterns widely used by technical analysts. Well-known chart patterns, whose names are usually derived from their shapes in bar charts, are gaps, spikes, flags, pennants, wedges, saucers, triangles, head-and-shoulders, and various tops and bottoms (Schwager 1996). The tools developed in this project will generate chart useful in indentifying these chart patterns for analysts.

Over time, investors have experimented with technical trading rules drawn from a very wide universe, in principle, thousands of parameterizations of a variety of types of rules. As time progresses, the rules that happened to perform well historically receive more attention and are considered 'serious contenders' by the investment community, while unsuccessful trading rules are more likely to be forgotten. After a long sample period, only a small set of trading rules may be left for consideration, and these rules' historical track record will be cited as evidence of their merits. If enough trading rules are considered over time, some rules are bound by pure luck, even in a very large sample, to produce superior performance even if they do not genuinely possess predictive power over asset returns.

While there is no final agreement between traders and academicians about the efficiency of the foreign exchange or stock market, the old fashioned view in economic books that exchange rates and equity prices follow a random walk has been dismissed by many research works [Tenti 1996]. There is however strong evidence indicating the returns are not independent of past changes.

The prices of many commodities reflect seasonal cycles. Due to the agricultural nature of most commodities, these cycles are easily explained and understood. However, for some securities, the cyclical nature is more difficult to explain. Theories as to why certain securities exhibit cyclical patterns range from weather and sun spots, to planetary movement and basic human psychology. I feel human psychology is responsible.

We know that prices are a consensus of human expectations. These expectations are always changing, shifting the supply and demand lines, and causing prices to oscillate between overbought and oversold levels. Fluctuations in prices are a natural process of changing expectations and lead to cyclical patterns.

One of the limitations is that Technical Analysis or Time Series Analysis techniques do not include or take into account a number of factors such as macroeconomical or political

effects, whether it be national or international, which may seriously influence the equity markets. Technical Analysis as its name suggests does not study the cause of the price move; it is the studies of the pattern of the price movements.

From one of the most detailed review on the profitability of technical analysis, Park Cheol-Ho and Irwin S H. (2004), states and I quote, "Early studies indicated that technical trading strategies were profitable in foreign exchange markets and futures markets, but not in stock markets before the 1980s. Modern studies indicated that technical trading strategies consistently generated economic profits in a variety of speculative markets at least until the early 1990s. Among a total of 92 modern studies, 58 studies found positive results regarding technical trading strategies, while 24 studies obtained negative results. Ten studies indicated mixed results. Despite the positive evidence on the profitability of technical trading strategies, it appears that most empirical studies are subject to various problems in their testing procedures, e.g., data snooping, ex post selection of trading rules or search technologies, and difficulties in estimation of risk and transaction costs". Future research must address these deficiencies in testing in order to provide conclusive evidence on the profitability of technical trading strategies.

More studies and research has been done on application of information systems in financial markets and profitability of technical trading rule including in areas such as recurrent neural networks, and Artificial Intelligence, (See Tenti, Paolo 1996, Trippi, et. al. 1996), Mehta, Mahendra, 1998)

The investments and the market timing signals as implemented in outsourced systems may not address trading rules at the NSE, transaction cost, and market characteristic specific to the NSE and its investors. It's also important to note that outsourced systems may be not be suitable for NSE investors depending on their specific investment objectives and financial position. There is thus a need for continued research and effort to develop local system and tool for emerging markets.

This project builds on the wide research work on technical analysis trading methods by automating some of the basic chart generation and overlay methods, trend identification and trading rules. This is a foundation to more research in the area of automated trading system. We will not thus focus on the profitability but rather the procedures used in chart generation and technical indicator calculation

2.2 Technical Analysis indicators and charts

2.2.1 Time series

Any series of measurements of anything at all that are usually taken at regular intervals. A **time series** is a sequence of data points, measured typically at successive times, spaced at (often uniform) time intervals. **Time series forecasting** is the use of a model to forecast future events based on known past events. To forecast future data points before they are measured. A

standard example in trading is the opening price of a share of stock based on its past performance. The time series plot gives a visual assessment of autocorrelation of series plot though it is subjective and depends considerably on experience.

Blue: Index, Green: EMA26

Figure 2.1 NSE20 time series

A time series gives a quick view of the general trend and may experienced analyst preffer to view the series first before further analysis.

2.2.2 Moving Averages

Moving averages have been the subject of more discussion in most technical analysis than any other technical indicators and are widely used by financial trading institutions. Our methodology is conducted in several steps. Firstly, we have to implement our trading system based on moving averages. In developing a trading system, you need to determine when to enter and when to exit the market.

Simple Moving Average.

The average price of a security or currency over a specified time period used to spot pricing trends by smoothing out the large fluctuations. A moving average is an indicator that shows the average value of a security's price over a period of time. A Simple Moving Average is calculated by adding the closing price of the security for a number of time periods and then dividing this total by the number of time periods. The result is the average price of the security over the time period. Simple Moving Averages give equal weight to each price. A buy signal (upward arrow) is generated when the security's price rises above its moving average, and a sell signal (downward arrow) is generated when the security's price falls below its moving average.

$$SMA(n) = \frac{P_{t-n+1} + P_{t-n+2} + \ldots + P_t}{n}$$

Figure 2.2. Simple moving average

The figure above shows two of the most popular simple moving averages: the 200 days simple moving average **(SMA 200)** and the 50 day simple moving average **(SMA50)**.

Dual Moving Average Crossover

Moving average based trading systems are the simplest and most popular trend-following systems among practitioners. According to the (dual) moving average method is one of the few technical trading procedures that is statistically well defined. The Dual Moving Average Crossover system generates trading signals by identifying when the short-term trend rises above or below the long-term trend.

Although the period and type of the moving average can change the general specifications of the moving average system are as follows:

a. Definition

- Shorter Moving Average over s days at time t, $SMA_t = \frac{\sum_{i=1}^{s} P_{t-i+1}^c}{s}$, where P_t^c is the close at time s and s <t.
- Longer Moving Average over l days at time t, $SML_t = \frac{\sum_{i=1}^{l} P_{t-i+1}^c}{l}$, where $s < l \leq t$

b. Trading rules

- Go long at P_{t+1}^o if, $SMA_t > LMA_t$ where P_{t+1}^o is the open at time $t+1$.
- Go short at P_{t+1}^o if $SMA_t < LMA_t$

c. Parameters

- Parameters: s, l.

Long Trend identification Rules

- Rule 1: If SMA(200)<SMA(50) the long term trend is Bullish
- Rule 2: If SMA(200)<SMA(50) and slope(SMA50)>0 the long term trend is Bullish with momentum increasing.
- Rule 3: If SMA(200)<SMA(50) and slope(SMA50)<0 the long term trend is Bullish with momentum decreasing.
- Rule 4: If SMA(200)>SMA(50) the long term trend is Bearish
- Rule 5: If SMA(200)>SMA(50) and slope(SMA50)<0 the long term trend is Bearish with momentum increasing.
- Rule 6: If SMA(200)>SMA(50) and slope(SMA50)>0 the long term trend is Bearish with momentum decreasing.

Exponential Moving Average (EMA):

An Exponential Moving Average is calculated by applying a percentage of today's closing price to yesterday's moving average value. Exponential Moving Averages place more weight on recent prices. Buy and sell signals are as below.

Moving Average Convergence/Divergence (MACD):

MACD uses different exponential moving averages to generate buy and sell indicators. Differential Line (DL) is the difference between a short and long-period exponential moving average, typically 12 and 26 periods. The Signal Line (SL) is typically a 9-period exponential moving average. When the DL crosses the SL from above, a sell indicator is generated, and when it crosses from below a buy signal is generated.

MACD-Histogram:

The MACD-Histogram represents the difference between MACD and it's signal line (usually the 9-day EMA of the MACD). The plot of this difference is presented as a histogram, making centerline crossovers and divergences easily identifiable. Whenever MACD crosses the signal line, MACD-Histogram crosses the zero line.

The formula for/using exponential moving average are:

EMA(current)=((price(current)-EMA(previous))*multiplier)+EMA(previous)

MACD=EMA(26)-EMA(12) is known as Moving Average Convergence Divergence

$MACD = EMA(12)$ of price $- EMA(26)$ of price.

Signal = $EMA(9)$ of MACD

Histogram = Signal - MACD

Short –Term Trend identification Rules

- Rule 1: If MACD>0 the short term trend is Bullish
- Rule 2: If MACD>0 and slope of (MACD)>0 the short term trend is Bullish with bullish momentum increasing.
- Rule 3: If MACD>0 and slope of (MACD)<0 the short term trend is Bullish with bullish momentum decreasing.

- Rule 4: If MACD<0 the short term trend is Bearish
- Rule 5: If MACD<0 and slope of (MACD)<0 the short term trend is Bearish with bearish momentum increasing.
- Rule 6: If MACD<0 and slope of (MACD)>0 the short term trend is Bearish with bearish momentum decreasing.

Buy & Sell decisions using SMA & EMA

When two moving averages are employed, the longer one is used for trend identification (i a longer term) and the shorter one for timing purposes or indicator.

- The Long term decisions are made using the 200 days and 50 days simple moving averages.
- The Short term decisions are made using the 26 days and 12 days exponential moving averages.

Buying and selling signals are generated when the short period moving average rises above (or falls below), the long period moving averages. When the short-period moving average penetrates the long-period moving averages, a trend is considered to exist, and theoretically traders can generate profits from trading the market.

Mathematically the trading rules in their simplest form can be expressed as follows using SMA(n):

- Rule 1: If (SMA(n period) < Pt) then "Sell", and
- Rule 2: If (SMA(n period) > Pt) then "Buy".

Where SMA(n period) is the simple moving average price of n period, and Pt : the current price

- Rule 3: If (EMA(n period) < Pt) then "Sell", and
- Rule 4: If (EMA(n period) > Pt) then "Buy".

Where EMA(n period) is the exponential moving average price of n period, and Pt : the current price.

When including the Transaction costs as bands then the trading rules can be modified to:

- Rule 1: If SMA(n period) - Pt > Transaction Costs then "Sell",
- Rule 2: If Pt - SMA(n period) > Transaction Costs then "Buy",
- Rule 3: If EMA(n period) - Pt > Transaction Costs then "Sell", and
- Rule 4: If Pt - EMA(n period) > Transaction Costs then "Buy".

Where SMA(n period): the moving average price of n period, and Pt : the current price.

The rules were extended so that the signals were generated only if the differences cover the transaction costs.

2.2.3 MACD Decision System

The MACD-Histogram represents the difference between the MACD and its trigger line, the 9-day EMA of MACD. The plot of this difference is presented as a histogram, making centerline crossovers and divergences easily identifiable. A centerline crossover for the MACD-Histogram is the same as a moving average crossover for MACD. If you will recall, a moving average crossover occurs when MACD moves above or below the trigger line.

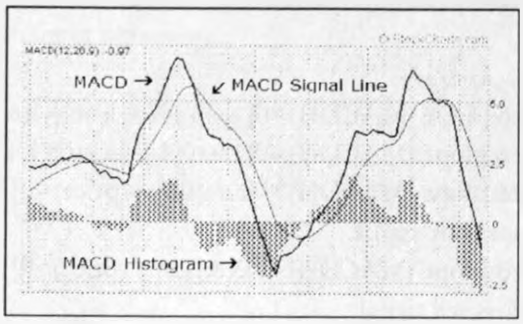


Figure 2.3. MACD and MACDH

- Buy when MACD-histogram declines below its centerline and its slope turns up. Place a stop-loss order below the low of the price bar corresponding to the lowest bar of MACD-Histogram.
- Sell when MACD-histogram rallies above its centerline and then its slope turns down. Place a stop-loss order above the high of the price bar that corresponds to the highest bar of MACD-histogram.
- The best buy signals are given by bullish divergences between MACD-histogram and price. When prices decline to a lower or equal low but MACD-histogram holds above its previous low, buy as soon as the indicator ticks higher, Place a stop below the price low corresponding to the latest bottom in MACD-histogram.
- The best signals to sell short are given by bearish divergences between MACD-histogram and Price. When prices rise to a new high but MACD-histogram makes a lower top, sell as soon as the indicator ticks lower. Place a stop above the high associated with the tallest bar of MACD-histogram at the second top.

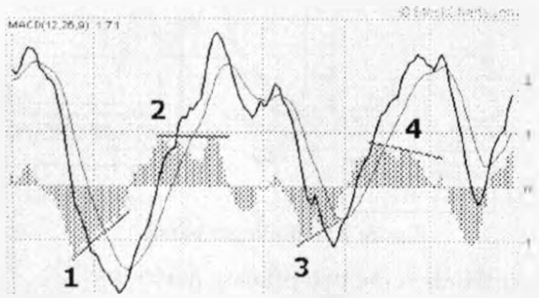


Figure 2.4. Negative and Positive diverge

1. The first point shows a sharp positive divergence in the MACD-Histogram that preceded a Bullish Moving Average Crossover.

2. On the second point, the MACD continued to new Highs but the MACD-Histogram formed two equal Highs. Although not a textbook case of Positive Divergence, the equal High failed to confirm the strength seen in the MACD.
3. A Positive Divergence formed when the MACD-Histogram formed a higher Low and the MACD continued lower.
4. A Negative Divergence formed when the MACD-Histogram formed a lower High and the MACD continued higher.

MACDH rules.

1. IF {[MACDH<0]&&[slope (MACDH)>0] then place a stop loss- buy order,
2. IF {[MACDH>0]&&[slope (MACDH)<0] then place a stop loss- sell order,
3. IF {[MACDH<0]&&[slope (MACDH)>0]&&[slope (price)<0]} THEN Bullish Divergence IMPLY place stop-loss buy signal.
4. IF {[MACDH>0]&&[slope (MACDH)<0]&&[slope (price)>0]} THEN Bearish Divergence IMPLY place stop-loss sell signal.

2.2.4 Bollinger Bands (BB):

Developed by John Bollinger, Bollinger Bands are an indicator that allows users to compare **volatility** and relative price levels over a period time. The indicator consists of three bands designed to encompass the majority of a security's price action.

- A simple **moving average** in the middle. The centre band is the 20-day simple moving average.
- An upper band (SMA plus 2 standard deviations)
- A lower band (SMA minus 2 standard deviations)

Using the standard deviation ensures that the bands will react quickly to price movements and reflect periods of high and low volatility. Sharp price increases (or decreases), and hence volatility, will lead to a widening of the bands. Closing prices are most often used to compute Bollinger Bands.

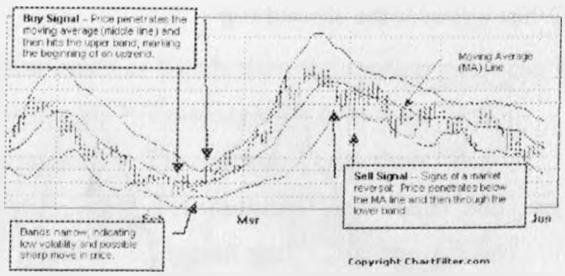


Figure 2.5. Bollinger bands

By themselves, Bollinger Bands serve two primary functions:

- To identify periods of high and low volatility
- To identify periods when prices are at extreme, and possibly unsustainable, levels.

Other aspects of technical analysis, such as momentum, moving averages and retracements, can then be employed to help determine the direction of the potential breakout.

2.2.5 Momentum

Momentum is the measure of a price difference (change) over time. The amount of price change and how long it took are the basis for many different indicators that have been developed to help provide information on price, volume and trend integrity. Momentum is a technical analysis indicator calculated by subtracting a stock's closing price N days ago from the today's closing price, where N is an input parameter.

CHAPTER THREE

System Analysis and Design

3.1 Introduction

A high technology system encompasses a number of elements: software, hardware, people, database, documentation and procedures. System engineering helps to translate requirements into a model of a system that makes use of one or more of these elements.

In order to attain the goals of this project, I, have endeavored to apply systematic, disciplined, quantifiable approach to the development, operation, and maintenance of software; that is, the application of software engineering.

System engineering begins by taking a world view. A business domain or product is analyzed to establish all the product requirements. Focus is then narrowed to domain view (module) where each of the system elements is analyzed individually.

3.2 System Analysis

3.2.1 Stake holders

TTSS can be generally classified as knowledge worker system for it is aimed as technical and professional staff in the share investment industry. Its theme is market analysis using technical analysis methods an area that presumes that market behavior is not random but portrays predictable cyclic behavior. It thus focuses on the data analysis as well as generating timely information for decisions on market related issues. The core stakeholders can be identified as;

- **Technical and professional staff** in the share investment industry, these include
    - Market analysts involved in the equities trading business,
    - Brokers and stock brokerage firms,
    - Investment banks and asset managers,
    - Interested exchange officials,
    - Tactician/Financial analyst and Foreign Exchange specialists

- Traders, Dealers, Portfolio Managers, Commodities , Derivatives and Fixed Income markets analysts,

- **Remote web users;** TTSS has been constructed using a web user in mind to enhance the chance of a remote user. This would enable organizations, e.g. an investment bank, stockbrokerage film or investment advisers to host it on their web page to enhance on their customer services.
- **The system designer and system builder;** This is the goal of this project and I thus play the role of the system analyst and builder.

3.2.2 Survey of ICT usage and features

A pilot study conducted to identify feature available and general ICT usage in the enterprises of the equity market financial sector and regulating bodies. The goal of this preliminary survey was to evaluate the current status of ICT usage, market players' awareness of technical trading methods. This survey, although very general, helped to establish the compatibility of the system envisioned to data and other systems in use within the sector. The survey was conducted by;

- Evaluation of web sites of enterprises of the equity market financial sector,
- Interviewing officials and trading clerical of brokerage firms,
- Interviewing officials and trading clerical at the NSE, and
- Observational visits to the NSE trading floor and online trading points at registered brokerage firms.

From the survey we realised that ICT usage among enterprises of the equity market financial sector is wide spread into almost all their operations. These include

- **E-banking;** this was evident between banks and stockbrokers and investment banks where stockbrokerage firms can monitor their account status online.
- **Electronic fund transfer** is applied by stock brokers to pay investors, and by the NSE registered companies to pay dividends to investors.
- **Share ownership management tools;** Share ownership and changes in ownership of all securities are effected by book entries in the securities accounts that shareholders maintain with the brokerage firms and updates made with the Central Depository & Settlement Corporation (CDSC) (a statutory body that manage equity ownership).
- **Portfolio management tools**. These were maintained by agents, stock brokerage firms and investment banks.

The NSE is responsible for the system which connects brokerage companies to NSE and allows for the processing and delivery of orders, order-match execution, execution confirmation and the dissemination of market information on behalf of NSE. The computerized system at the NSE provides a fair and transparent order routing and execution trading system with price and time priority. It is also more efficient as trades are matched instantaneously, regardless of volume, resulting in capacity for high turnover. This makes for a more liquid market.

With scripless settlement at the NSE, the number of back office staff has decreased, and there is no need for manual sorting of share certificates. Stockbrokers' workstations provide comprehensive information about the market, such as market summary, aggregate quantity of outstanding orders at each price, number of shares transacted at each price, and corporate actions. Such information has increased the transparency of the market and stockbrokers are in a better position to inform investors.

Feature not available: The following features were identified as missing or least developed;

- Investment research tools to collate and map the summary data released on periodic basis by the NSE,
- Historical stock charts generating and overlay tools.
- Access to real-time quotes, trend identification and buy/sell decision support tools
- Online analysts' evaluation and opinion of the market trends and events. This is a common feature in developed online trading sites.

3.2.3 Requirements analysis

Requirements engineering provides a bridge to design and constructions. Requirements analysis provides the appropriate mechanism for understanding what user wants, analyzing need, assessing feasibility, negotiating or prioritize a reasonable solution, specifying the solution unambiguously, validating the specification, and managing the requirements as they are transformed into an operational system

The requirements analysis process can be described in distinct steps

- **A feasibility study,** is conducted during system initialization,
- **Requirements elicitation:** Ask the specialist, users, and others what the objectives for the system or product are, what is to be accomplished, how the system or product fits into the needs of the business, and finally, how the system or product is to be used on a day-to-day basis.
- **Requirements analysis and negotiation:** Analysis categorizes requirements and organizes them into related subsets; explores each requirement in relationship to others; examines requirements for consistency, omissions, and ambiguity; and ranks requirements based on the needs of specialist or users.
- **Requirements specification;** A specification can be a written document, a graphical model, a formal mathematical model, a collection of usage scenarios, a prototype, or any combination of these. Requirements are represented in a manner that ultimately leads to successful software implementation.
- **System modeling;** From the model, it would be relatively easy to assess the efficiency of the workflow
- **Requirements validation;** Requirements validation examines the specification to ensure that all system requirements have been stated unambiguously; that inconsistencies, omissions, and errors have been detected and corrected; and that the work products conform to the standards established for the process, the project, and the product.

- **Requirements management:** Requirements management is a set of activities that help the project team to identify, control, and track requirements and changes to requirements at any time as the project proceeds.
- **Prototyping;** Evaluation Form 2 (see appendix B) is a questionnaire used during the system analysis and design iterations to elicit requirements and prompt users feelings about the system. Form 1 (see appendix B) was used during the evaluation at the last stages of implementation.

Requirements analysis is the first technical step in the software process. It is at this point that a general statement of software scope is refined into a concrete specification that becomes the foundation for all software engineering activities that follow.

An important step in developing technical trading support system is to identify the technical trading indicators to be used for charts generation, analysis and decision support. Some of the charts and indicators that can be selected includes among others;

- Absolute Breadth Index (ABI)
- Advance Decline Ratio
- Advance/Decline Index
- ADX
- Andrews Pitchfork
- Bollinger Bands
- Breadth Thrust Indicator,
- Bullish Percent Index,
- Chaikin Money Flow Indicator
- Chande Momentum Oscillator (CMO)
- Climactic Volume
- Commodity Channel Index (CCI)
- Commodity Selection Index (CSI)
- Displaced Moving Average (DMA)
- Exponential Moving Average (EMA)
- Fan Principle - Technical Indicator
- Fibonacci Trading
- Moving average convergence divergence MACD
- Money Flow Index
- On Balance Volume (OBV)
- Parabolic SAR Indicator
- Positive Volume Index
- Price Rate of Change (ROC)
- Projection Oscillator
- Public Short Ratio
- Qstick
- Random Walk Index
- Rate of Change (ROC)
- Relative Volatility Index (RVI)
- Relative strength index RSI.
- Sentiment Indicators
- Simple Moving Average
- Slow Stochastic Oscillator
- Swing Trading
- Technical Analysis and Market Sell Offs
- Tick Volume
- Upside Downside Volume Indicator
- Volume Analysis
- Volume Rate of Change

There are many other technical analysis indicators and thus selecting the most used and well understood by users requires to be prioritized. There is need to identify indicators that are dependent on other and thus ought to be developer as dependent modules.

3.3 Analysis and design models for TTSS

3.3.1 System context diagram for TTSS

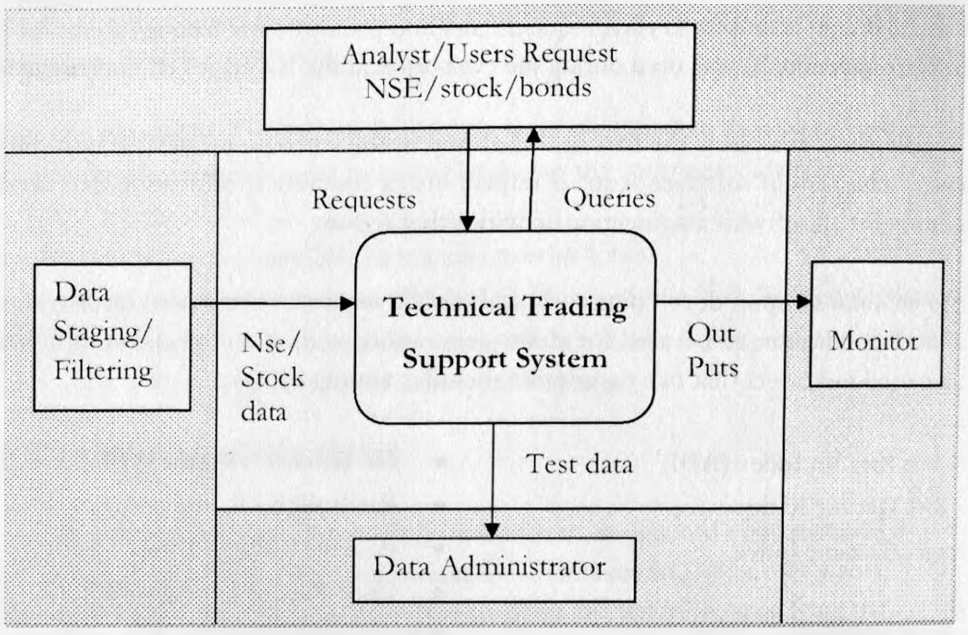


Figure 3.1 System context diagram

The diagram above put the system context in different classification; the top segment is the user interface processing, the left and right segments are the input processing and output processing respectively, the bottom segment is the maintenance and self-test, and the center segment is the process and control functions

3.3.2 Use case diagrams

1. **Use case diagram for a user/analyst:**

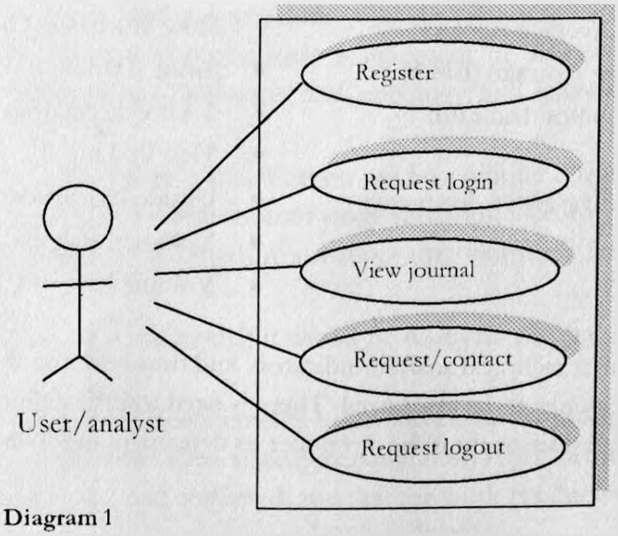


Figure 3.2 Use Case Diagram 1

2. **Use case diagram for NSE Index Analyst:**

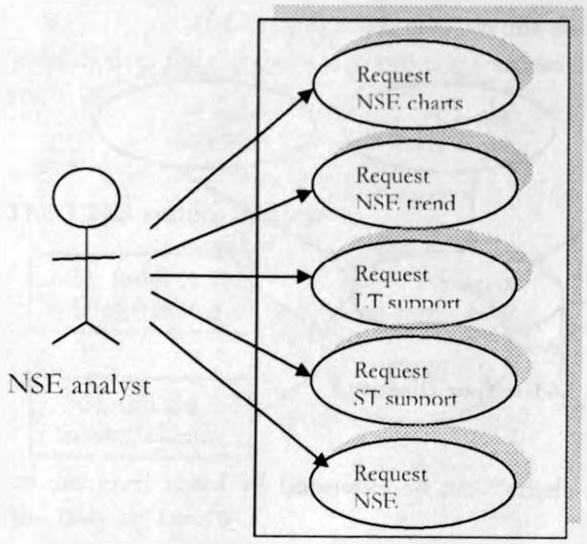


Figure 3.3 Use Case Diagram 2

3. **Extension use case:** extends the fist scenario of use case above (figure 3.3)

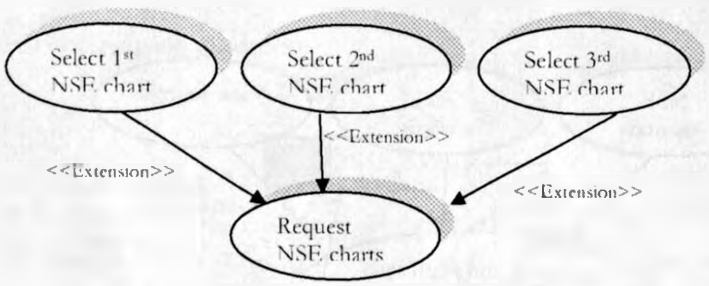


Figure 3.4 Use Case Diagram 3

The use case "request NSE charts" can be **extended** by lower level use cases that make the function complete.

4. **Use case diagram for a specified stock/bond Analyst:**

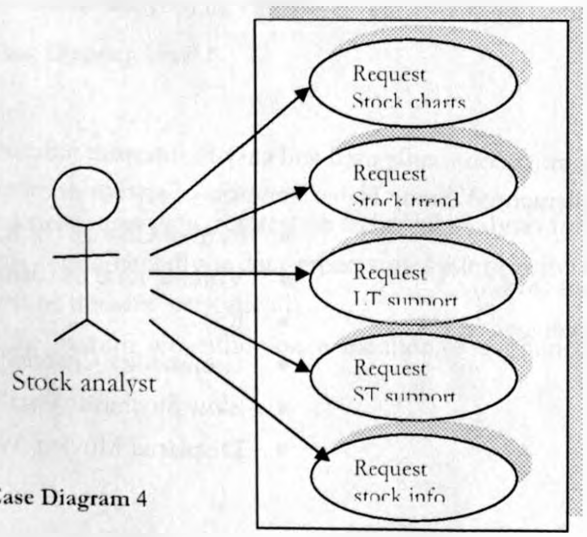


Figure 3.5 Use Case Diagram 4

5. **Extension use case:** extends the use case above (Figure 3.5).

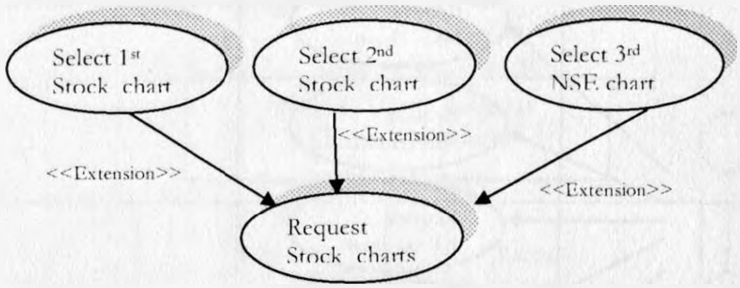


Figure 3.6 Use Case Diagram 5

The use case "request stock charts" can be **extended** by lower level use cases that make the function complete.

6. **Use case diagram for a specified stock Analyst**

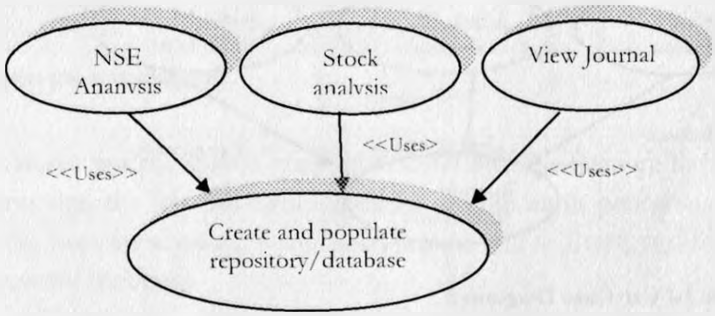


Figure 3.7 Use Case Diagram 6

A database must be designed and populated before conducting any analysis on the NSE stock index or on the individual stocks. "Uses" is used to identify the functions that depend on others.

Our priority will be the most commonly used and easy to interpret indicators and charts, other indicators can be implemented during higher iteration of system development.

- Time series graphs
- Simple Moving Averages (SMA)
- Exponential Moving Averages (EMA)
- MACD
- Bollinger Bands
- Volume Analysis
- Rate of Change (ROC)
- Volume Rate of Change
- RSI
- Commodity Channel Index (CCI)
- Slow Stochastic Oscillator
- Displaced Moving Average (D)

3.3.3 Data Flow Diagrams

The purpose of data flow diagram is to provide a semantic bridge between users and system developers.

Level 0 DFD: The TTSS system context

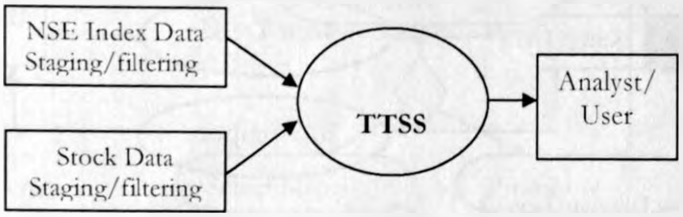


Figure 3.8 Data Flow Diagram Level 0

Level 1 DFD: TTSS system,

Breaks the system into two sub modules,

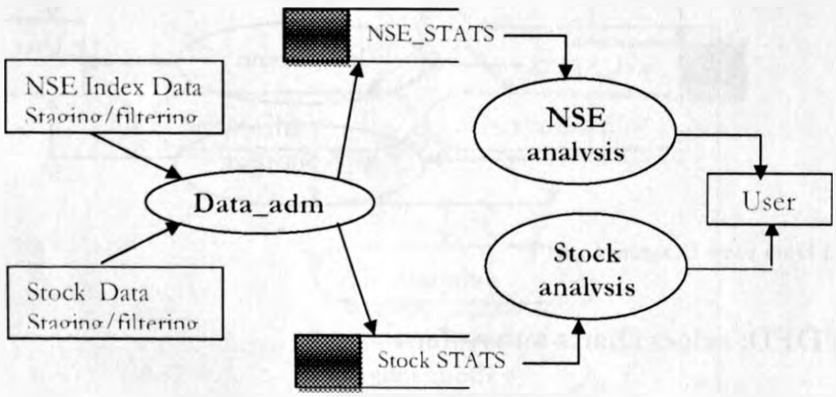


Figure 3.9 Data Flow Diagram Level 1

- The system accepts user data, request on technical analysis from a monitor or PC.
- The system is fundamentally a data processing system using data store in a database. The database must be updated periodically.
- Outputs of the system are either on a monitor of a connected computer or stored in a database.

Level 2 DFD: TTSS NSE index analysis sub-system

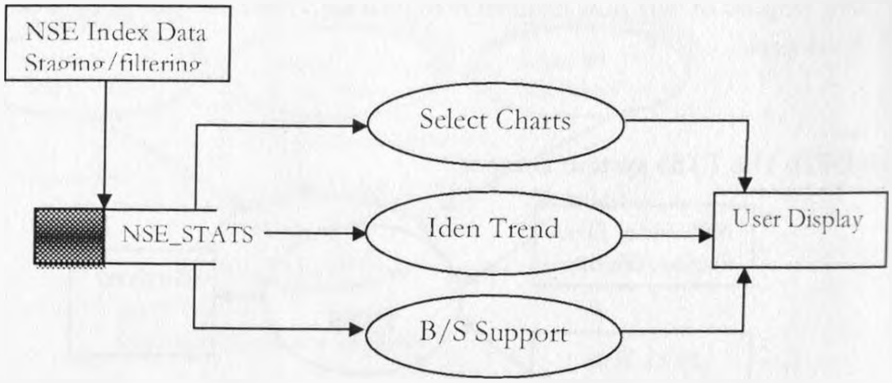


Figure 3.10 Data Flow Diagram Level 2

Level 2 DFD: TTSS stocks analysis sub-system

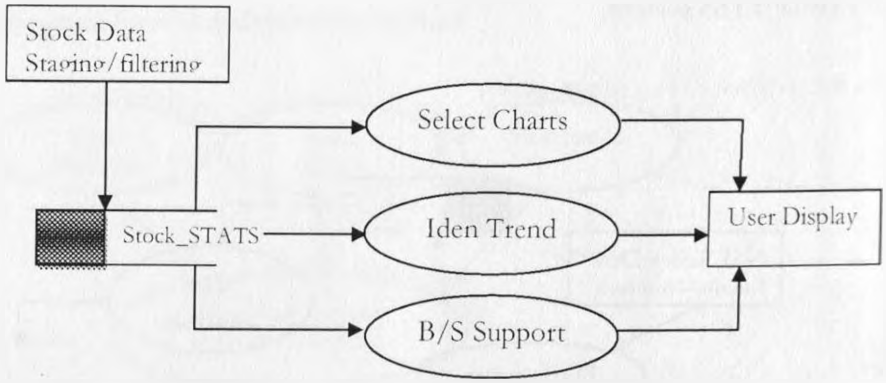


Figure 3.11 Data Flow Diagram Level 2

Level 3 DFD: select charts subsystem

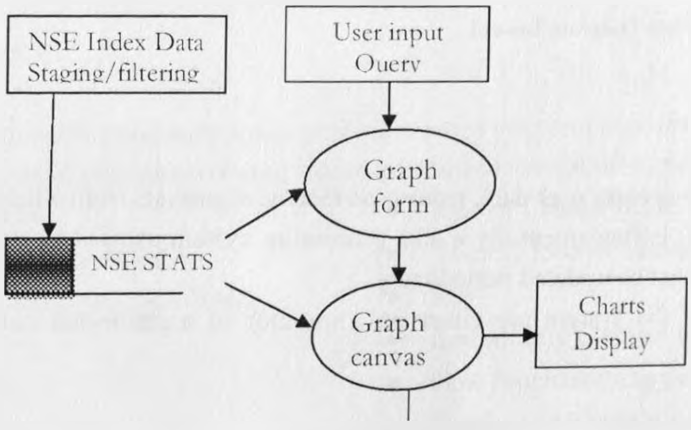


Figure 3.12 Data Flow Diagram Level 3

Activities diagram for TTSS

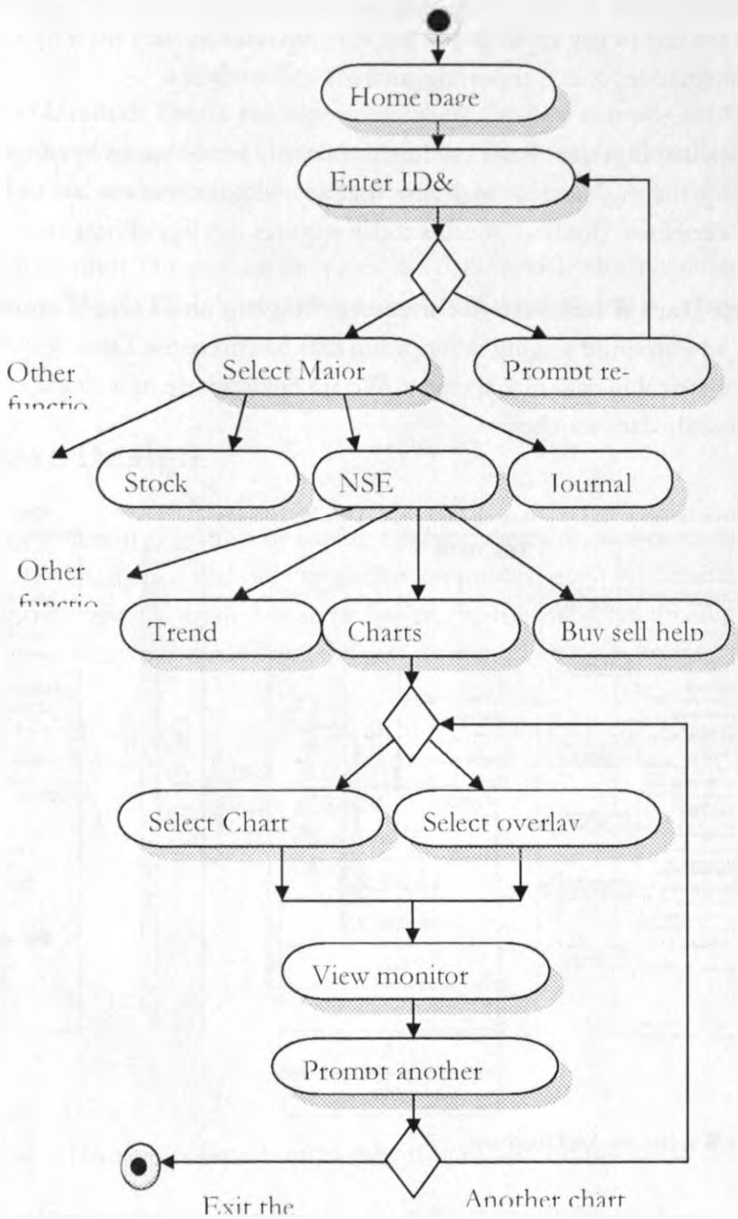


Figure 3.13 Activity Diagram

A lower level activity diagram can be drawn for all the rounded cornered rectangles. Emphasis has been laid on the chart overlay as this is a main feature in technical trading.

3.4 Data warehouse

Data warehouse: A data warehouse is a separate data environment that is not directly integrated with the day to day applications but encompasses all data used by a business. TTSS supports data integration, query, reporting, analysis and analytics.

Business intelligence: Business Intelligence is a broad category of applications and technologies for gathering, storing, analyzing, and providing access to data to help clients make better business decisions. Business success today requires intelligent data use.

Two tier Data Warehouse Architecture- Staging and Data Warehouse: This is the scenario where an enterprise staging is supplying data to enterprise Data Warehouse. This is close to point of arrival in data management. We are talking here of a single staging area leading to an enterprise-wide data warehouse.

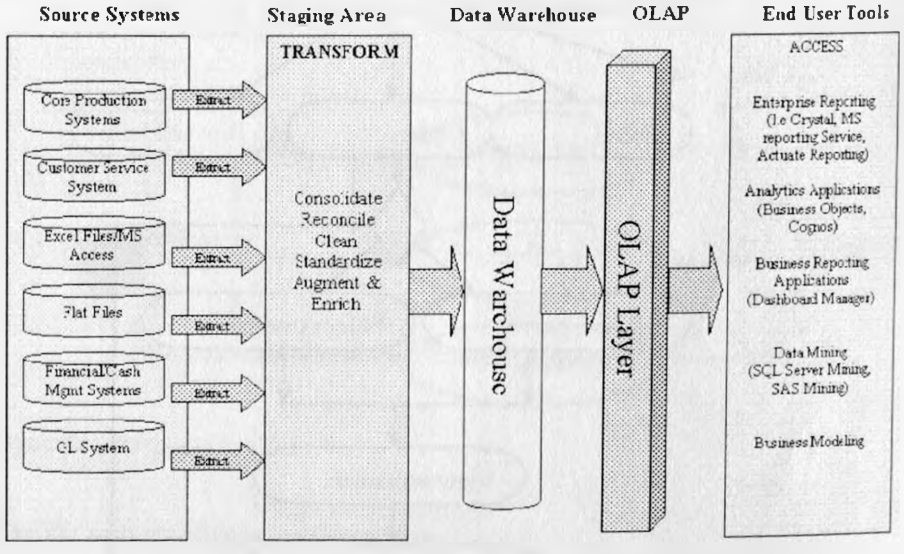


Figure 3.14 Data Warehouse Architecture

Source systems and databases; Source Systems are all those 'transaction or production' raw data providers, from where the details are pulled out for making it suitable for data warehousing. The sources can be quite diverse:

- Production databases like Oracle, Sybase, SQL.
- Excel Sheets.
- Database of small time applications like in MS Access.
- ASCII/Data flat files.

Data Staging; The data staging area is the place where all 'grooming' is done on data after it is pulled from the Source Systems. The end point of grooming is for the data to be loaded into

the 'Analysis or presentation server'. Data staging covers most of the 'back-bone' activities of a Data-Warehouse, which typically are also the biggest analytical and technical challenge of a project. These activities are extraction and transformation,

Presentation/Loaded; This is the repository where the data is finally loaded after going through all the works of extraction and transformation. This becomes the ultimate source for information for various reasons ranging from queries to advanced data modeling.

Dimensional Model; The presentation area has data model, which is different from that of production system. This is called dimensional model. It is the way data is organized in data-warehouse.

3.5 Data base Design

For an information system to be useful, reliable, adaptable, and economic, it must be based on sound data modeling, and only secondary on process analysis. Equities, bonds and other financial instruments are traded in an exchange; the following are the important entities and their description necessary for storing the data generated which is useful for our system

a) The entity exchange below defines the attributes of an exchange,

a) Stock exchange
Ex_code
Ex_name
type
Service_region
country
city

b) Daily index is an entity representing daily data release on the index,

b)Daily_index
Ex_code
Index1
Index2
capitalization
Equity_turnover
Bond_turnover

c)Share_details
Share_code
company
Exchange_code*
Home_country
Total_shares
classification
Par_value

c) Share_details entity describes different equities being traded at the exchange,

d)Daily_statistics
Day_number
Price_date
Share_code*
open
high
low
close
volume
Trading_status

e)Weekly_statistics
week_number
Week_date
*Share_code**
vwap
Tranding_status
Price_change
Share_traded
capitalization
EPS
DPS
PE
dividend

d) Daily and e) weekly statistics can be described using daily_statistics and weekly_statistics respectively.

The primary key are in **bold and underlined**, where as foreign keys are in ***italics****.

Data design and component level; The low level data type and operation are

- Dates are of data type date, it allows conversion form DD/MM/YYYY to UNIX time and form UNIX time to DD/MM/YYYY. The data type and operations allow date addition operations, conversion to various date formats and displaying on a graphic.
- Open, low, high, close and derived variables are of currency data type. The main operations are finding moving averages and displaying on a graphic.
- Volume and other derive variable are of floating point data types and retrieved for display.

Entity relationship diagram for TTSS database

The Entity relation diagram (ERD) give a data model showing the entities and their relationship.

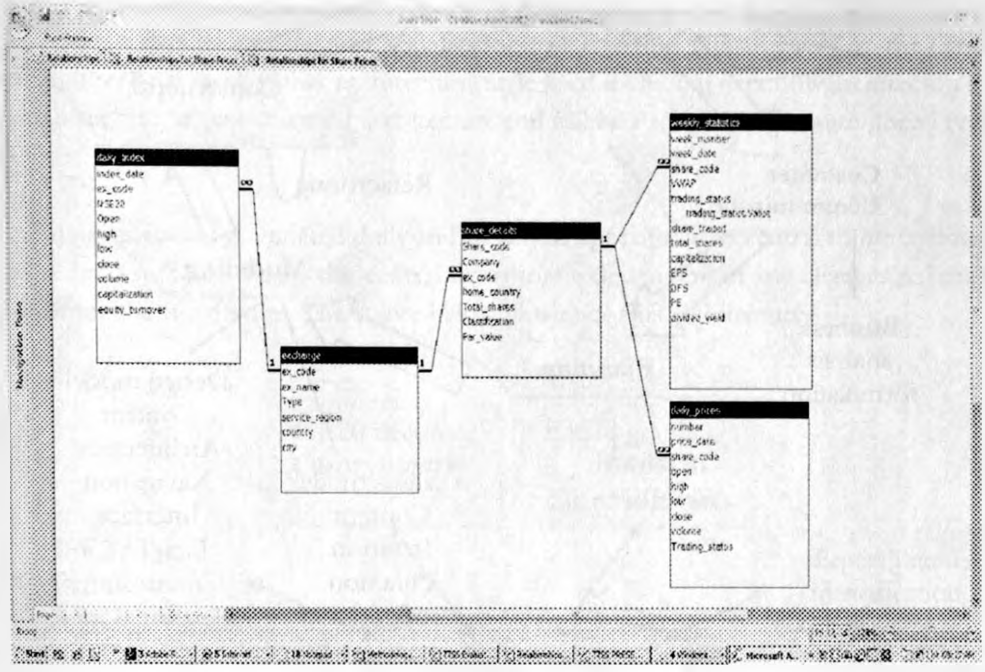


Figure 3.15 Entity Relationship Diagram

3.6 Web Design

A design model encompasses content, aesthetics, architecture, interface, navigation, and component-level design issues are the primary work product of web engineering design. Technical attributes that lead to high quality web application include Usability, functionality, reliability, efficiency, maintainability, availability, scalability, security and time to market.

The WebE process (see Pressman (2005)) must be adapted to fit the specific area of application. The generic process framework –communication, planning, modeling, construction, and deployment is applicable to webE.

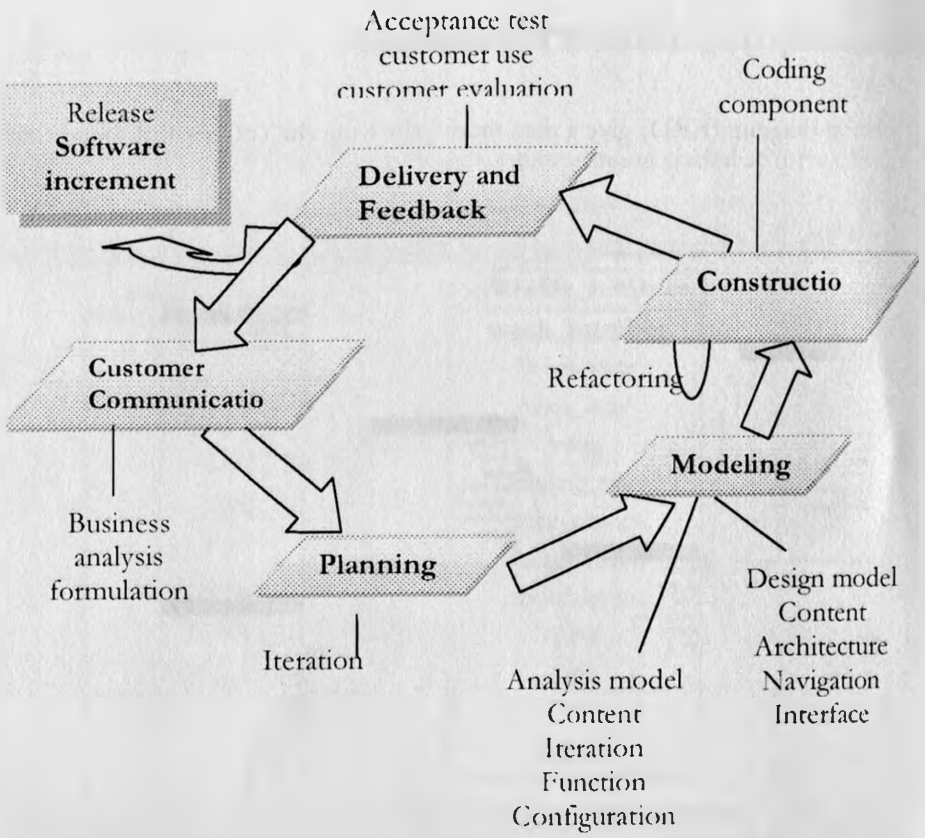


Figure 3.16 Web Engineering process.

The webE process is predicated on three points: incremental delivery, continuous change and short timeline. Web Applications can be assessed using a variety of quality criteria that include usability, functionality, reliability, efficiency, maintainability, security, availability, and time to market.

Since this is a web based application six major steps are recommended driven by information obtained during analysis:

- **Content Design:** Design of content object and their relationships,
- **Graphic design:** the look and feel that the end user sees,
- **Architectural design:** focuses on the overall hypermedia of all content objects and functions,
- **Interface design:** the overall layout and interaction mechanisms that define the user interaction
- **Navigation design:** defines how the end user navigates through the hypermedia structure,
- **Component design;** represent the detailed internal structure of the functional elements

Among the techniques required for successful web application design are component based software engineering, networking, architectural and navigational design, internet

standards/languages, human interface design, graphics design, content layout, and web application testing.

3.7 The Data centered Architecture.

TTSS is a data processing and visualization tool and thus relays heavily on the data centered architectural style. Other architectural style used including data flow architecture, layered architecture, object-oriented architecture and call and return architecture. (See Pressman RS (2005).)

A data store that is updated daily and weekly as appropriate is central to the architecture of TTSS. Client software access the central repository independent of any changes to data or the action of other client software. The figure below illustrates this architecture.

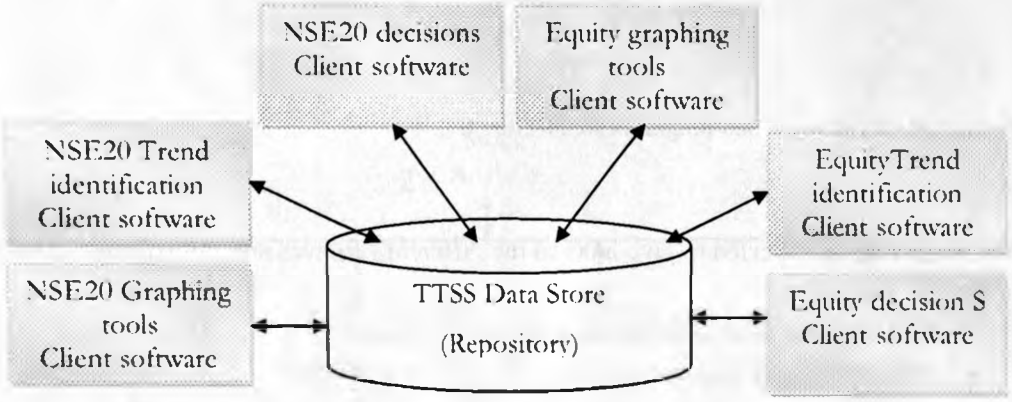


Figure 3.17. TTSS Data-centered architecture.

This architecture ensures that existing components can be changed and new client components added to the architecture without concern about other clients.

3.8 System Decomposition

Composite structure is a mixture of linear structure, random structure and Hierarchical structure web design.

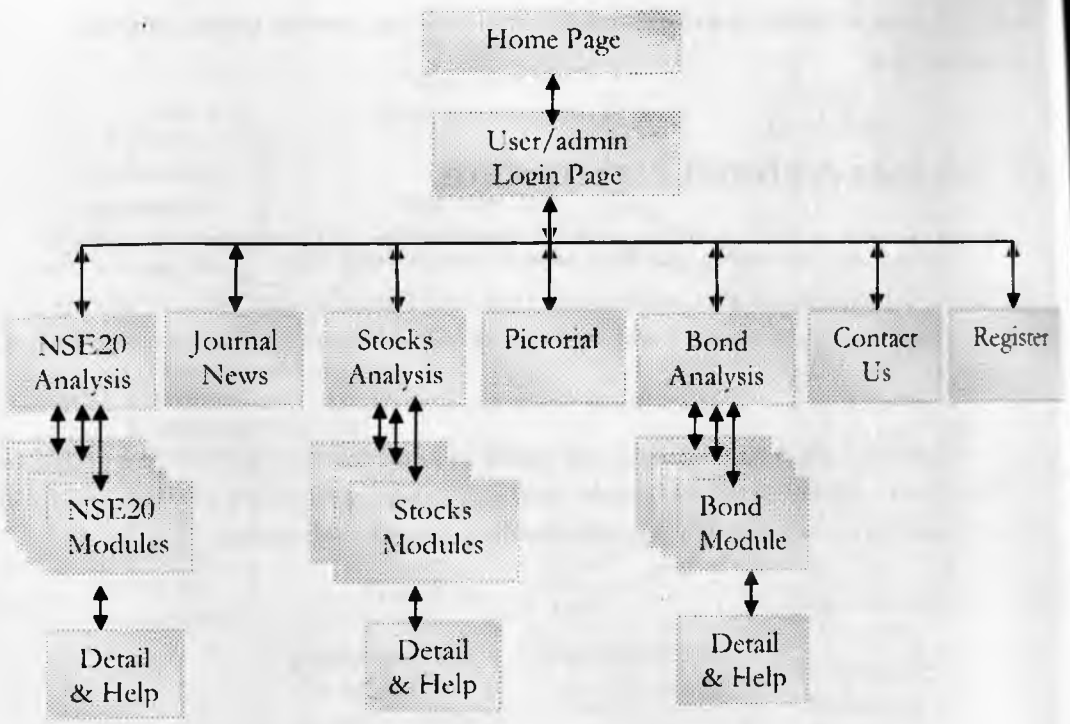


Figure 3.18a TTSS chart: Sub-programs architecture 1.

The home page is expected to give links to the different modules and information. After logging in the user can access;

- NSE20 index analysis modules
- Individual stock analysis modules
- Information support modules including registration, contact, pictorial, journal and events modules,

The analysis modules as in figure below enable users to

- Generate and overlay charts,
- Identify trend in the market or individual shares,
- Provide buy and sell decision support that ensure timely decision while combined with the chart generation module,

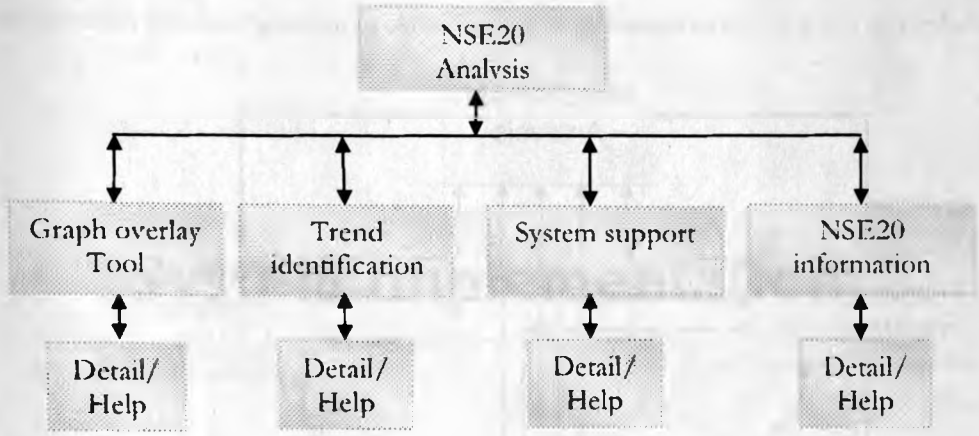


Figure 3.18b TTSS Sub-programs architecture 2.

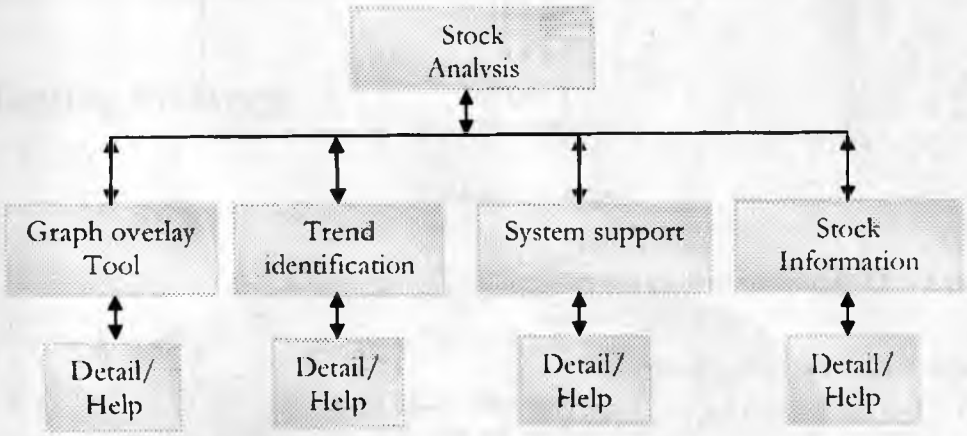


Figure 3.18c TTSS Sub-programs architecture 3.

- Like the hierarchical (top-down) structure, there are direct links from the home page to each of the features of the system (e.g. NSE20 analysis, Stocks analysis, member register.).
- There are direct links from the each module to modules at lower levels (e.g. stock analysis module has sub-module for each of the main companies of the NSE (i.e., Barclays, Sasini, Equity.), and from each company to different tools linked to the databases.
- The audience has access to any home page from any other main page (like in a random access structure).
- The details of each analysis method are linked in a linear structure, which might be appropriate for the sequencing of instruction within an analysis method.

3.9 Modules Coding Strategy

The following software development cycle is used while generating code for each module:

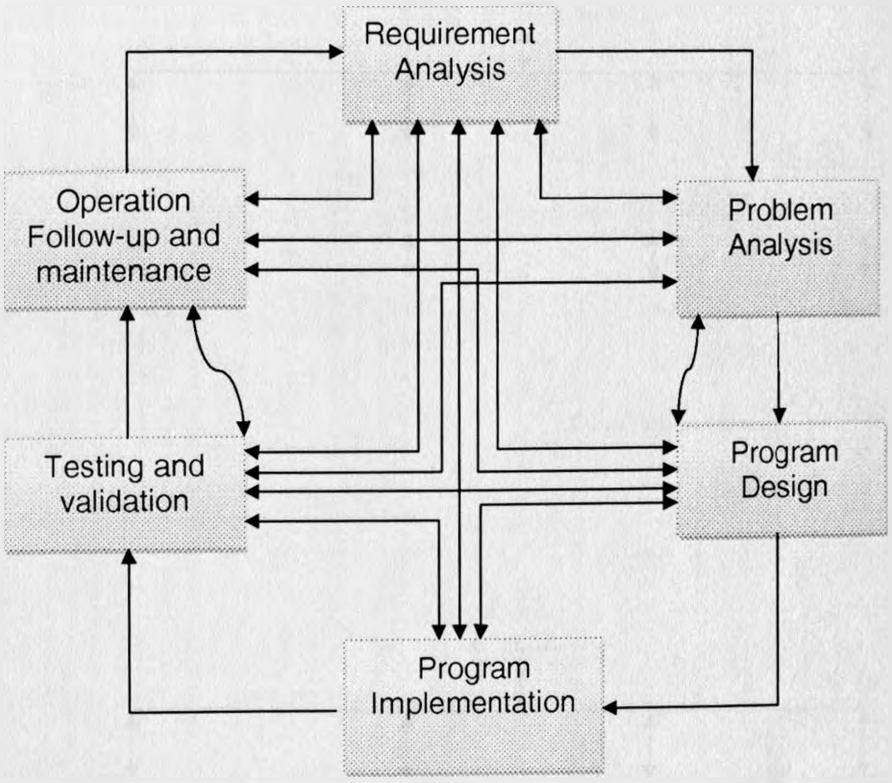


Figure 3.19 TTSS modules coding strategy.

Functions of the web based tool are:

- Get the periods for which the graphs are to be generated,
- Get the different series to be displayed for comparison and those to be overlaid,
- Select the best scale for given period and series for which the graphs are required,
- Create a grid with both the axis calibrated,
- Generate the graphs on prompt,
- Label the generated graphs appropriately

The goal in module design is to ensure high cohesion and low coupling. High cohesion implies that a component or class encapsulates only attributes and operations that are closely related to one another and to the component itself. Coupling is a quantitative measure of the degree to which classes are connected to one another

CHAPTER FOUR

System Implementation

4.1 Introduction

To ensure that TTSS meets the users requirement a test strategy that accommodates low-level tests are necessary to verify that a small source code segment has been well implemented as well as high-level tests that validate major functions against the product requirements. Reusable source code is debugged and tested to ensure compliance to requirement.

4.2 Testing Strategy.

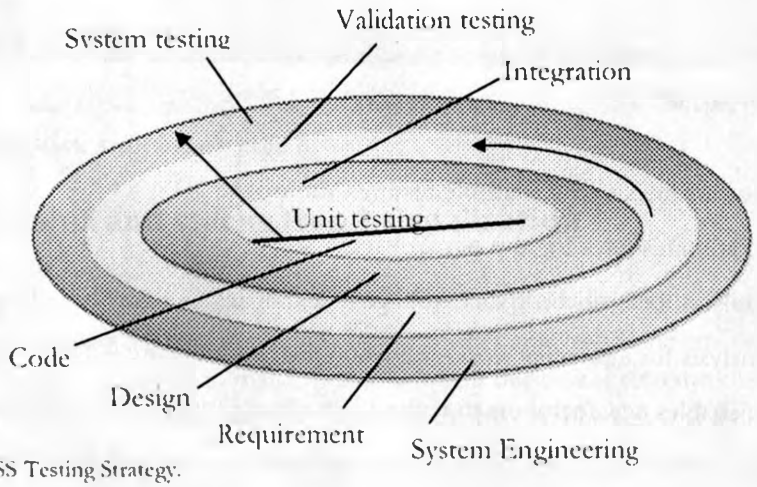


Figure 4.1 TTSS Testing Strategy.

Testing begins at the core of the spiral, unit testing, as you move outward in a spiral mechanism you encounter higher level testing with corresponding system requirements.

The goal of web applications testing is to exercise each of the many dimensions of the web application quality with intent of finding errors or uncovering issues that may lead to quality failures. Testing focuses on among others, content, functions, structure, usability, and navigability, performance, and capacity and security.

The end point of grooming is for the data to be loaded into the analysis or presentation server. Data staging covers most of the 'back-bone' activities of a data-warehouse. This ensures the web application passes performance and stress testing. For security purpose the users are required to enter username and password for authentication purpose.

4.3 Results

4.3.1 Home Page

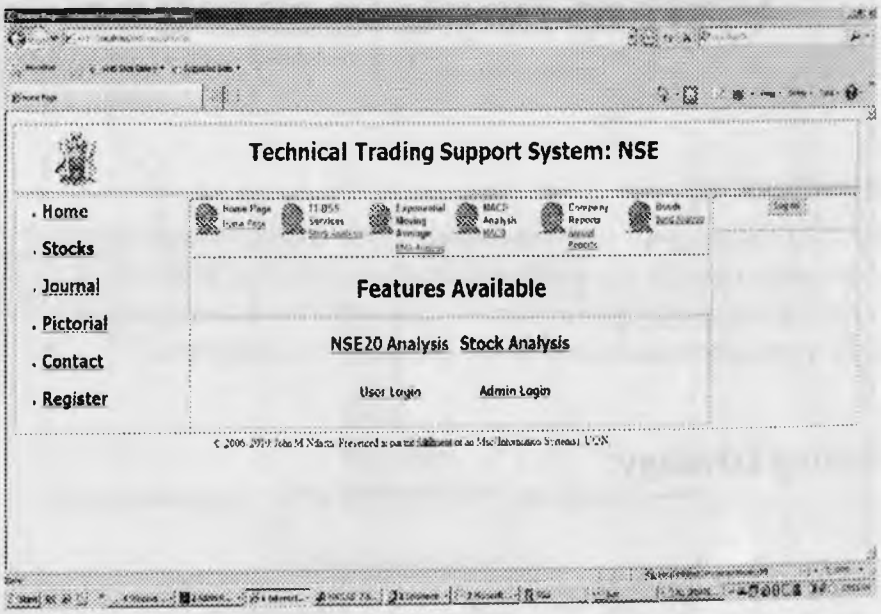


Figure 4.1 TTSS home page

The home page offers links to the available features among the

- User and adiministrator login page
- NSE20 anlysis for Nairobi stock exchange index analysis,
- Stock Analysis for individual stock evaluation page, (see fugure 4.2 below),
- Register: enables new members to register before accessing the analysis tools
- Journal and pictorials offers otherews and information important to markert professinals,
- Contact: this page enables a person to send comment on the web facility with least effort and receive instant acknoledgement, and
- Other facilities eg links to bond analysis, companys annual reports and futher analysis tool. These tool were not fully developed bby the time limit provided.

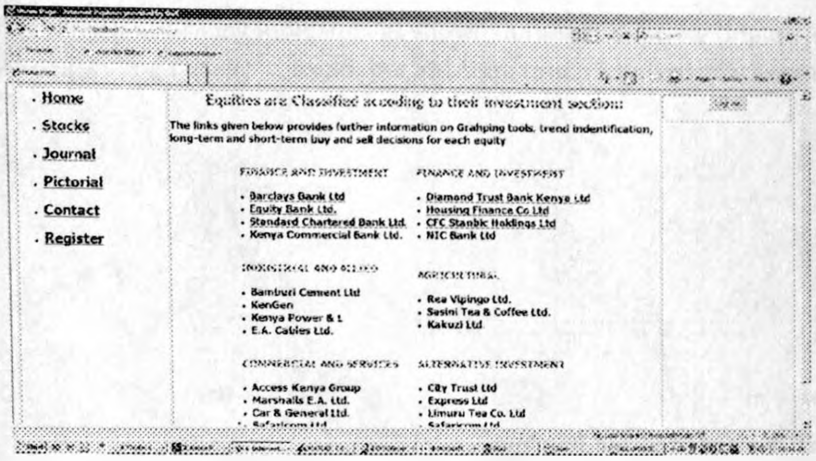


Figure 4.2 TTSS Stock Analysis web page 1.

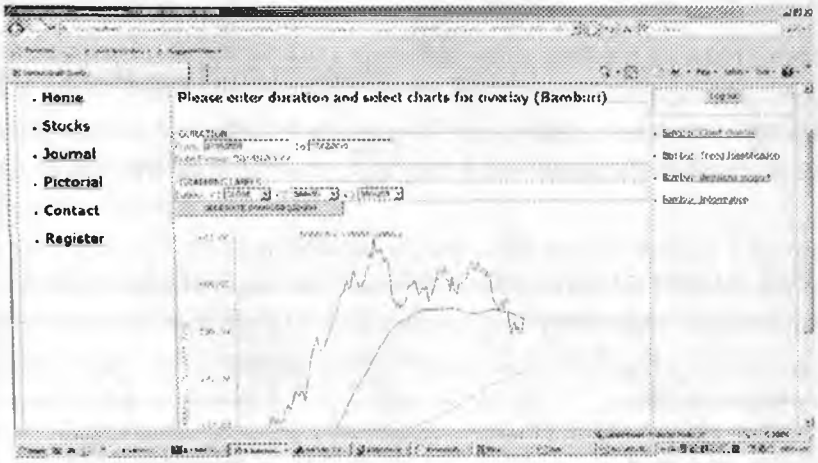
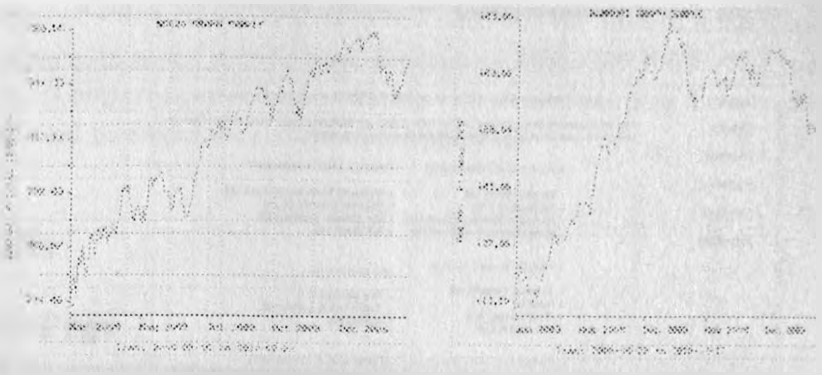


Figure 4.3 TTSS Stock Analysis web page 2.

4.3.2 NSE index and stocks trend visualisation

The ability to visualize the general trend for both the index and individual stock is the simplest and an important first step in any to any further analysis. Some analysts believe that viewing the trend is sufficient to make their investment decision. From the charts generating module it's possible to visualize trends as given in the two graphs below (Figure 4.4).



(a) (b)

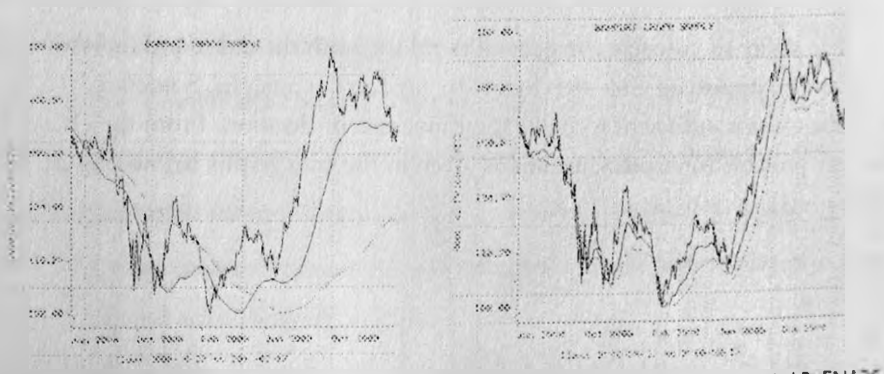
Figure 4.4 NSE20 index trend and Bamburi

4.3.2 Charts overlay module

In strong trending markets, some indicators work well while others fail to give good results. In consolidating or trading markets, those indicators that failed during trending market environments often work best. Before analyzing a security with a set of indicators, it is essential to determine the trend of the security and then apply the appropriate indicators in the analysis.

Figures 4.5 (a) demonstrate chart overlay for closing price, SMA(50), and SMA(200). A crossover of the blue SMA50 above SMA200 indicates a long term change in trend and hence a long term buyer should make a buy investment. Figures 4.5 (b) demonstrate chart overlay for closing price, EMA(12), and EMA(26). It shows that exponential moving average are more sensitive to price movements

Figure 4.5 (a) and (b) below, give moving average overlay charts for Bamburi stock price from 27/06/2008 to 17/02/2010.



Label 1: CLOSE Label 2: SMA50 Label 3: SMA200 (b) Label 1: CLOSE Label 2: EMA12 Label 3: EMA26

Figure 4.5 Chart Overlay NSE20 index trend and Bamburi K Ltd.

Moving averages are laging indicators as shown in the chart below (Figure 4.6). It take some time before detecting change in trend, but SMA are much less sensitive as compared with the EMA.

Labels: Label 1: CLOSE Label 2: SMA200 Label 3: SMA50

(b) Label 1: CLOSE, Label 2: EMA26, Label 3: EMA12.

Figure 4.6 Lagging Indicators

4.3.3 Trend identification module

This module uses the SMA200 and SMA50 to identify the long term trend and EMA12 and EMA26 to identify the short term trend (Figure 4.7 a). buy and sell decisions can also be viewed from results (Figure 4.7 b).

Trend identification and General Decisions for Bamburi K. Ltd.

(a)

(b)

Figure 4.7 Trend Identification and Decisions

The output has been reformatted to fit our report writing facility. The buy and sell decision support is given in table

4.3.4 Comparative analysis tool

The tool enables the concurrent visualization and comparison of different series that do not have equivalent scales. One can study the relation, if any, of volume traded on price trend as depicted in the figure 4.8 below. Volume traded is usually enormous compared to share price. For example total shares traded on a daily basis for Safaricom K. Ltd., are in the order of

millions but the price range from 2.50 to 6.00 KES. With some insight it's possible for comparisons involving such differing scales.

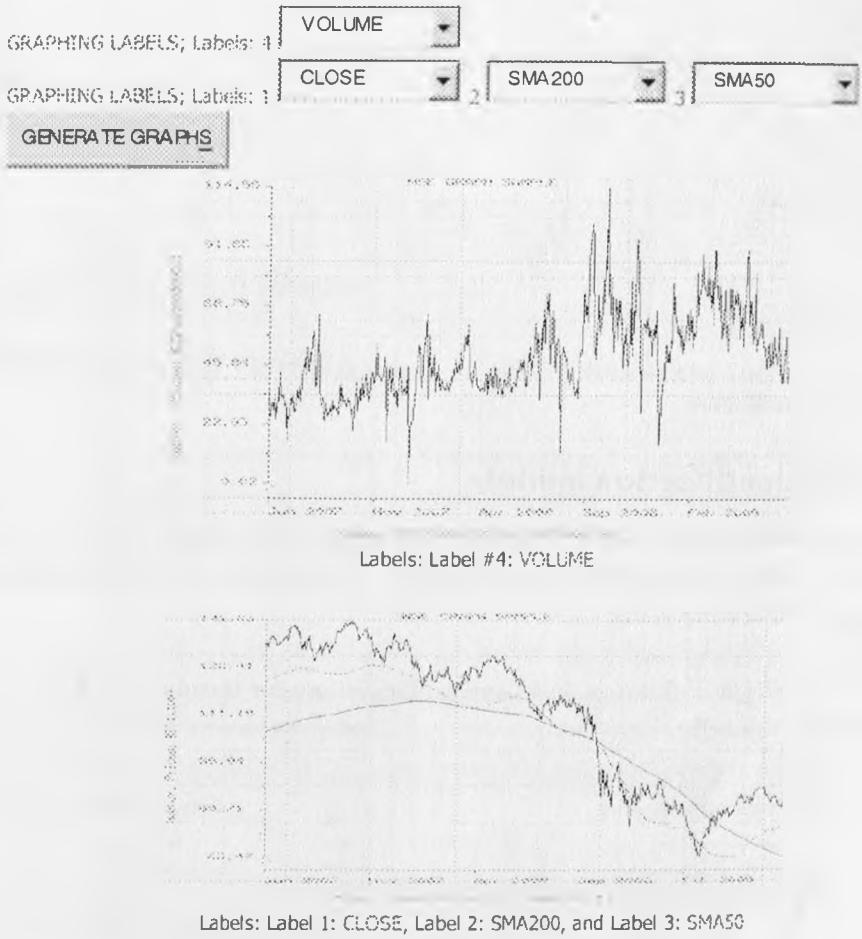


Figure 4.8 Cycles Comparison and Analysis.

4.4 Comparison with similar and related tools

In comparison to existing tools for the NSE, TTSS offers a range of more dynamic and interactive tools for market analysis. TTSS tool can be increased and improved to meet higher standards and quality attained by other tool in foreign markets. The table below gives a comparison of TTSS tool with other tool surveyed online for local and foreign market.

Web page Home page	No of TT indicators identified	Priority tools	Charts overlay tool	Charts tool Evaluation & Description
www.mystocks.co.ke/	2	Price chart SMA 10, 20 RSI	Can overlay only one SMA	Plots price for a fixed periods
www.nch.co.ke/	1	Static charts	Non	Not interactive
//finance.yahoo.com/	More than 25	SMA, EMA, MACD, MFI, ROC, RSI,Slow Stoch, Fast Stoch	Multiple	Highly Interactive tools.
TTSS NSE	7	Price series, SMA, EMA, MACD, MACD histogram, and Bollinger bands	Multiple	Interactive tools

Figure 4.8 TTSS Comparison with other tools

CHAPTER FIVE

Discussion

5.1 TTSS Information System

The modules and tools that we have implemented in TTSS demonstrate the important role data analysis and visualization in extracting business information. The modules successfully implemented include;

NSE20 index module: NSE20 index module is useful for analysis of past NSE20 index series. It includes:

- Chart generating and overlay module: using this module enable one to generate and overlay charts for both long term and short term moving averages.
- The trend identification module: this module can be used to identify whether the market is trending upward (Bullish Trend) or the markets are trending downwards (Bearish).
- Help or information for the working of the module and market related information.

Share analysis modules: Share analysis modules are useful for analysis of past share prices. Such modules include:

- Chart generating and overlay module: using this module enable one to generate and overlay charts for individual stocks for both long term and short term moving averages.
- The trend identification module: this module can be used to identify whether individual share prices are trending upward (Bullish Trend) or downwards (Bearish).
- Buy and sell decision support module that using moving average crossover determine most appropriate time to buy or sell. The SMA methods are slower than EMA methods in detecting trend change and moving average crossover.
- Help or information for the working of the module and market related information.

It is important to note that;

- The modules perform the analysis and decisions based on simple moving average, exponential moving average or MACD technical trading rules,
- It is evident that the 200-50 simple moving averages system is less sensitive to trend change than 26-12 days exponential moving averages system,

- The importance of being able to visualize trend and overlay charts cannot be overstated in stock market analysis. It is easy to visualise the type of cross over and whether the market are in oscillating.
- The trend identification module simplify the need to identify the crossover points in the charts, and
- Technical analysis is a useful tool to create a trading system that is profitable.

Using different indicators relationships can be found to improve forecasting and hence improve profit margins even after accounting for transaction cost. If implemented this framework would help decision makers to accurately predict stock price directions, market direction and hence enhance decision on stock trading.

The following table gives a summary of the steps take in the system development stages. These steps ensure that TTSS meet the quality standards of computer software development process and product.

Table 5.1 TTSS System development summary

	Stage	**Deliverable, methods and tools**
1	Project scope Problem definition	To develop a technical trading system that stores and uses periodic data from the NSE to generate and overlay charts, both for the NSE index and individual stocks. The system should also enable the analyst to identify trend and support buy and sell decisions using the same data. Support information and help should be availed on request.
2	Problem analysis	Identify which technical analysis methods to be used due to the advantages available
3	Requirement Analysis	Establish all the required objects, technical indicators, charts, decisions, and their data and process requirements for TTSS
4	Logical design Design analysis	Use case diagram are have used for functional analysis and DFD's to study behavioral analysis of the system
5	Physical design	Physical database, process and interface design for TTSS
6	Construction and testing, Installation and delivery	Tools used include My-sql database, PHP, WAMPSERVER, Code and module testing was done on the entire system

It's important to note that the TTSS information system can be classified as an expert system;

- Can support individual or entire team and can be hosted in a webpage to increase on customers awareness.

- It will be used repeatedly and constantly as long as data is updated,
- It has three major components: data, models, and user interface,
- It would help the user to make faster, smarter, better decisions.

The data warehouse and models base can be extended to include other financial time series including interest rates, exchange rates, bond yields, and quarterly earnings per share of a company.

The finding of the research confirms that technical analysis is a useful tool to create a trading system that is profitable. It is especially true in trending markets (upward or downward) where moving average method proves to be one of the best simple methods available.

TTSS can easily be modified to help educate and create interest in the public on the stock market business and analysis methods. This would attract a larger numbers of investors into the capital market. TTSS, if customized to target those investors situated in the countryside and who have no access to a financial analyst's advice, can help them access such information on the internet.

5.2 Challenges

Some challenges realized in this project include;

- Web applications are usually vast in size and thus require longer periods of time of incremental development to attain the complete system. There was a short timeline required to complete the application, this mitigates against the voluminous development processes.
- Multiple changes occurred as a result of changing user "feeling " of the prototype and due to evaluation of delivered modules,
- Availability of the entire data set for all the NSE20 index and historical prices for all equities traded at the NSE was not entirely possible for all the required attributes. The tools were developed in such a way to encourage scalability and thus it's easy to add new attributes.
- The current business reporting, though having standards, does not have a unique easily adaptable electronic format. Documents for different companies are in different formats and their adoption into the data warehouse would clearly be challenging.
- TTSS database data compatibility with the format released by the NSE was challenging. The data released require filtering and formatting before loading into the database.
- There are many more technical indicators, and different analysts have different inclination on the best indicators and charting formats.

5.3 Research opportunities

The following were identified as possible research opportunities that can be used to extend this work or give alternative approaches;

- Developing a more interactive and sophisticated charts generating and overlay tools,

- Ideally a system should encourage more units to be bought or sold when the signals appear to be very strong. In other words, this research does not look at any money management technique, an area where more research work can be done.
- Future research can be conducted to investigate how long traders should hold securities and how much he or she should buy or sell every time a signal is generated.
- We can expand our data warehouse to cater for data necessary for macroeconomic factor models, fundamental factor model and statistical factor models.The data warehouse and model base can be expanded to cater for return analysis. Three types of factor models are available for studying asset returns.
  - The first type is the *macroeconomic factor models* that use macroeconomic variables such as growth rate of GDP, interest rates, inflation rate, and unemployment numbers to describe the common behaviour of asset returns. Here the factors are observable and the model can be estimated via linear regression methods.
  - The second type is the *fundamental factor models* that use firm or asset specific attributes such as firm size, book and market values, and industrial classification to construct common factors.
  - The third type is the *statistical factor models* that treat the common factors as unobservable or latent variables to be estimated from the returns series.
- New methods of analysis to describe alternative approaches to volatility modelling, including use of high-frequency transactions data and daily high and low prices of an asset are possible with TTSS database.
- More research can be performed on advanced models such as soft computing, genetic algorithms and neuro-networks in pattern recognition algorithms and their analysis.

5.4 Conclusion

In the process of designing and developing this system important system analysis and design issues have arisen, the challenge faced by a during system analysis, system design and system implementation and testing stages have increased the learning process.

Although the NSE and listed companies continue to capture a great amount of data and information they are loosely integrated in the support of market analysts and interested stakeholders. TTSS is one such step in an effort to integrate data and create knowledge.

TTSS has been designed and built for the internet architecture due to the growing trend towards e-business and e-commerce application and can easily be used to add value to web application in the stock market services. More remote users can also be able to access the tools availed by TTSS. It's my hope that more studies will be conducted in the area and that these tools will find their place in the Kenyan stock market.

Appendix A

Daily Data from NSE

The stock exchange has multiple stocks classified according to different categories. The total number of share at a given date (10/12/2008):

	TOTAL NO OF SHARES ISSUED	MRT CAP '000'	12-Oct
Company			
Unilever Tea Kenya Ltd Ord 10.00	48,875,000	2,223,813	45.50
SHARES ISSUED Kakuzi Ord.5.00	19,599,999	779,100	39.75
Rea Vipingo Plantations Ltd Ord 5.00	60,000,000	1,194,000	19.90
Sasini Ltd Ord 5.00	228,055,500	3,181,374	13.95
COMMERCIAL AND SERVICES			
Accesskenya Ltd Ord. 1.00	199,885,578	7,195,881	36.00
Car & General (K) Ltd Ord 5.00	22,279,616	1,125,121	50.50
CMC Holdings Ltd Ord 5.00	582,709,440	12,236,898	21.00
Hutchings Biemer Ltd Ord 5.00	360,000	7,290	20.25
Kenya Airways Ltd Ord 5.00	461,615,484	22,849,966	49.50
Marshalls (E.A.) Ltd Ord 5.00	14,393,106	467,776	32.50
Nation Media Group Ord. 5.00	71,305,260	24,386,399	342.00
Safaricom Ltd Ord.0.05	40000000000	290,000,000	7.25
ScanGroup Ord. 1.00	159,000,000	5,207,250	32.75
Standard Group Ltd Ord 5.00	73,275,029	4,323,227	59.00
TPS Eastern Africa (Serena) Ltd Ord 1.00	105,864,742	7,622,261	72.00
Uchumi Supermarket Ltd Ord 5.00	180,000,000	2,610,000	14.50
FINANCE AND INVESTMENT			
Barclays Bank Ltd Ord 10.00	1,357,884,000	95,051,880	70.00
C.F.C Bank Ltd ord.5.00	273,684,211	30,378,947	111.00

Diamond Trust Bank Kenya Ltd Ord 4.00	163,037,108	15,162,451	93.00
Equity Bank Ltd Ord 5.00	370,277,702	112,934,699	305.00
Housing Finance Co Ltd Ord 5.00	115,000,000	3,881,250	33.75
Centum Investment Co. Ltd Ord 5.00	549,951,880	14,573,725	26.50
Jubilee Holdings Ltd Ord 5.00	45,000,000	8,415,000	187.00
Kenya Commercial Bank Ltd Ord 10.00	1,996,000,000	61,876,000	31.00
Kenya Commercial Bank Ltd Rights			5.45
Kenya Re-Insurance Corporation Ltd Ord 2.50	600,000,000	10,110,000	16.85
National Bank of Kenya Ltd Ord 5.00	200,000,000	12,300,000	61.50
NIC Bank Ltd Ord 5.00	296,692,383	17,504,851	59.00
Pan Africa Insurance Holdings Ltd Ord 5.00	48,000,000	3,408,000	71.00
Standard Chartered Bank Ltd Ord 5.00	271,967,810	56,841,272	209.00
INDUSTRIAL AND ALLIED			
Athi River Mining Ord 5.00	94,000,000	10,058,000	107.00
B.O.C Kenya Ltd Ord 5.00	19,525,446	3,124,071	160.00
Bamburi Cement Ltd Ord 5.00	362,959,275	69,688,181	192.00
British American Tobacco Kenya Ltd Ord 10.00	100,000,000	16,500,000	165.00
Carbacid Investments Ltd Ord 5.00	11,326,755	1,551,765	137.00
Crown Berger Ltd Ord 5.00	23,727,000	949,080	40.00
E.A.Cables Ltd Ord 5.00	202,500,000	8,150,625	40.25
E.A.Portland Cement Ltd Ord 5.00	90,000,000	10,350,000	115.00
East African Breweries Ltd Ord 2.00	790,774,356	155,782,548	197.00
Eveready East Africa Ltd Ord.1.00	210,000,000	1,155,000	5.50
Kenya Oil Co Ltd Ord 0.50	147,176,120	13,540,203	92.00
Kenya Power & Lighting Ltd Ord 20.00	79,128,000	16,537,752	209.00
KenGen Ltd. Ord. 2.50	2,198,361,456	53,310,265	24.25
Mumias Sugar Co. Ltd Ord 2.00	1,530,000,000	19,048,500	12.45
Olympia Capital Holdings ltd Ord 5.00	40,000,000	650,000	16.25
Sameer Africa Ltd Ord 5.00	278,342,393	2,574,667	9.25
Total Kenya Ltd Ord 5.00	173,013,000	5,190,390	30.00
Unga Group Ltd Ord 5.00	63,090,728	870,652	13.80

ALTERNATIVE INVESTMENT MARKET SEGMENT			
A.Baumann & Co.Ltd Ord 5.00	3,840,066	42,625	11.10
City Trust Ltd Ord 5.00	5,207,558	781,134	150.00
Eaagads Ltd Ord 1.25	8,039,250	281,374	35.00
Express Ltd Ord 5.00	35,403,790	693,914	19.60
Williamson Tea Kenya Ltd Ord 5.00	8,756,320	709,266	79.00
Kapchorua Tea Co. Ltd Ord 5.00	3,912,000	320,784	82.00
Kenya Orchards Ltd Ord 5.00	12,868,124	38,604	3.00
Limuru Tea Co. Ltd Ord 20.00	600,000	202,800	338.00
PREFERENCE SHARES			
Kenya Power & Lighting Ltd 4% Pref 20.00	1,800,000	14,400	8.00
Kenya Power & Lighting Ltd 7% Pref 20.00	350,000	3,500	10.00

Weekly Summary release on the NSE

WEEKLY MARKET STATISTICS FOR THE WEEK-ENDING FRIDAY 19th FEBRUARY 2010

Ordinary Shares	Par Value	VWAP Prices Last Fri.		VWAP Prices This Fri.	Prices Change %	Shares Traded During the week	Total Shares Issued	Mkt Cap. Kshs Mn.	EPS	DPS	PE	Dividend Yield
MAIN INVESTMENT MARKET SEGMENT (MIMS)												
Agricultural												
Kakuzi Ord.5.00	5/-	37.00		36.00	-2.70%	2 800	19 599 999	705.60	13.12	1.00	2.74	2.78%
Rea Vipingo Plantations Ltd Ord 5.00	5/-	12.70		12.60	-0.79%	26 100	60 000 000	756.00	2.48	0.50	5.08	3.97%
Sasini Ltd Ord 1.00	1/-	8.00	xd	7.80	-2.50%	422 200	228 055 500	1 778.83	2.30	0.40	3.39	5.13%
										Sector PE	3.48	

Commerc.and Allied												
AccessKenya Group Ltd Ord. 1.00	1/-	21.75		20.25	-6.90%	365 000	206 331 223	4 178.21	0.99	0.40	20.45	1.98%
Car & General (K) Ltd Ord 5.00	5/-	33.50	cd	33.50	0.00%	-	22 279 616	746.37	8.80	0.67	3.81	2.00%
CMC Holdings Ltd Ord 0.50	0.50/-	11.40	xd	11.20	-1.75%	724 600	582 709 440	6 526.35	0.93	0.35	12.04	3.13%
Hutchings Biemer Ltd Ord 5.00	5/-	20.25	S	20.25	0.00%	-	360 000	7.29	-18.34	0.00	-1.10	0.00%
Kenya Airways Ltd Ord 5.00	5/-	49.25		48.00	-2.54%	1 590 400	461 615 483	22 157.54	-8.84	1.00	-5.43	2.08%
Marshalls (E.A.) Ltd Ord 5.00	5/-	19.00		19.00	0.00%	3 000	14 393 106	273.47	-11.80	0.00	-1.61	0.00%
Nation Media Group Ord. 2.50	2.50/-	124.00		121.00	-2.42%	33 500	142 610 520	17 255.87	9.00	5.50	13.44	4.55%
Safaricom Ltd Ord 0.05	0.05/-	5.35		5.35	0.00%	34 141 700	40 000 000 000	214 000.00	0.265	0.10	20.19	1.87%
Scangroup Ltd Ord 1.00	1/-	26.75		26.50	-0.93%	55 600	220 689 655	5 848.28	1.79	0.62	14.80	2.34%
Standard Group Ltd Ord 5.00	5/-	35.00		35.50	1.43%	4 000	73 275 029	2 601.26	3.57	1.10	9.94	3.10%
TPS Eastern Africa (Serena) Ltd Ord 1.00	1/-	49.00		46.50	-5.10%	116 400	105 864 742	4 922.71	2.10	1.25	22.14	2.69%
Uchumi Supermarket Ltd Ord 5.00	5/-	14.50	S	14.50	0.00%	-	180 000 000	2 610.00	2.34	0.00	6.20	0.00%
										Sector PE	28.49	
Finance & Invest.												
Barclays Bank Ltd Ord 2.00	2/-	49.50	cd	49.75	0.51%	529 500	1 357 884 000	67 554.73	4.50	2.50	11.06	5.03%
Centum Investment Co Ltd Ord 0.50	0.50/-	12.90		12.60	-2.33%	287 300	549 951 880	6 929.39	0.57	0.00	22.11	0.00%
CFC Stanbic Holdings Ltd ord.5.00	5/-	43.25		44.00	1.73%	35 400	273 684 211	12 042.11	4.94	1.90	8.91	4.32%
Diamond Trust Bank Kenya Ltd Ord 4.00	4/-	72.50		70.00	-3.45%	36 300	163 037 108	11 412.60	6.28	1.40	11.15	2.00%
Equity Bank Ltd Ord 0.50	0.50/-	16.05	cd	15.50	-3.43%	3 622 000	3 702 777 020	57 393.04	1.14	0.40	13.60	2.58%
Housing Finance Co Ltd Ord 5.00	5/-	17.50		17.10	-2.29%	229 100	230 000 000	3 933.00	0.80	0.30	21.38	1.75%
Jubilee Holdings Ltd Ord 5.00	5/-	138.00		135.00	-2.17%	9 300	45 000 000	6 075.00	14.14	4.25	9.55	3.15%
Kenya Commercial Bank Ltd Ord 1.00	1/-	21.50		21.00	-2.33%	1 454 800	2 217 777 777	46 573.33	1.80	1.00	11.67	4.76%
Kenya Re-Insurance Corporation Ltd Ord 2.50	2.50/-	13.10		12.85	-1.91%	3 449 800	600 000 000	7 710.00	1.97	0.50	6.52	3.89%
National Bank of Kenya Ltd Ord 5.00	5/-	37.25		39.25	5.37%	66 300	200 000 000	7 850.00	4.50	0.00	8.72	0.00%
NIC Bank Ltd Ord 5.00	5/-	35.00		35.25	0.71%	811 200	326 361 621	11 504.25	3.49	0.50	10.10	1.42%
Olympia Capital Holdings ltd Ord 5.00	5/-	7.35		7.20	-2.04%	45 700	40 000 000	288.00	-1.53	0.10	-4.71	1.39%

Pan Africa Insurance Holdings Ltd Ord 5.00	5/-	45.50		45.00	-1.10%	11 600	48 000 000	2 160.00	-2.00	1.60	-22.50	3.56%
Standard Chartered Bank Ltd Ord 5.00	5/-	173.00		173.00	0.00%	18 300	271 967 810	47 050.43	11.34	10.00	15.26	5.78%
The Co-operative Bank of Kenya Ltd Ord 1.00	1/-	9.70		9.85	1.55%	19 490 100	3 499 212 000	34 467.24	0.80	0.10	12.31	1.02%
										Sector PE	12.06	
D.Indust. & Allied												
Athi River Mining Ord 5.00	5/-	108.00		104.00	-3.70%	120 400	99 055 000	10 301.72	5.08	1.25	20.47	1.20%
B.O.C Kenya Ltd Ord 5.00	5/-	149.00	cd	155.00	4.03%	1 300	19 525 446	3 026.44	7.88	6.80	19.67	4.39%
Bamburi Cement Ltd Ord 5.00	5/-	163.00		167.00	2.45%	85 300	362 959 275	60 614.20	8.78	6.00	19.02	3.59%
British American Tobacco Kenya Ltd Ord 10.00	10/-	188.00		190.00	1.06%	162 300	100 000 000	19 000.00	17.00	17.00	11.18	8.95%
Carbacid Investments Ltd Ord 5.00	5/-	100.00		99.50	-0.50%	13 900	33 980 265	3 381.04	7.54	5.00	13.20	5.03%
Crown Berger Ltd Ord 5.00	5/-	25.00		24.75	-1.00%	14 400	23 727 000	587.24	1.20	1.00	20.63	4.04%
E.A.Cables Ltd Ord 0.50	0.50/-	23.50		22.00	-6.38%	243 200	202 500 000	4 455.00	1.94	1.00	11.34	4.55%
E.A.Portland Cement Ltd Ord 5.00	5/-	80.00	xd	80.00	0.00%	10 600	90 000 000	7 200.00	20.38	1.30	3.93	1.63%
East African Breweries Ltd Ord 2.00	2/-	154.00	cd	152.00	-1.30%	218 900	790 774 356	120 197.70	9.09	8.05	16.72	5.30%
Eveready East Africa Ltd Ord.1.00	1/-	3.70		3.60	-2.70%	188 800	210 000 000	756.00	0.135	0.00	26.67	0.00%
KenGen Ltd Ord. 2.50	2.50/-	13.95		13.50	-3.23%	1 009 500	2 198 361 456	29 677.88	0.94	0.50	14.36	3.70%
KenolKobil Ltd Ord 0.50	0.50/-	65.00		63.00	-3.08%	22 800	147 176 120	9 272.10	8.15	8.56	7.73	13.59%
Kenya Power & Lighting Co Ltd Ord 20.00	20/-	152.00		150.00	-1.32%	245 800	79 128 000	11 869.20	40.76	8.00	3.68	5.33%
Mumias Sugar Co. Ltd Ord 2.00	2/-	10.30		10.15	-1.46%	5 262 600	1 530 000 000	15 529.50	1.05	0.40	9.67	3.94%
Sameer Africa Ltd Ord 5.00	5/-	6.45		6.40	-0.78%	216 400	278 342 393	1 781.39	0.54	0.00	11.85	0.00%
Total Kenya Ltd Ord 5.00	5/-	30.50		30.25	-0.82%	103 700	173 013 000	5 233.64	4.02	2.50	7.52	8.26%
Unga Group Ltd Ord 5.00	5/-	9.10		9.15	0.55%	9 300	75 708 873	692.74	1.55	0.00	5.90	0.00%
										Sector PE	12.48	
ALTERNATIVE INVESTMENT MARKET SEGMENT (AIMS)												
A.Baumann & Co Ltd Ord 5.00	5/-	11.10	S	11.10	0.00%	-	3 840 066	42.62	-2.02	0.00	-5.50	0.00%
City Trust Ltd Ord 5.00	5/-	95.00		100.00	5.26%	200	5 728 314	572.83	5.13	1.00	19.49	1.00%

Eaagads Ltd Ord 1.25	1/25	20.00		19.00	-5.00%	3 500	16 078 500	305.49	1.85	0.625	10.27	3.29%
Express Ltd Ord 5.00	5/-	8.90		8.80	-1.12%	18 400	35 403 790	311.55	-1.24	0.00	-7.10	0.00%
Williamson Tea Kenya Ltd Ord 5.00	5/-	130.00		130.00	0.00%	8 400	8 756 320	1 138.32	12.62	4.00	10.30	3.08%
Kapchorua Tea Co. Ltd Ord Ord 5.00	5/-	94.50		94.50	0.00%	-	3 912 000	369.68	17.87	2.50	5.29	2.65%
Kenya Orchards Ltd Ord 5.00	5/-	3.00		3.00	0.00%	-	12 868 124	38.60	-1.24	0.00	-2.42	0.00%
Limuru Tea Co. Ltd Ord 20.00	20/-	305.00		305.00	0.00%	-	1 200 000	366.00	14.10	5.00	21.63	1.64%
										Sector PE:	16.65	
FIXED INCOME MARKET SECURITIES SEGMENT (FISMS)												
Preference Shares												
Kenya Power & Lighting Ltd 4% Pref 20.00	20/-	8.00		8.00	0.00%	-	1 800 000	14.40		0.80		10.00%
Kenya Power & Lighting Ltd 7% Pref 20.00	20/-	5.50		5.50	0.00%	-	350 000	1.93		1.40		25.45%
Week's Equity Trading Summary:	Week			NSE 20 Share Index								
No. of Deals	8 775			Last Fri:	3606.46	Change:	52.47					
Week's Volume shares	#####			This Fri:	3553.99	% Change:	-1.45%					
Week's Value (Kshs)	#####											
Mkt Cap (Ksh Billion)	914.048			All Share Index (NASI								
Mkt Cap (US $ Mill)	12 187			Last Fri:	79.06	Change:	0.57					
MAIN MARKET P/E	14.72			This Fri:	78.49	% Change:	-0.72%					

Appendix B

This appendix contain questionnaires used to evaluate the system during prototyping (TTSS Evaluation form 2), and during evaluation of the complete system (TTSS evaluation form 1)

TTSS Evaluation Form 1.

Date.../..../2010

This information will be used to evaluate Technical Trading Information Support System.

Name:..... Institution:.....

1. Under which category would you classify yourself? check as many as appropriate

___Market Analyst/professional. ___Individual Analyst. ___Cooperate Analyst.

___Stock Trader ___research/student ___Others (Specify .....)

Rating: Please use the following rating when answering the questions

Scale: 5 highest; 1 -lowest; 0 does not exist/apply. **Circle the most appropriate number.**

Bulleted items are overall questions that are weighted separately from each section.

1. How would you rate your familiarity and understanding of technical analysis indicators, chart overlay, and technical trading rules? **0 1 2 3 4 5**
2. Do you have any computerised information system that helps you visualise trends and supports your decisions on trading at the NSE (check as appropriate) ___**Yes** ___ **No**
3. If you have such a system, "as in 3" which of the following indicators and charts are available (check as many as appropriate)

___ Time series graphs
___ Simple Moving Averages (SMA)
___ Exponential Moving Averages (EMA)
___ MACD
___ Bollinger Bands
___ Volume Analysis
___ Rate of Change (ROC)
___ Volume Rate of Change
___ RSI
___ Commodity Channel Index (CCI)
___ Slow Stochastic Oscillator
___ Displaced Moving Average (DMA)

Technical Trading Information Support System (TTSS)

Security

4. I found it easy to register/ login/logout, and important icons and links were available.
0 1 2 3 4 5

User Interface/Navigation

5. There were links icons or other graphical tools appropriate to aid in searching and navigating the resource. **0 1 2 3 4 5**

6. The directions for doing a search were brief, but complete and clear.

0 1 2 3 4 5

7. This resource provides links by (check as many as appropriate):

___ Question (natural language query) ___ Topic. ___ Keyword

___ Pull down menu ___ Search ___ others (please specify)

TTSS charts generating tools

8. It was clear and easy on how to generate Charts and I found it comfortable to use the tools

0 1 2 3 4 5

9. The chart generating tools gives enough choice to meet your analysis needs

0 1 2 3 4 5

10. What other charts/indicators do you feel are important and should be included in the choices?

.....

.....

11. I could complete a successful query/generate graph without system stalling.

0 1 2 3 4 5

12. Approximately what times did it take to generate a chart? Check as appropriate.

___ Very fast ___ <1/2 minutes. ___<1 Minute. ___<2 minute. __very slow.

13. **Circle the most appropriate response concerning using the chart generating tools.**

- 5 Most analysts were/will able to use the tools without any training session.
- 4 Most analysts were/will be able to use the tools after one training sessions.
- 3 Most analysts who were/will able to use the tools need two individual training.
- 2 Only very advanced analyst will able to use the tools with a minimum of training.
- 1 no stock market analyst will able to use this tool at all.

Other TTSS tools. (Trend identification and Buy/sell support)

14. The trend identification and buy/sell support tools are useful.

0 1 2 3 4 5

15. There is information found that is appropriate for understanding background issues for each stock traded at the NSE. 0 1 2 3 4 5

16. Does the tool provide easy remote access? 0 1 2 3 4 5

17. The tools and pages were easily customized? 0 1 2 3 4 5

TTSS Overall evaluation

18. I believe TTSS resource is a powerful tool for performing market analysis for professional analysts

0 1 2 3 4 5

Comments:

19. Any comment or observation that you would like to convey for consideration on any improvement required on TTSS. .....

.....

.....

.....

TTSS Evaluation Form 2.

Date..../..../2010

This information will be used to evaluate Technical Trading Information Support System.

Name:.....Institution:.....

1. Under which category would you classify yourself? check as many as appropriate

___Market Analyst/professional. ___ Individual Analyst. ___Cooperate Analyst.

___ Stock Trader ___ Researcher/Student ___ Others (Specify .....)

Rating: Please use the following rating when answering the questions

Scale: 5 highest; 1 lowest; 0 does not exist/apply. **Circle the most appropriate number.**

2. How would you rate your familiarity and understanding of technical analysis indicators, chart overlay, and technical trading rules? **0 1 2 3 4 5**
3. Do you have any computerised information system that helps you visualise trends and supports your decisions on trading at the NSE (check as appropriate) ___**Yes** ___ **No**
4. If you have such a system, "as in 3" which of the following indicators and charts are available (check as many as appropriate)

_ Time series graphs
_ Simple Moving Averages (SMA)
_ Exponential Moving Averages (EMA)
_ MACD
_ Bollinger Bands
_ Volume Analysis
_ Rate of Change (ROC)
_ Volume Rate of Change
_ RSI
_ Commodity Channel Index (CCI)
_ Slow Stochastic Oscillator
_ Displaced Moving Average (DMA)

Technical trading information support System

5. Were there links icons or other graphical **tools appropriate** to **aid** in **searching** and **navigating** the resource? **0 1 2 3 4 5**
6. The chart generating tools gives enough choice of charts to meet your analysis needs **0 1 2 3 4 5**
7. By order of priority (1 being the highest), which of the following technical analysis indicators ought to be included in the system:

_ Time series graphs
_ Simple Moving Averages (SMA)
_ Exponential Moving Averages (EMA)
_ MACD
_ Bollinger Bands
_ Volume Analysis
_ Rate of Change (ROC)
_ Volume Rate of Change
_ RSI
_ Commodity Channel Index (CCI)
_ Slow Stochastic Oscillator
_ Displaced Moving Average (DMA)

8. What other charts/indicators do you feel are important and should be included in the choices provided .....

.....

9. **Circle the most appropriate response concerning using the chart generating tools.**

- 5 Most analysts were/will able to use the tools without any training session.
- 4 Most analysts were/will be able to use the tools after one training sessions.
- 3 Most analysts who were/will able to use the tools need two individual training.
- 2 Only very advanced analyst will able to use the tools with a minimum of training
- 1 No stock market analyst will able to use this tool at all.

Comments:

10. Any comment or observation that you would like to convey for consideration during any improvement on TTSS. .....

.....

.....

.....

Appendix C

Sample code; nse20.php

```
<?php
session_start();
ob_start();
$timelimit = 60*6;  // set a time limit in seconds
$now = time();  // get the current time
$redirect = 'http://localhost/includes/login.php';   // where to redirect if rejected
if !isset($_SESSION['authenticated'])  // if session variable not set, redirect to login page
        {
        header("Location: $redirect");
        exit;
         }
         // if timelimit has expired, destroy session and redirect
         elseif ($now > $_SESSION['start'] + $timelimit) {// empty the $_SESSION array
         $_SESSION = array();
         // invalidate the session cookie
         if (isset($_COOKIE[session_name()])) {
         setcookie(session_name(), '', time()-86400, '/');
         }
         // end session and redirect with query string
         session_destroy();
         header("Location: {$redirect}?expired=yes");
         exit;
         }
         // if it's got this far, it's OK, so update start time
else {
         $_SESSION['start'] = time();
         }
?>

<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
<?php include("../includes/title.inc.php");
include("../includes/random_image.php"); ?>
<head>
<meta http-equiv="Content-Type" content="text/html; charset=iso-8859-1" />
<title>NSE20 Graph Overlay</title>
<link href="assets/journey.css" rel="stylesheet" type="text/css" media="screen" />
</head><body>
<fieldset >
        <?php @include("../includes/ttlogo.php"); ?>
</fieldset >
<table border="1" style="font-family: tahoma">
  <tr><td height="" width="300" colspan="" valign="top">
    <div id="maincontent" ><?php @include("../includes/amenu.php"); ?>  </div> </td>
```

```
        <td valign=top width="900">


<!-- dynamic plots section ==========================================>

<?php @include("../includes/time_seriestool_nse20.php");?>

<!-- dynamic plots section ==========================================>

</p></td>
<td width=300  valign="top" align="center">
<fieldset>
        <div ><p><?php include('../includes/logout.inc.php'); ?></p>      </div>
</fieldset>
        <div align=left><?php @include("../includes/nse20menu.php");?></div>
</td></tr></td></table>

<table><tr><td width=300></td><td width=700 ><div id="footer">
        <?php include("../includes/footer.inc.php"); ?>
</div></td>    </tr></table></body></html>
```

Sample Code. Graph console.

```
<?php
class timeSeriesGraph
{
        private $img;
        private $height = 500;
        private $width = 600;
        private $yAxixScale = 1;
        public $title = 'This is the Graph Title';
        public $xLabel = 'And X-Axis Comes Here(Time)';
        public $yLabel = 'Y-Axis Also Here (Scale)';
        public $from;
        public $to;
        public $data = array();
        public $data2 = array();
        public $data3 = array();

        public function __construct($title,$xLabel,$yLabel,$from,$to,$data =
array(),$data2=array(),$data3 = array())
        {
                /**
                * Initialize data for the graph
                * $data is a one dimensional array indexed by time points
                */
                $this->title = $title;
```

```
        $this->xLabel = $xLabel;
        $this->yLabel = $yLabel;
        $this->data = $data;
        $this->data2 = $data2;
        $this->data3 = $data3;
        $this->from = $from;
        $this->to = $to;
        /**
         * Create the image resource first;
         */
        $this->img = imagecreatetruecolor($this->width,$this->height);
        /**
         * Prepare the canvas back ground
         */
        $this->bgAxes();
        /**
         * Caliberate the Axes
         */
        $this->caliberate();
        /**
         * Label Axes
         */
        $this->labelAxes();
        /**
         * Render the image as a png graph
         */
        $this->doTheGraph();
        header('Content-type: image/png');
        imagepng($this->img);
        imagedestroy($this->img);
}
/**
 * Draw meshed back ground and label the axes
 */
private function bgAxes()
{
        $bg = imagecolorallocate($this->img,255,255,255);
        imagefilledrectangle($this->img,0,0,$this->width,$this->height,$bg);
        $mesh = imagecolorallocate($this->img,241,241,241);
        imagerectangle($this->img,0,0,($this->width-1),($this->height-1),$mesh);
        /**
         * Mesh vertically first
         */
        $x=0;
        while($x<$this->width)
        {
                imageline($this->img,$x,0,$x,$this->height,$mesh);
                $x +=20;
        }
        /**
         * Now Mesh horizontally
```

```
        */
        $y=0;
        while($y<$this->height)
        {
                imageline($this->img,0,$y,$this->width,$y,$mesh);
                $y +=20;
        }
        /**
        * Label the axes and titles
        */
        $labels = imagecolorallocate($this->img,0,179,0);
        $w = imagefontwidth(10)*strlen($this->title);
        $pw = ($this->width - $w)/2;
        imagestring($this->img,10,$pw,5,$this->title,$labels);

}
private function caliberate()
{
        $labels = imagecolorallocate($this->img,0,179,0);
        imageline($this->img,100,20,100,440,$labels);
        imageline($this->img,100,440,$this->width,440,$labels);
        $bg = imagecolorallocate($this->img,255,255,255);
        imageline($this->img,100,420,100,440,$bg);
        imageline($this->img,100,435,100,440,$labels);
        imageline($this->img,100,420,105,425,$labels);
        imageline($this->img,105,425,95,430,$labels);
        imageline($this->img,95,430,100,435,$labels);
        /**
        * Caliberate X - axis
        */
        $x=100;
        while($x<$this->width)
        {
                imageline($this->img,$x,445,$x,440,$labels);
                $x+=100;
        }
        $y=420;
        while($y>=20)
        {
                imageline($this->img,95,$y,100,$y,$labels);
                $y-=40;
        }
        if(is_array($this->data)&&$this->data!=null)
        {
                $dif = $this->yAxisCalibre(max($this->data));

                $min = number_format(min($this->data)/$dif,2,'.','');
                $w = 100 - (imagefontwidth(10)*strlen($min)+10);
                imagestring($this->img,10,$w,410,$min,$labels);

                $max = number_format(max($this->data)/$dif,2,'.','');
```

```
            $w = 100 - (imagefontwidth(10)*strlen($max)+10);
            imagestring($this->img,10,$w,10,$max,$labels);
            $scale = (max($this->data)-min($this->data))/5;
            $y=330;
            $val = min($this->data)+$scale;
            while($y>20)
            {
                    $vals  = number_format($val/$dif,2,'.',',');
                    imagestring($this->img,10,$w,$y,$vals,$labels);
                    $val +=$scale;
                    $y-=80;
            }
            $this->yAxixScale = 80/$scale;
            $this->xAxisCaliblre();
        }

}
private function yAxisCalibre($max)
{
        $srtlen = strlen(number_format($max,2,'.',''));
        $dif = $srtlen-6;
        if($dif<=0)
        {
                return 1;
        }
        else
        {
                $scale = pow(10,$dif);
                $this->yLabel .= '(x'.$scale.')';
                return $scale;
        }
}
private function xAxisCaliblre()
{
        $labels = imagecolorallocate($this->img,0,179,0);
        $dateScale = ($this->to - $this->from)/5;
        if($dateScale<=86400)
        {
                $prefx='';
                $date = 'D jS';
        }
        elseif($dateScale<=432000)
        {
                $prefx='';
                $date = 'D';
        }
        elseif($dateScale<=604800)
        {
                $prefx='WK ';
                $date = 'W';
        }
```

```
        elseif($dateScale<=2592000)
        {
                $prefx='';
                $date = 'M jS';
        }
        elseif($dateScale<=12960000)
        {
                $prefx='';
                $date = 'M Y';
        }
        elseif($dateScale<=31104000)
        {
                $prefx='';
                $date = 'M Y';
        }
        else
        {
                $prefx='';
                $date = 'Y';
        }
        $time = $this->from;
        for($x=100;$x<$this->width;$x = $x+100)
        {
                $showtime = date($date,$time);
                imagestring($this->img,10,$x,450,$prefx.$showtime,$labels);
                $time +=$dateScale;
        }
}
private function labelAxes()
{
        $labels = imagecolorallocate($this->img,0,200,200);
        /**
         * Label the x - axis
         */
        $w = imagefontwidth(10)*strlen($this->xLabel);
        $h = imagefontheight(10)+5;
        $pw = ($this->width - $w)/2;
        imagestring($this->img,10,$pw,($this->height-$h),$this->xLabel,$labels);
        /**
         * Label the y-axis
         */
        $h = imagefontwidth(10)*strlen($this->yLabel);
        $ph = ($this->height - $h)/2;
        imagestringup($this->img,10,1,($this->height-$ph),$this->yLabel,$labels);
}
private function doTheGraph()
{

        $labels = imagecolorallocate($this->img,200,0,0);
        $M = count($this->data);
        $min = min($this->data);
```

```
            $xAxisScale = ($this->width-100)/$M;
            $pointA['x'] = 100;
            $pointA['y'] = 420 - (($this->data[0]-$min)*$this->yAxixScale);
            $n=1;
            while($n<$M)
            {
                    $pointB['x'] = ($pointA['x']+$xAxisScale);
                    $pointB['y'] = 420 - (($this->data[$n]-$min)*$this->yAxixScale);
                    imageline($this-
>img,$pointA['x'],$pointA['y'],$pointB['x'],$pointB['y'],$labels);
                    $pointA['x'] = $pointB['x'];
                    $pointA['y'] = $pointB['y'];
                    ++$n;
            }
            $this->data = $this->data2;
            $labels = imagecolorallocate($this->img,0,0,200);
            $M = count($this->data);
            $min = min($this->data);
            $xAxisScale = ($this->width-100)/$M;
            $pointA['x'] = 100;
            $pointA['y'] = 420 - (($this->data[0]-$min)*$this->yAxixScale);
            $n=1;
            while($n<$M)
            {
                    $pointB['x'] = ($pointA['x']+$xAxisScale);
                    $pointB['y'] = 420 - (($this->data[$n]-$min)*$this->yAxixScale);
                    imageline($this-
>img,$pointA['x'],$pointA['y'],$pointB['x'],$pointB['y'],$labels);
                    $pointA['x'] = $pointB['x'];
                    $pointA['y'] = $pointB['y'];
                    ++$n;
            }
            $this->data = $this->data3;
            $labels = imagecolorallocate($this->img,0,200,0);
            $M = count($this->data);
            $min = min($this->data);
            $xAxisScale = ($this->width-100)/$M;
            $pointA['x'] = 100;
            $pointA['y'] = 420 - (($this->data[0]-$min)*$this->yAxixScale);
            $n=1;
            while($n<$M)
            {
                    $pointB['x'] = ($pointA['x']+$xAxisScale);
                    $pointB['y'] = 420 - (($this->data[$n]-$min)*$this->yAxixScale);
                    imageline($this-
>img,$pointA['x'],$pointA['y'],$pointB['x'],$pointB['y'],$labels);
                    $pointA['x'] = $pointB['x'];
                    $pointA['y'] = $pointB['y'];
                    ++$n;
            }
        }
```

```
}
/**
 * PREPARE TO DRAW GRAPHS
 */
/**
 * ***************************************************************************
 * CONNECT TO MYSQL DATABASE
 */
/*CONNECTION VARIABLES*/
$dbHost = ''; //database server
$dbName = 'shares'; //ENTER NAME OF DATABASE
$dbUser = 'root'; //Database user name
$dbPass = ''; //database passowrd
/* ACTUAL CONNECTION */
$con = mysql_connect($dbHost,$dbUser,$dbPass)or die(mysql_error());
mysql_select_db($dbName,$con)or die(mysql_error());
/*NOW WE CAN EXECUTE QUERIES*/

$query = "SELECT `".$_GET['label1']."` FROM `knse20` WHERE
`date`>='".$_GET['datefrom']."' AND `date`<='".$_GET['dateto']."'";
//echo $query.'<br>';
$resource = mysql_query($query)or die(mysql_error());
$i=0;

while($row = mysql_fetch_array($resource))
{
        $data[$i] = $row[$_GET['label1']];
        ++$i;
}
$query = "SELECT `".$_GET['label2']."` FROM `knse20` WHERE
`date`>='".$_GET['datefrom']."' AND `date`<='".$_GET['dateto']."'";
//echo $query.'<br>';
$resource = mysql_query($query)or die(mysql_error());
$i=0;
while($row = mysql_fetch_array($resource))
{
        $data2[$i] = $row[$_GET['label2']];
        ++$i;
}
$query = "SELECT `".$_GET['label3']."` FROM `knse20` WHERE
`date`>='".$_GET['datefrom']."' AND `date`<='".$_GET['dateto']."'";
//echo $query.'<br>';
$resource = mysql_query($query)or die(mysql_error());
$i=0;
while($row = mysql_fetch_array($resource))
{
        $data3[$i] = $row[$_GET['label3']];
        ++$i;
}
```

```
$graph = new timeSeriesGraph('NSE GRAPH SAMPLE','Time: '.$_GET['datefrom'].' to
'.$_GET['dateto'],'Approx. Prices:
KES',$_GET['fromUnix'],$_GET['toUnix'],$data,$data2,$data3);
?>
```

Sample Code. Graph generator.

```
/** timeseries_tool_nse20
<?php
/**
 * ***************************************************************************
 * CONNECT TO MYSQL DATABASE*/
/*CONNECTION VARIABLES*/
$dbHost = '';            //database server
$dbName = 'shares';      //ENTER NAME OF DATABASE
$dbUser = 'root';        //Database user name
$dbPass = '';            //database password
/* ACTUAL CONNECTION */
$con = mysql_connect($dbHost,$dbUser,$dbPass)or die(mysql_error());
mysql_select_db($dbName,$con)or die(mysql_error());
/*NOW WE CAN EXECUTE QUERIES*/
/**
 * ***************************************************************************
 */
        $query = "SELECT * FROM `nse20` LIMIT 0,0";
        $resource = mysql_query($query)or die(mysql_error());
/**
 *
 ==========================================================
 * CREATE FIELD NAMES ARRAY FOR LABELS
 */
$j=0;
$fields = array();
for($i=0;$i<mysql_num_fields($resource);++$i)
 {
        $r = mysql_fetch_field($resource);
        if($i>1)/*SKIP the first & second field(id and date fields)*/
        {
                $fields[$j] = $r->name ;
                ++$j;
                //echo '<option value="',$r->name,'">'.strtoupper($r->name).'</option>';
        }
 }
 /**
  * ==========================================
  */
$froma = '16/03/1982';
$toa = '22/02/2010';
```

```
if($_GET['froma']!='')
{
        $froma = $_GET['froma'];
        $toa = $_GET['toa'];
}
/**
* ================================================
*/
$from = '16/03/1982';
$to = '22/02/2010';
if($_GET['from']!='')
{
        $from = $_GET['from'];
        $to = $_GET['to'];
}
?>
<?php
echo $error;
?></font>
<br />
<form method="get" action="">
<fieldset style="font-family: tahoma">
<legend style="color: red"><h2>Please enter duration and select charts for overlay (NSE20
Index)</h2></legend>
<font color="red">
<font color="red">
<?php
echo $error;
?></font>
<br />
<fieldset style="color: green; font-family: tahoma">
<legend style="color: blue">DURATION</legend>
From: <input type="text" name="from" value="<?php echo $from?>"/> To <input
type="text" name="to"value="<?php echo $to?>"/><br />
Date Format: DD/MM/YYYY
</fieldset>
<br />
<fieldset style="color: green; font-family: tahoma">
<legend style="color: blue">GRAPHING LABELS</legend>
Labels: #1
<select name="label1">
<?php
for($i=0;$i<count($fields)-4;++$i)
{
        if($_GET['label1']==$fields[$i])
        {
                $sel = ' selected="yes"';
        }
        echo '<option value="',$fields[$i],'"',$sel,'>'.strtoupper($fields[$i]).'</option>';
        $sel='';
}
```

```
?>
</select>
#2
<select name="label2">
<?php
for($i=0;$i<count($fields)-4;++$i)
{
        if($_GET['label2']==$fields[$i])
        {
                $sel = ' selected="yes"';
        }
        echo '<option value="',$fields[$i],"",$sel,'>'.strtoupper($fields[$i]).'</option>';
        $sel="";
}
?>
</select>
#3
<select name="label3">
<?php
for($i=0;$i<count($fields)-4;++$i)
{
        if($_GET['label3']==$fields[$i])
        {
                $sel = ' selected="yes"';
        }
        echo '<option value="',$fields[$i],"",$sel,'>'.strtoupper($fields[$i]).'</option>';
        $sel="";
}?>
</select><br />
<input type="submit" name="action" value="GENERATE GRAPHS"/>
</fieldset></form>
<?php

if($_GET['action']=='GENERATE GRAPHS')
{
        $froma = explode('/',$_GET['froma']);
        $date_from = $froma[2].'-'.$froma[1].'-'.$froma[0];
        $fromUnix = mktime(0,0,0,$froma[1],$froma[0],$froma[2]);
        $toa = explode('/',$_GET['toa']);
        $date_to = $toa[2].'-'.$toa[1].'-'.$toa[0];
        $toUnix = mktime(0,0,0,$toa[1],$toa[0],$toa[2]);
        $label4 = $_GET['label4'];

        $from = explode('/',$_GET['from']);
        $date_from2 = $from[2].'-'.$from[1].'-'.$from[0];
        $fromUnix2 = mktime(0,0,0,$from[1],$from[0],$from[2]);
        $to = explode('/',$_GET['to']);
        $date_to2 = $to[2].'-'.$to[1].'-'.$to[0];
        $toUnix2 = mktime(0,0,0,$to[1],$to[0],$to[2]);
        $label1 = $_GET['label1'];
        $label2 = $_GET['label2'];
```

```
        $label3 = $_GET['label3'];
}
else
{
        $fromUnix = mktime(0,0,0,16,03,1982);
        $date_from = '1982-03-16';
        $toUnix = mktime(0,0,0,22,02,2010);
        $date_to = '2010-02-22';
        $label4 = 'close';

        $fromUnix2 = mktime(0,0,0,16,03,1982);
        $date_from2 = '1982-03-16';
        $toUnix2 = mktime(0,0,0,22,02,2010);
        $date_to2 = '2010-02-22';
        $label1 = 'open';
        $label2 = 'high';
        $label3 = 'low';
}
?>
</fieldset>
<fieldset>
<?php
$URLQueryString = "label1=".$label1."&label2=".$label2."&label3=".$label3;
$URLQueryString .="&fromUnix=".$fromUnix2."&toUnix=".$toUnix2."";
$URLQueryString .="&datefrom=".$date_from2."&dateto=".$date_to2;
?>
<img src="graph_plot_nse20.php?<?php echo $URLQueryString?>"/><br />
Labels:<br />
Label #1: <font color="red"><?php echo strtoupper($label1)?></font><br />
Label #2: <font color="blue"><?php echo strtoupper($label2)?></font><br />
Label #3: <font color="green"><?php echo strtoupper($label3)?></font><br />
</fieldset>
```

Sample code: Trend Identification

```
<?php
//DB CONECTION----------------------------------------
$con = mysql_connect('','root','')or die(mysql_error());
mysql_select_db('shares',$con)or die(mysql_error());
// QUERY
$query = "SELECT `date`,`close`,`ltrend`,`strend`,`emadiff`,`smadiff` FROM `nse20` ORDER
BY `date` DESC" ;
$res = mysql_query($query)or die(mysql_error());
$row = mysql_fetch_object($res);
echo "<h2 alighn='center'> NSE20 General Desicions</h2>";
echo '<table border="1" cellspacing="8" style="font-family: tahoma" >';
```

```
echo "<tr  align=center  style= 'color:red'
><td><h2>Date</h2></td><td><h2>Close</h2></td></td><td><h2>Long term
trend</h2><td><h2>Short term Trend</h2></td></tr>";

for($i=count($row)+1;$i>count($row)-8;--$i)
{
$row = mysql_fetch_object($res);
echo '<tr align=center><td>'.$row->date.'</td><td>'.$row->close.'</td><td>';
if(("$row->ltrend"=="LBLB")){echo "long-term<br/>Bullish:<br/><h3>BUY</h3>"; }

        elseif(("$row->ltrend"=="LBL")&&("$row->smadiff"<1)){echo "Long-
        term<br/>Bullish BUY:"; }
        elseif(("$row->ltrend"=="LBL")&&("$row->smadiff">1)){echo "Long-term<br/>
        Bullish:"; }
        elseif("$row->ltrend"=="LBRS"){echo "Long-term
        <br/>Bearish:<br/><h3>SELL</h3>"; }
        elseif(("$row->ltrend"=="LBR")&&("$row->smadiff">-1)){echo "Long-term<br/>
        Bearish:<br/>"; }
        elseif(("$row->ltrend"=="LBR")&&("$row->smadiff"<-1)){echo "Long-term
        <br/>Bearish:"; }
  else{echo "Long-term Bullish"; }
  echo'</td><td>';

   if("$row->strend"=="SBLB"){echo "Short-term<br/>Bullish:<br/><h3>BUY</h3>"; }
        elseif(("$row->strend"=="SBL")&&($row->emadiff<1)){echo "Short-
        term<br/>Bullish:<br/>Shor-term BUY"; }
        elseif(("$row->strend"=="SBL")&&("$row->emadiff">1)){echo "Short-term
        <br/>Bullish:"; }
        elseif(("$row->strend"=="SBR")&&("$row->emadiff">-1)){echo "Short-term<br/>
        Bearish:<br/> "; }
        elseif(("$row->strend"=="SBR")&&("$row->emadiff"<-1)){echo "Short-term
        <br/>Bearish:<br/>"; }
        elseif("$row->strend"=="SBRS"){echo "Short-term
        <br/>Bearish:<br/><h3>SELL</h3>";}
    else{echo "Short-term Bullish"; };
    echo'</td><td>';

    }
```

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