STOCK MARKET PRICE ANALYSIS

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JAYPEE INSTITUTE OF INFORMATION TECHNOLOGY, NOIDA

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DECLARATION

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which has been accepted for the award of any other degree or diploma of the university or other institute of higher learning, except where due acknowledgment has been made in the text.

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CERTIFICATE

This is to certify that the work titled "**Stock Market Price Analysis**" submitted by "**Chinmay Phutela"** and **"Shubham Kumar Jain**" in partial fulfillment for the award of degree of B.Tech of Jaypee Institute of Information Technology University; Noida has been carried out under my supervision. This work has not been submitted partially or wholly to any other University or Institute for the award of this or any other degree or diploma.

Signature of Supervisor:
Name of Supervisor: Mr. Kishore Kumar Yarramshetty
Designation: Assistant Professor (Grade-I)

Date : 20-12-2016

ACKNOWLEDGEMENT

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SUMMARY

Within past 10 years, the growth in IT sector has been unprecedented. Stock market and its trends are being studied till date using different algorithms of data science. Algorithmic trading is a method of executing a large order using automated pre-programmed trading instructions accounting for variables such as time, price, and volume to send small slices of the out to the market over time. They were developed so that traders do not need to constantly watch a stock and repeatedly send those slices out manually. Back in 2007, already 30% of the US equities volume was algorithmic (Economist 2007). This equals approximately 20 trillion USD per year. In 2010, as much as 70% of all dollar volume can be attributed to fully automated algorithmic trading.

In order to resolve the crisis of the same, we intended to implement different algorithms for analyzing different sets of data on daily, monthly, and yearly basis and make recommendations for the user to sell or buy various stocks. Currently we are testing this strategy for IT industry and will be preparing a comparative study for this in the near future so as to which strategy is best suited for a particular company.

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LIST OF SYMBOLS & ACRONYMS

Acronyms	Description
HFT	High Frequency Trading
AT	Algorithmic Trading
IT	Information Technology
IEEE	Institute of Electrical and Electronics Engineers

CHAPTER 1
INTRODUCTION

1.1 General Introduction

After the headway in the PC world, exchange based trading has experienced a huge change. Since time in history, people have utilized the rate of data further bolstering their good fortune disregarded to determine benefits – be it Rothschild who posted his men at war-sites so that he could be the first to take in the result of the England-France war and infer anomalous benefits or Reuters who utilized the pigeons to give data to his customers speedier that were much quicker than the post train, giving speedier access to stock news from the Paris stock trade. Data today goes at a rate speedier than whatever other time in recorded mankind's history, and accordingly the individuals who use this quicker pace of exchange of data could advantage in their trading operations.

As a human stimuli to this flow of information, computers have come to play a large part in the trading on exchanges - beginning with back office to streamline operations, to finally sending an order to the exchange based on predefined rules. The usage of computers for sending an order to the exchange based on predefined rules is broadly called algorithmic trading.

Algorithms are now a day-to-day feature in the trading horizon that it is unachievable for a human intelligence and offer a unbiased decision not to offer them because that is what the customer expect. These computational models can do tick by tick evaluation for every quote and trade for each stock market, identify liquidity opportunities, and turn the information into intelligent trading decisions.

On the sell aspect the companies realized that they might produce frameworks and provide it to their buy side purchasers to facilitate their commercialism ways. The primary generation of the sell side ways were straightforward order slicing that primaril split large order sizes to small individual orders and managed the order flow. The later generations evolved into advanced systems that request to reduce not solely the whole value of dealings however conjointly optimize the liquidity constraints. The expansion of recursive commercialism is incredibly closely connected to the event of the electronic commercial market.

This project aims at providing the client suggestion for selling/buying of share in order to maximize profit and manage risk factor .The project aims at specifically the major players in the IT stock market domain. The five companies included for the analysis are-

1) Infosys

2) Wipro

3) Oracle

4) HCL

5) TCS

The reason for selecting IT industry in particular is that the risk factor is minimum while the profitability is almost certain in most cases as the field is ever advancing and full of opportunities.

The debate of the day is now about high frequency trading (HFT) and algorithmic trading (AT). Once organised financial trading is done electronically, it becomes possible to setup a man-machine hybrid, where a human controls a computer program which does the actual work of looking at information and sending back orders. This man-machine hybrid is faster than a human, is less error-prone than a human, and costs less than a human. Once again, millions of jobs are on the line.

Several oncerns have however been expressed on whether a HFT/AT world is socially desirable or not. Critics argue that high levels of HFT / AT does not do any good to the quality of the markets, exacerbates market volatlity, and induces `flash crashes'. There are fears that liquidity provision in the AT world is transient: it is argued that in times of market stress, algorithms step away from this essential function, and instead become liquidity demanders, worsening the volatlity in the markets and creating `liquidity black holes'. These are non-trivial concerns; many regulators have started exploring the extent to which the new AT/HFT world has new kinds of market failures, and the kinds of regulatory interventions that might be appropriate in that environment.

1.2 Current and Open problems

As for the field of finance, there is some new technological advancement that is taking place every second to meet the current challenges in the best possible manner. In this field,

especially in the field of stock markets it's not only the solution that matters but the solutions that are optimized to give the best results. For the algorithmic trader this raises the important issue of determining the profitability of a strategy . Investors (including the trader themselves) need a measure of how profitable a strategy is to justify allocating it money. If profitability is too low your algorithms may not be competitive with other investment opportunities. If the profits are too high you may be taking excessive risk. Here are five factors to consider when assessing your algorithm's profitability:

- SECURITY ISSUES: Since it involves huge amount of money, the biggest problem is security over internet for banking details and authenticity of the medium used for transaction and portfolios invested in. A lot of proxy companies have come in the recent time which have fooled the naive traders and there have been repeated cases of the same.

- RISK vs PROFIT TRADE-OFF: The general principle behind stock market is higher the risk ,higher the gain .But the catch here is to strike the optimal ratio between the two so to strike the balance between the revenue earned to capital invested at risk. Just as in any asset class there is a range of returns and risks associated with various algorithmic trading strategies. Some are high risk while others are low risk. One role of the algorithmic trader is to determine if a strategy provides attractive risk-adjusted returns by backtesting and/or using comparable strategies as a proxy. It is not unheard of to filter through hundreds of strategies before finding one that has the necessary characteristics.

- UNPREDICTABILITY: Despite of all the measure taken ,market crashes are something that are unavoidable and leave stock market in a deep shock to recover from. The recovery however takes time and usually is dependent on the industries capability to fight back. Algorithms require constant monitoring.

- REQUIRES HUMAN SUPERVISION: Despite the headlines to the contrary algorithms need constant human supervision. Continuous trading coupled with operational complexity creates highly non-linear risk profiles. Proven strategies can fail drastically when markets abruptly change. Cumulative losses from unnoticed software glitches can exceed all previous gains. One of the best ways to prevent extreme events from dominating our experience is to continuously modify our actions in response to the algorithm's performance. Identifying and fixing small problems can prevent them from turning into large problems.

- APPLICABILITY OF ALGORITHM ON DIFFERENT MARKETS: While there many algorithms out there in market ,still to find industry specific algorithm is still a big task. For the type of risk every industry tackles is different.
- FINDING RELATIONSHIP BETWEEN VARIABLES: One of the first hurdles faced before adopting stochastic or random models in finance is the recognition that for all practical purposes, the prices of equities in an efficient market are random variables, that is while they may show some dependence on fiscal and economic processes and policies, they have component of randomness that makes them unpredictable.

1.3 Problem statement

In this project first we will be analysing the existing methodologies in the domain of algorithmic trading followed improvisation of the same by minimising the risk factor and trading in multiple domains.These project could be broadly divided into four phases:

- First step is to analyse the various available markets and then choose the specific industry and study its stock market trend.
- Second step is to analyse the commodity we want to trade (in our case stocks).
- Third is to study the existing algorithm for the same and improvise upon it to minimise risk.
- Fourth is to compare it with existing algorithm and analyse its efficiency.

1.4 Overview of proposed solution approach and Novelty/benefits

In this project, we analysed different industries banking, infrastructure etc and we finally choose IT industry and its 5 major players from stock market i.e.(HCL,Infosys,ORACLE,TCS,WIPRO).

First step was gathering historic data for these companies. Second was analysing the data and the industry trend. Third we applied we three different algorithm for different time periods to determine which one gives a more accurate prediction for the future values.The three algorithms are Moving averages, Calendar spread and trend prediction (delta inversion).The

different time periods for which we applied them varied from 1 year to a day. Their results was then analysed and then algorithm along with its time period was finalised. Currently the analysis for application of algorithms in particular to IT industry it hasn't been done.Considering the aspect of failure of Facebook IPO and success of alibaba.It is Important to analyse the factors governing the price of stocks in this particular industry. However,certain factors such as human discretion or current market trend or sudden crash can never be regulated.

The risk can never be minimised to zero however maximum precautions can be taken by various tools for analysing and predicting the future value of stocks depending upon the previous trend. Here what matter the most is the time period in consideration and the current trend the industry is following.

CHAPTER 2
BACKGROUND STUDY

2.1 Literature Survey

2.1.1 Summary of papers

PAPER 1

Title	**Automated System Trading, Algorithms and Programming - To Buy or To Sell The Trend?**
Authors	Jussi Kirves
Year of Publication	2014
Publishing details	Department of Economics Aalto University School of Business
Summary	This paper actually forms the basis of our project. Here in this paper it comapres various strategies and primarily focuses on bollingers strategy to determines the profitability of a stock. It also compares various commodities and how its stock prices varies with the variations in the indices. The detailed studies of moving average along with bollinger band is explained.

Web link	https://aaltodoc.aalto.fi/bitstream/handle/123456789/14176/hse_ethesis_13741.pdf?sequence=1

PAPER 2

Title	**Market Statistics and Technical Analysis:The role of Volume**
Authors	Lawrence blume
Year of Publication	1994,March
Publishing details	Journal of Finance,Volume 49 ,Issue 1
Summary	This paper determines the role of volume and time slab for determining average and how different traders received different .It also uses different technical indicators for determine the buy or sell signal.
Web link	http://volume.technicalanalysis.org.uk/BlEO94.pdf

PAPER 3

Title	**An Introduction To Regression Analysis**
Authors	Alan O. Sykes
Year of Publication	2014
Publishing details	University of Chicago
Summary	This paper defines how regression analysis can be used to determine the dependency of a dependent variable over other independent variables via the two methods – simple linear and multiple linear regression. The paper also tells us the importance of the coefficient of determination (R Squared) to select an appropriate method among the many available method of forecasting and prediction.
Web link	Law.uchicago.edu/files/files/20.Skyes_Regression.pdf

PAPER 4

Title	**Empirical Optimization of Bollinger Bands for Profitability**

Authors	Oliver Douglas Williams
Year of Publication	2005
Publishing details	The University of Western Ontario
Summary	This paper endeavours to evaluate the profitability of Bollinger Bands through an empirical study. Bollinger Bands are able to capture sudden fluctuations in price level, which may be used when tweaking its inputs to derive a trading rule. For the purpose of projecting prices, technical analysts have chosen a moving average of 15-20 days for short term analysis and 200 days for long term analysis. Moving averages in relation to profitability is the focus of this study. What follows is a discussion on the development of Bollinger Bands from trading bands, and moving averages.
Web link	http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2321140

PAPER 5

Title	**A Learning Adaptive Bollinger Band System**
Authors	Matthew Butler And Dimitar Kazakov
Year of Publication	2015
Publishing details	In Proceedings Of Ieee Computational Intelligence For Financial Engineering And Economics, 2015
Summary	This paper introduces a novel forecasting algorithm that is a blend of micro and macro modelling perspectives when using Artificial Intelligence (AI) techniques. The micro component concerns the fine-tuning of technical indicators with population based optimization algorithms. This entails learning a set of parameters that optimize some economically desirable fitness function as to create a dynamic signal processor which adapts to changing market environments. The macro component concerns combining the heterogeneous set of signals produced from a population of optimized technical indicators. The results demonstrate that the proposed system is effective at combining the signals into a coherent profitable trading system but that the performance of the system.
Web link	https://www-users.cs.york.ac.uk/kazakov/papers/cifer2012_adapt_bollinger_bands.pdf

PAPER 6

Title of paper	**Forecasting electricity consumption by using Holt-winters and seasonal regression models**
Authors	Vinko Lepojević, Marija Anđelković-Pešić
Year of Publication	2011
Publishing details	Economics And Organization Vol. 8, No 4
Summary	There are many approaches to modeling and forecasting economic time series. The old methods are sophisticated, but the introduction of new methods, is expected to provide more reliable forecasts. The success of the applied forecasting method depends partly on the properties of time series. With proper choice of the method, taking into account the assumptions of its application, it is possible to provide high-quality forecasts.
Web link	http://facta.junis.ni.ac.rs/eao/eao201104/eao201104-09.pdf

PAPER 7

Title	**Time Series Forecasting Using Holt-Winters Exponential Smoothing**

Authors	Prajakta S
Year of Publication	2004
Publishing details	Kanwal Rekhi School of Information Technology
Summary	The Holt-Winters exponential smoothing is used when the data exhibits both trend and seasonality. The two main HW models are Additive model for time series exhibiting additive seasonality and Multiplicative model for time series exhibiting Multiplicative seasonality.
Web link	https://labs.omniti.com/people/jesus/papers/holtwinters.pdf

PAPER 8

Title	**Trend Following Algorithms For Technical Trading In Stock Market**
Authors	Simon Fong, Jackie Tai, Yain Whar Si
Year of Publication	May 2011
Publishing details	Journal Of Emerging Technologies In Web Intelligence, Vol. 3

Summary	Trend following (TF) is a rule-based trading mechanism that taps on the movements of long-term market trend instead of relying on any forecast or external information to decide when to buy and when to sell a stock. Its simple operation is in contrast to complicated prediction methods which typically would try to predict a future trend by analyzing the historical data and may be other factors. TF makes no prediction and it is well known for its simplicity. Although TF is a popular strategy in finance and was implemented in some commercial trading system decades ago, there have not been many studies of TF in computer science.
Web link	http://www.igidr.ac.in/pdf/publication/WP-2014-023.pdf

2.1.2 Integrated summary

The aim of finance systems today is to analyze techniques that can appropriately judge the stock market. After the research and evaluating different strategies to analyze the markets, the most used strategies are: Technical trading algorithms. It is a method of evaluating securities by statistically analyzing its historic trading data. Depending on various factors, appropriate algorithms thus can be used to recommend a buy or sell based on the user's requirement.

2.2 Details of Empirical Study (Field Survey, Existing Tool Survey, Experimental Study)

For this project we did study of stock trends for various industry including energy ,banking, infrastructure etc .Finally we choose the IT industry.Primarily because of its growth rate and risk factor is vey low.We did go through online surveys to find what which prospect the investor look at while investing. Second was finalising the algorithm .We finalised algorithms which best suited the industry :moving averages ,trend analysis ,bollinger bands and

calendar spread. Existing tools which Investors today use are MATLAB and quantcomm which enables them to dry run their algorithm on real time data and not only that but also get advise from traders. New languages like MQL are being used by traders to code the algorithms.

2.2.1 Existing approaches of tools and Survey

There are mainly two types of approaches that exists in the field of algorithmic trading:

Execution strategies: These strategies solve the problem of buying or selling large orders of financial instruments with a minimum difference of the final weighted average transaction price from the current market price of the instrument. This category of strategies is actively used by investment funds and brokerage firms around the world.

Speculative strategies: The main purpose of the speculative strategies is to get profit in the short term due to the "exploitation" of fluctuations in market prices of financial instrments. In order to classify them, experts distinguish seven main groups of speculative strategies, some of which use the principles and algorithms of other groups.

Here in this project we have basically used speculative strategies for profit maximisation :

- **Trend Following Strategies:** The most common algorithmic trading strategies follow trends in moving averages, channel breakouts, price level movements and related technical indicators.Trades are initiated based on the occurrence of desirable trends.It is based on the principle of identifying the trend on the time series of price values of financial instrument (using for that purpose a variety of technical indicators), and buying or selling an instrument with the appearance of corresponding signals.A characteristic feature of trend following strategies is that they can be used on almost all time frames - from the tick to monthly, but because of the fact that profitability of these strategies depends on the ratioof correct to incorrect predictions about the future direction of price movements.

- **Pairs trading strategy :** It is based on the analysis of price's relation of two highly correlated financial instruments. A key principle of pair trading stratgies is the convergence property of the current price with its moving average. That is why in the case of deviation from the average ratio for a predetermined value, investor should buy a certain amount of first financial instrument and simultaneously sell

another appropriate financial instrument. In the situation, when prices return to the average ratio, investor should execute the opposite transaction.

- **Arbitrage Opportunities:** Buying a dual listed stock at a lower price in one market and simultaneously selling it at a higher price in another market offers the price differential as risk-free profit or arbitrage. The same operation can be replicated for stocks versus futures instruments, as price differentials do exists from time to time. Implementing an algorithm to identify such price differentials and placing the orders allows profitable opportunities in efficient manner.
- **Front running strategies:** It is based on an analysis of instant liquidity of the instrument and the average volume of transactions on the instrument within a certain time period. If investor can find some market orders in the "area" close to the best bid and ask prices,and if the total volume of these orders exceeds the average volume of transactions over a certain time period on the specified value, then he\ she should place the order in the same direction with price a little bit higher, than the price with average volume (in case of buying), or with price a little bit lower
- **Index Fund Rebalancing:** Index funds have defined periods of rebalancing to bring their holdings to par with their respective benchmark indices. This creates profitable opportunities for algorithmic traders, who capitalize on expected trades
- **Trading Range (Mean Reversion)**: Mean reversion strategy is based on the idea that the high and low prices of an asset are a temporary phenomenon that revert to their mean value periodically. Identifying and defining a price range and implementing algorithm based on that allows trades to be placed automatically when price of asset breaks in and out of its defined range.
- **Moving Averages:** This strategy involves calculating average for past few months and comparing with average with different observation period to check for variations and hence predict what can be the future trends.
- **High Frequency Trading:** High frequency trading makes money by time efficiency.High-frequency trading uses complex algorithms to analyze multiple markets and execute orders based on market conditions. Typically, the traders with the fastest execution speeds will be more profitable than traders with

slower execution speeds. As of 2009, it is estimated more than 50% of exchange volume comes from high-frequency trading orders.

- **Calender Spread:** This algorithm deals with the fact that maximum impact and correct prediction of the next days price can be done analysing the past trend in the difference of opening and closing prices(regression analysis).

- **Bollinger strategy:** In this strategy we predict the future trends by calculating the deviations and comparing it bolllinger brand values to determine buy or sell prices.

While these are primary strategies ,new strategies with better risk determination is added each year. Better the risk factor ,more reliable is the strategy.

2.2.2 Experimental Studies

For case studies we have used various wall street journals and the issue raised during the implementation of algorithm and its efficiency compared to other strategies .Ever since algorithmic trading came into being at new york stock exchange it has been exponentially spreading to all other platforms.But the most debated question is still is whether algorithmic trading fetches returns worth praising when compared with initial investment. Second is the need for monitoring the algorithms performance over a period of time and making it free from bugs over a period of time. Third is the efficiency in case of periods of crashes for ex-2010 flash crash(At 2:42 p.m., with the Dow down more than 300 points for the day, the equity market began to fall rapidly, dropping an additional 600 points in 5 minutes for a lossof nearly 1,000 points for the day by 2:47 p.m. Twenty minutes later, by 3:07 p.m., the market had regained most of the 600-point drop).

Other improvisations that we have tried working upon is to minimise risk by deciding upon a correct amalgamation of different securities to be invested in and also by reducing the risk factor.The recent turmoil in the stock markets, especially the Asian stock markets and the resultant movement in the index and stock volatilities have left quite a few cash equity traders scarred. It is not just the equity derivatives and index linked traders who have been taken on a roller coaster ride by the markets; the cash equity traders in banks and fund management houses have also had a very rough time.There is a special class of quantitative trading strategy that many cash equity traders, especially the ones who do algorithmic trading, use which is called the Risk Minimization strategy (or the MCR optimization strategy).

CHAPTER 3

ANALYSIS, DESIGN AND MODELLING

3.1 Requirement Specifications

Software Requirement

1. Operating system: windows 7/10 , Macintosh version 8 and onwards
2. Software: Mozilla Firefox or Google Chrome

Hardware requirement

1. CPU: 500 MHz processor
2. Computer Processor: Intel i5 or Intel i3 core
3. Computer Memory: 500Mb or more
4. Graphics hardware: Not required
5. Network: Internet Connection Required for Graphs

3.2 Functional and Non Functional requirements

Functional Requirements

ID	Title	Description	Priority
R1.01	Input	The system must be able to accept all valid data sets for visualization	1
R1.02	Graph generation	After a user inputs the data set, the algorithm must work appropriately for graph generation	1
R1.03	Proper output	The graph plotted by the system must be easy to understand and must have proper hue and orientation.	1
R1.04	Feature Selection	This event selects the appropriate features for the Classification of datasets extracted.	2
R1.05	Data Classification	This event selects the appropriate features for the Classification of datasets extracted. All the analysis is dependent on this data set only	3
R1.06	Import new data set	If a new data set is added then the graph obtained must be accurate and rapid. Live data can be integrated anytime for better results	2
R1.07	Transaction Control	The user must have controls over his transaction log and number/loads of shares he/she invested in.	4

Table 2: Functional Requirements

Non-Functional Requirements

3.2.1 Efficiency of the tool

Efficiency of the system is the main concern. It may be defined as to how accurately the multidimensional data is visualized by the system

3.2.2 Reliability

The system deals with large and important data sets and therefore try to make it less prone to failures.

3.2.3 Portability

The system must be usable in different environments like Linux, windows etc.

3.2.4 Usabilty

The system must be user friendly, easy to learn, satisfying to use and fast. The less the user has to be dealing with complexities, the more satisfied will he be.

3.2.5 Performance

The system must offer high accuracy, fast processing and high throughput because one second difference in analysis can cause millions of losses.

3.2.6 Security

System must be safe from external hacks and data thefts. User Transaction details and dmat account must stay secure.

3.2.7 Efficiency

System must use algorithms efficiency for best results and maximum profits of the user.

3.4 Overall architecture with component description and dependency details

Input current stock price data in the excel files →Log on to the website → Find Trend using Holt-winters algorithm → Find other daily trends using Bollinger Band → Recommendations are made on the basis of these trends → Sell or Buy Stock → View your transactions.

Component Description

1. *function forecastHoltWinters($anData, $nForecast = 1, $nSeasonLength = 1, $nAlpha = 0.2, $nBeta = 0.01, $nGamma = 0.01, $nDevGamma = 0.1):*

Triple Exponential Technique to do trend analysis based on seasonal repititions.

2. *function bollingerBand($array):*

Estimate the upper, middle and lower bands based on the current data and checks for the best recommendation according to the same.

3. *function stats_standard_deviation(array $a, $sample = false):*

Calculates the standard deviations used for calculating the bands in the Bollinger band algorithm.

4. *function sheetData($sheet):*

An excelreader PHP file used to read data from the excel files and store them on arrays on PHP.

5. *areaChart.Line(areaChartData, areaChartOptions):*

Used to plot the respective opening and closing prices of the companies using area charts.

6. *array_sum($trend_last_six) & array_sum($trend_twelve):*

Used to evaluate sums for the six month and twelve month averages.

3.5 Design Documentation

3.5.1 Use Case Diagram

Stock Market Price Analysis will have two actors who can act simultaneously. They are:

1) User
2) Admin

Fig. 3.4.1. - Use Case Diagram

3.4.2 Control Flow Diagram

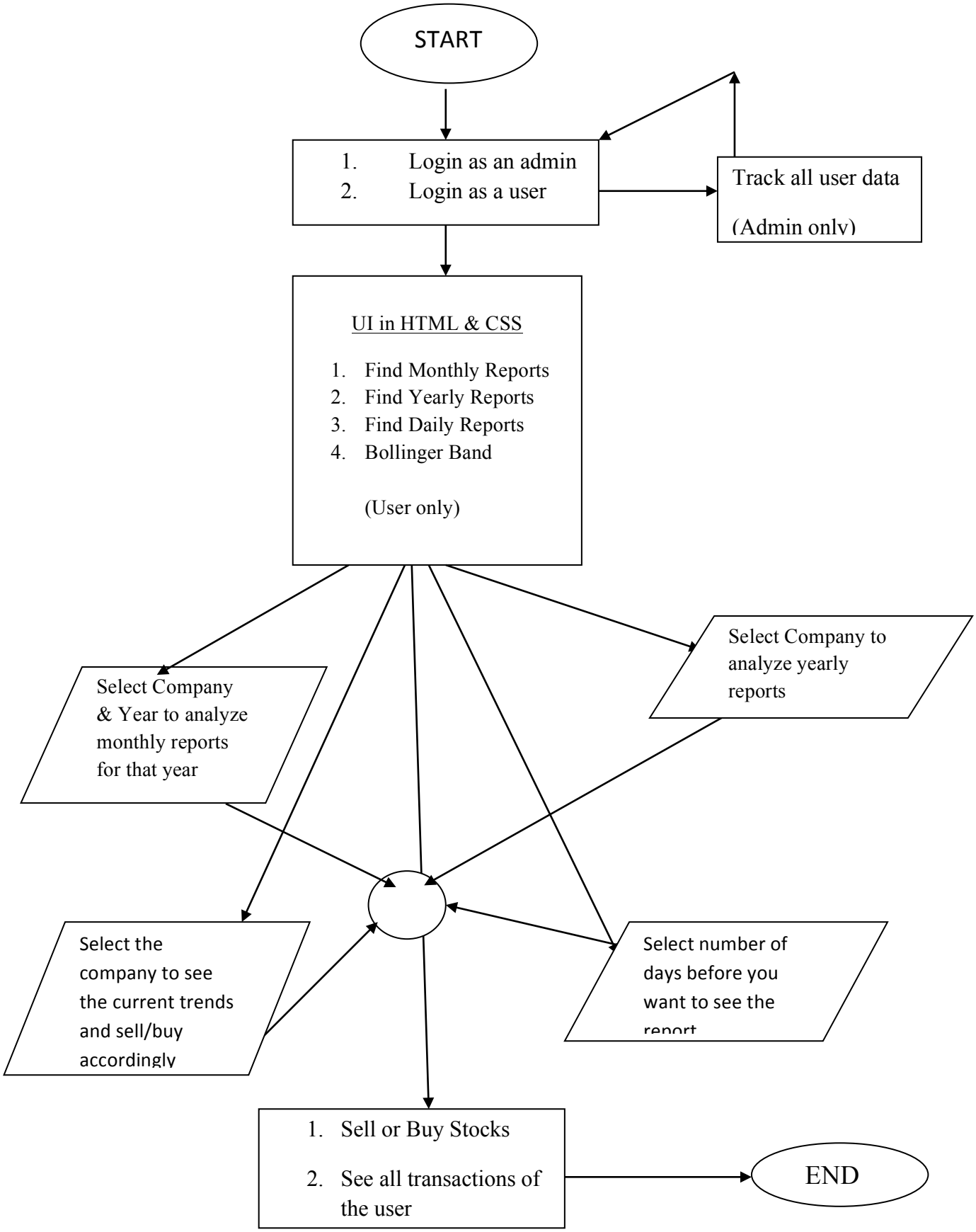

Fig. 3.4.2 – Control Flow Diagram

3.4.3 Data Structures and Algorithms/Protocols

1)Trend analysis using regression modelling and Holt Winter Algorithm:

Regression Modelling:

Regression or trend analysis looks at two or more variables to study how changes in one variable affects others. The first variable is the independent variable while the others are dependent ones. Regression analysis looks for the presence or absence of any association between the independent and dependent variables. A correlation coefficient quantifies the degree of association.

Regression analysis can be linear (linear correlation between variables; e.g., X = 10 + 4Y) or non-linear (e.g., X = 10 + 4Y2), and simple (two variables) or muliple (more than two variables).

In case of our data .The independent and dependent variables are opening and closing prices respectively Their graph is plotted and the next value is determined if it is predicted to be greater than the average then buy is recommended else sell.

Holt Winter Algorithm:

Triple Exponential Smoothing, also known as the Holt-Winters method, is one of the many methods or algorithms that can be used to forecast data points in a series, provided that the series is "seasonal", i.e. repetitive over some period. The main subject here is a *series*. In the real world we are most likely to be applying this to a *time series*, but for this discussion the time aspect is irrelevant. A series is merely an ordered sequence of numbers. We might be using words that are chronological in nature (past, future, yet, already), but only because it makes it easer to understand. So forget about time, timestamps, intervals, time does not exist, the only property each data point has (other than the value) is its order: first, next, previous, last, etc.

2)Moving averages:

For a long time moving averages has been used for a financial datasmoothing. It is one of the first indicators in technical analysis trading. Many traders debated that one moving average

is better than others. As a result a lot of moving averages have been created.Moving averages are one of the key tools used to analyse financial time series. In a nutshell, moving average is simple weighted sum (mean) calculated over selected historical price range. Financial data usually is noisy, if we choose to represent today's price as mean of today's price and 2 days before, all ups and downs will be averaged. Using more historical prices (increasing period), we can achieve more smoothed price that would show the trend, despite the price fluctuations.

3)Calender spread:

A calendar spread is terminology used for trade where simultaneous Buy and Sell is being carried out on futures/options. In a more simple term, the strategy has two legs, with one leg being Buy/Sell of a particular instrument and the other leg being Sell/Buy of same instrument. The idea behind the trade is to profit from the differential spread existing at different point of time over the course of expiry. This done by averaging and calculating the difference in opening and closing prices.

4)Bollinger bands: In Bollinger Band the philosophy behind is that asking the market what is happening is always a better approach than telling the market what do to.

Here in bollinger band we calculate the average using the "simple" (as shown in the formula for the middle band), and using 2 standard deviations. He has also found that moving averages of less than 10 periods do not work very well.

Bollinger Bands are displayed as three lines,(the bands). The middle band is a simple moving average. In the following formula, "n" is the number of time periods in the moving average (e.g., 15 days). The upper and lower bands are calculations using standard deviations.

In the implementation phase of this project we began by collecting data.The problem with historic data is it doesn't take in account the present and future value of currency and the data cannot be normalised and we have to take the value based on the feed from yahoo finance.

Secondly we begin by calculating the middle band.The middle band is nothing but the simple average of 15 day value to determine the average value of stocks.

$$Middle\ Band = \frac{\sum_{j=1}^{n} Close_j}{n}$$

The upper band is the same as the middle band, but it is transformed by a number of standard deviation (e-g.2deviations). In this next formula,"D" is the amount of standard deviations. Unlike moving average envelopes, in which the upper and lower bands are shifted versions of the security's moving average, the Bollinger bands do not necessarily resemble each other because instead of a shift, the middle band is a transformation through the standard deviation .In most cases, the nature of the periods is immaterial; all seem to respond to correctly specified Bollinger Bands.They have been used on monthly and quarterly data.The trading bands answer the question of whether prices are high or low on a relative basis.This statement actually depends on the key phrase"a relative basis.This is because the trading bands do not give absolute buy and sell signals when they brake through. Rather, they provide a framework within which price may be related to indicators.

Equation 3 Upper Bollinger Band

$$UpperBand = Middle\,Band + \left[D \times \sqrt{\frac{\sum_{j=1}^{n} (Close_j - Middle\,Band)^2}{n}} \right]$$

Equation 4 Lower Bollinger Band

$$LowerBand = Middle\,Band - \left[D \times \sqrt{\frac{\sum_{j=1}^{n} (Close_j - Middle\,Band)^2}{n}} \right]$$

3.6 Risk Analysis and Mitigation

Risk Analysis:

Risk ID	Risk Area	Description of Risk	Probability(P)	Imapct(I)	RE(P*I)	Mitigation Plan

1	Stability	The ability of the algorithms to tackle large volume of data or respond to abrupt value s.	M	L	M	For this ,the algorithms should be scaled to meet the requirement of how much data to tackle and to respond to sudden change in va,ue it should loo k for such a value in past and respond to general average or stop trading for a while

2	Clarity	The understanding of the solution by the client and making a informed decision as per the recommendations.Here it largely depends upon the UI.	L	H	M	To avoid this risk the architecture or UI of the algorithm used should easy understable by the user and he should be provided
3	Lack of physical control	physical control on the market prices which are used to analyze the data and decide the output.	L	M	M	Double checking the market using the algorithm .
4	Algorithms	Analyzing the data may not fetch the right result due to fault in algorithm	L	M	L	Algorithm must be planned properly and efficiently to avoid this.

5	Coding and implementation	Irregularity in work done will affect the schedule adversely	M	L	M	Work should be done on the scheduled time.
6	Process control	This refers to the human and computer share in the final decision making process.That is to what extent can the developer effect final result	L	L	L	The final result is entirely calculated based not he values by the computer and no human intervention is possible.However the final decision making is totally in hand of the client ,the is free from any bias .

7	Reliability	The result given ,to what extent can they be relied upon	L	H	M	It refers to the level to which the client can trust hence before making the final decision, the comparison to various factors that led to the particular result and previous data should be done by user.

Table 3.1: Risk Analysis

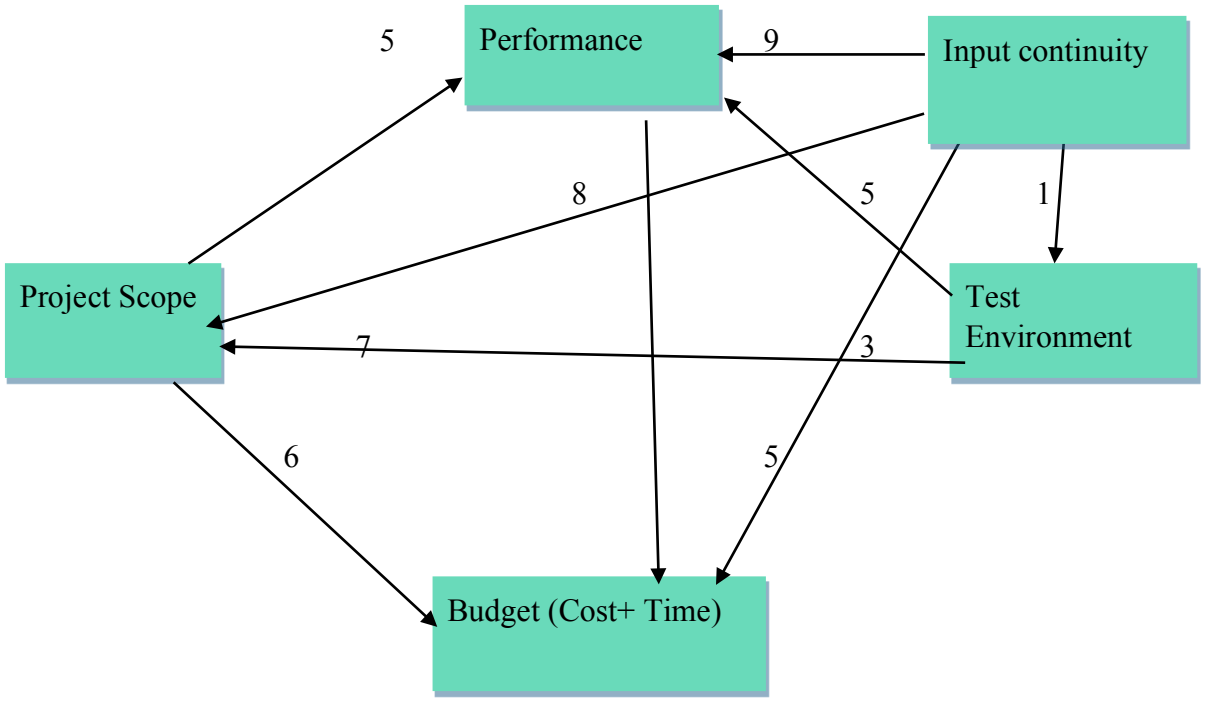

Fig. 3.5 – Weighted Inter-Relation Graph

S.N.	Risk Area	# of Risk Statements	Weights (In +Out)	Total Weight	Priority
1	Budget	5	6+5+3	14	2
2	Performance	4	5+5+9+8	27	1
3	Project Scope	4	8+7+5+6	26	4
4	Input Continuity	4	9+8+5+1	23	5
5	Test Environment	3	1+5+3	9	3

Table 3.2: Risk Area Wise Total Factor

Risk Mitigation Plan:

- Identify, characterize and assess threats.
- Assess the vulnerability and probability of critical assets to specific threats.
- Determine the risks.
- Identify ways to assess the risk.
- Prioritize risks reduction measures based on a strategy.

Risk mitigation occurs after the risk assessment phase is complete. Risk mitigation encompasses the prioritization, evaluation and implementation of appropriate security controls identified during the risk assessment phase. In the risk mitigation phase ,the organization identifies the types of controls that could be employed to reduce the level of risk at an acceptable level. These solution may include management, operational and/or technical controls.

1)First is to prevent crashes that occur the data backup should be prepared after a set interval to time.

2)To avoid people from overcrowding the server ,as soon as number of users exceed a certain amount the trading should be halted.

3)The given algorithm/strategy might always hold true, hence before investing the client must understand all the risk and should avoid investing in just one portfolios.

4)At times the predicted trends might not be what happens the next day hence all the investment should be done keeping that in mind.

CHAPTER 4

IMPLEMENTATION AND TESTING

4.1 Implementation Details and Issues

This project is aimed at creating a recommended system for IT industry stocks, in our case specifically Infosys, TCS, Wipro, Oracle, HCL. It provides the user as well as the admin with a login id with MD5 cryption.

When the user logs in, he/she can choose the set on which he/she tends to get the result. The choices provided are view by yearly report, view by monthly report and view the comparisons of all companies based on the particular day. When admin logs in he can see all that user has viewed. This is for the admin to understand that which share people like to invest in the most.

In the yearly report the user needs to select the desired company and the year for which he/she wants the recommendation and comparison. Based on the selection user can see the graph of the available values, trend and recommendation based on algorithm.

In monthly report, the user needs to select the desired company name and the month. Based on the selection user can see the graph of available values, the rend of last 15 opening and closing price, the last closing price ,the last opening price, result based on calaender spread and the recommendation based on algorithm.

In the last option the user has to select the day for which he/she wants to see the status of all companies and then gets the result to buy or sell. User can also see the trend of closing price and predicted closing price.

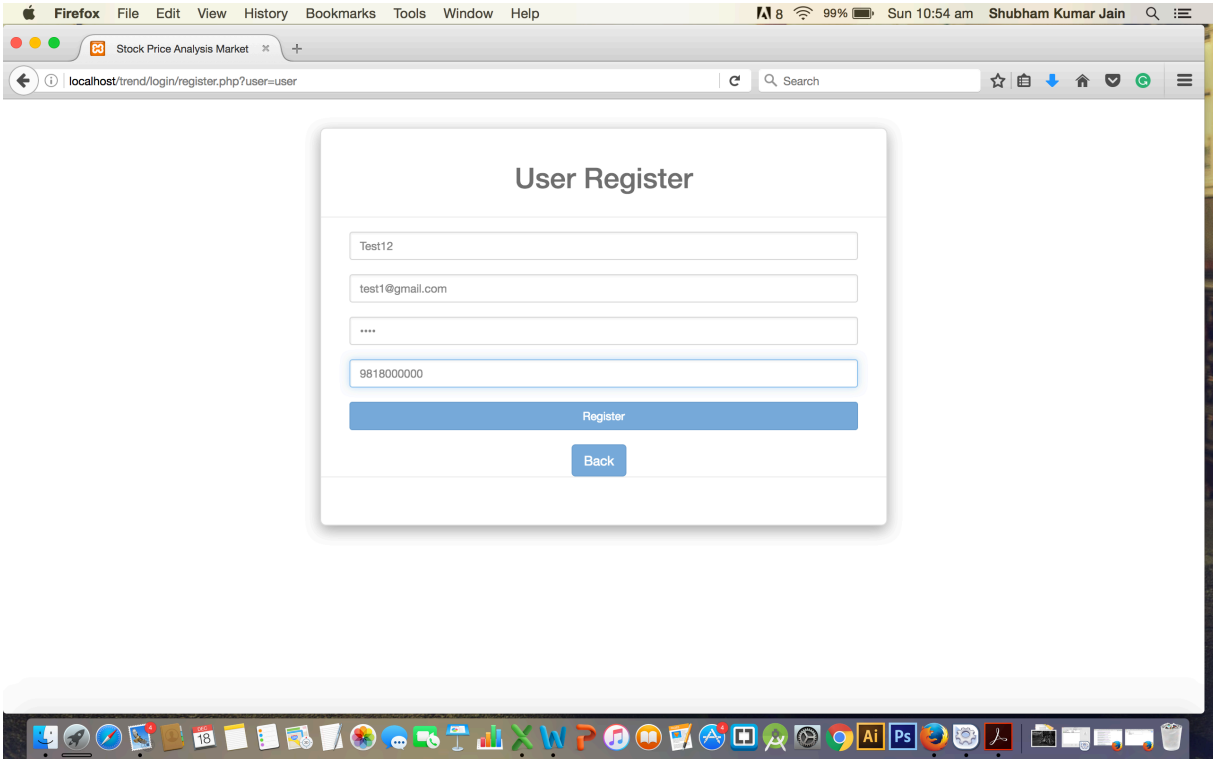

Fig. 4.1.1 – User Registration

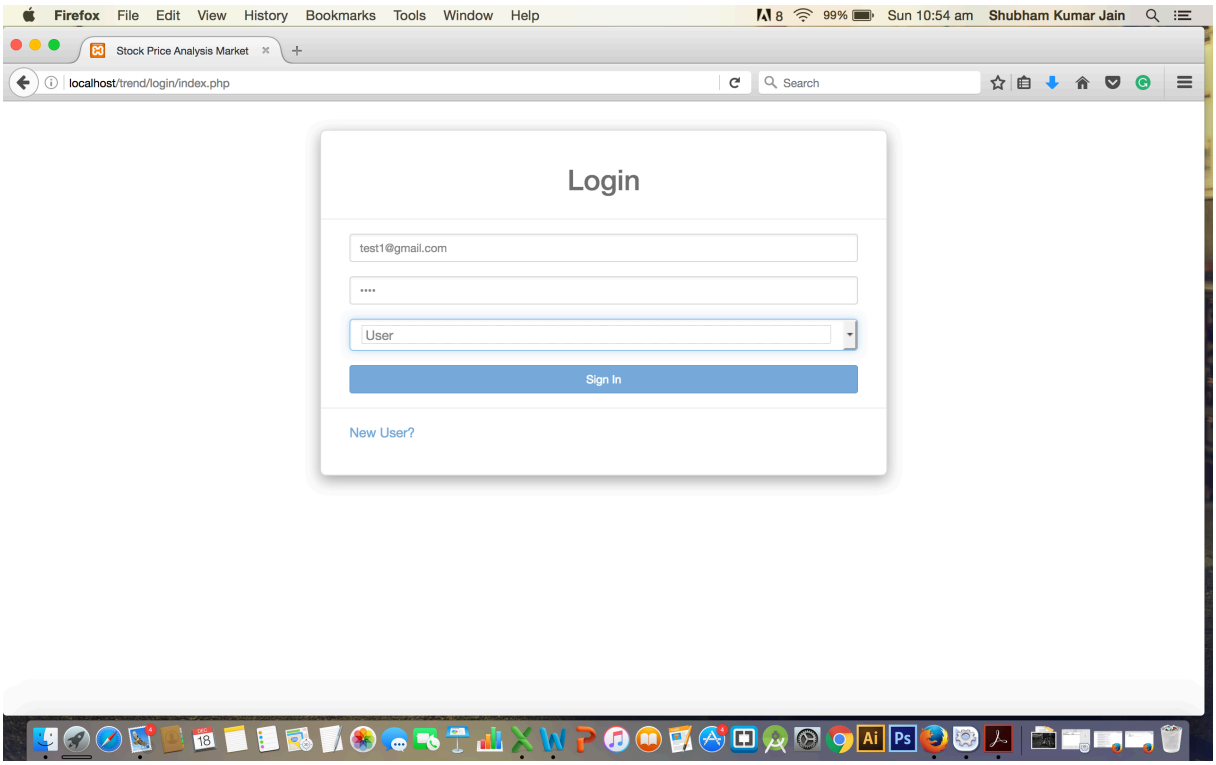

Fig. 4.1.2 – User Login

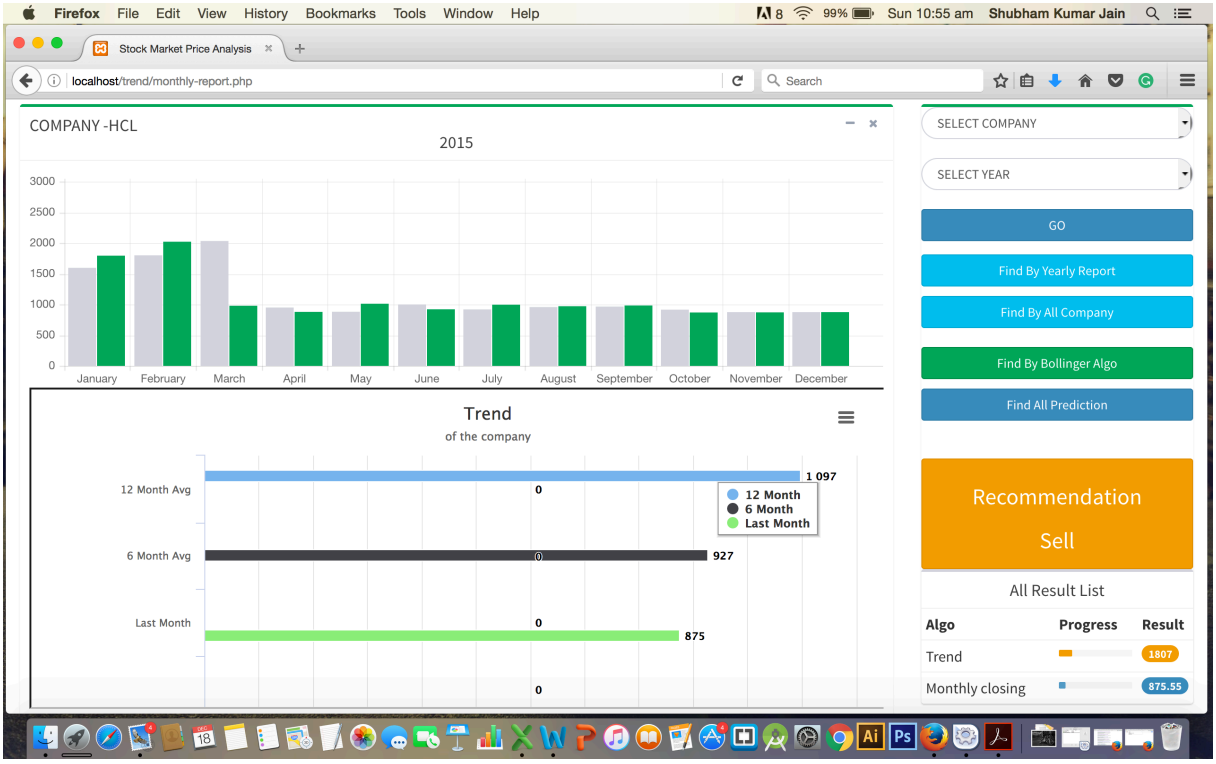

Fig. 4.1.3 – Monthly Reports

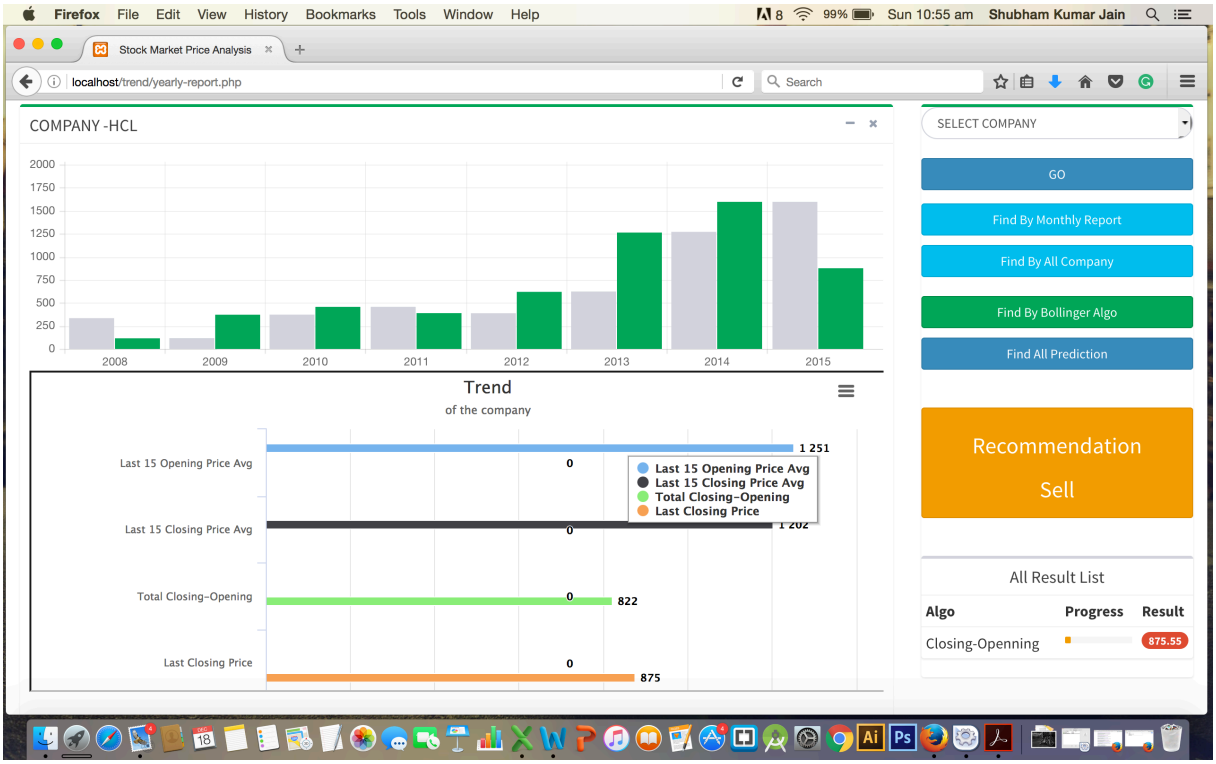

Fig. 4.1.4 – Yearly Reports

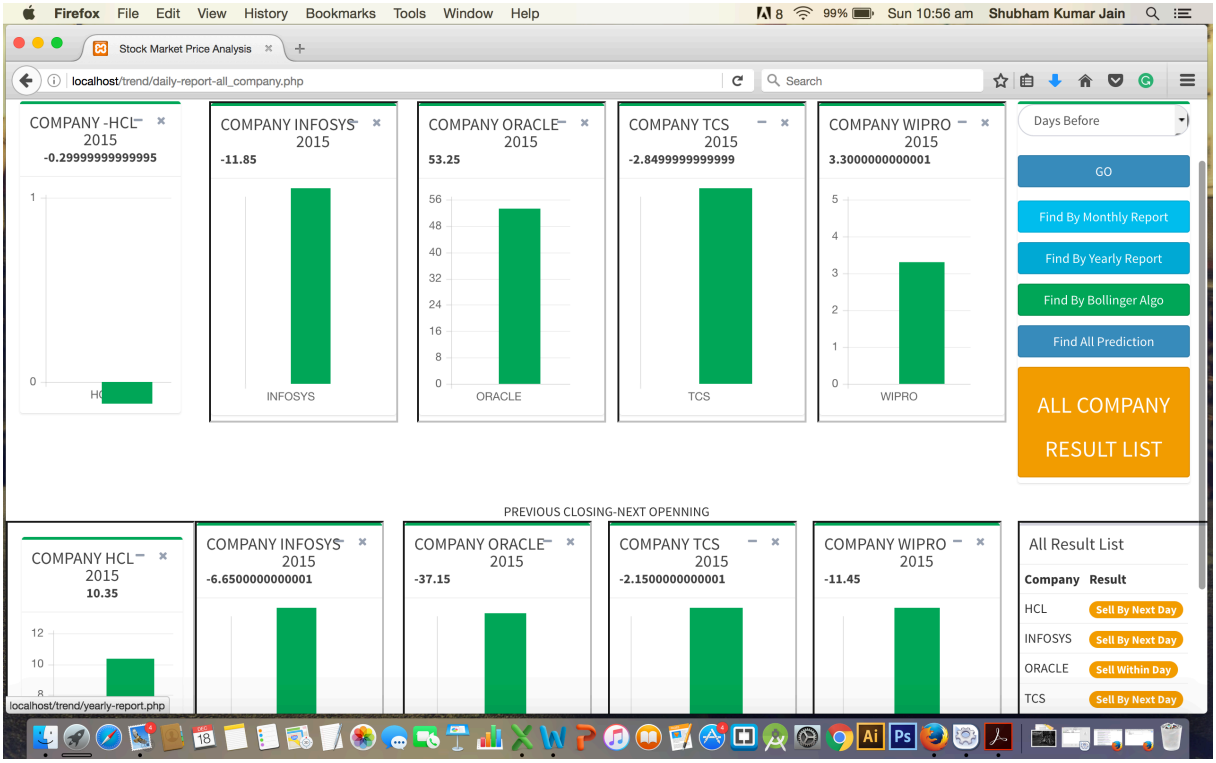

Fig. 4.1.5 – Daily Reports

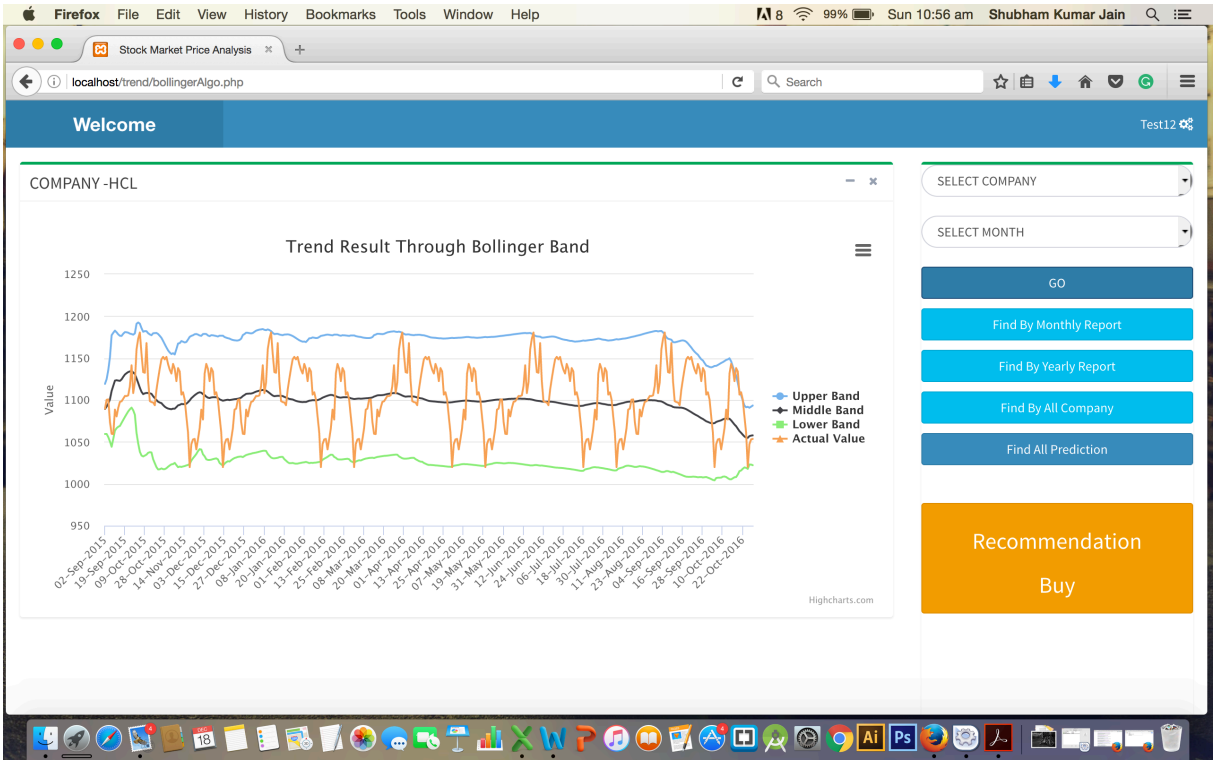

Fig. 4.1.6 – Bollinger Band

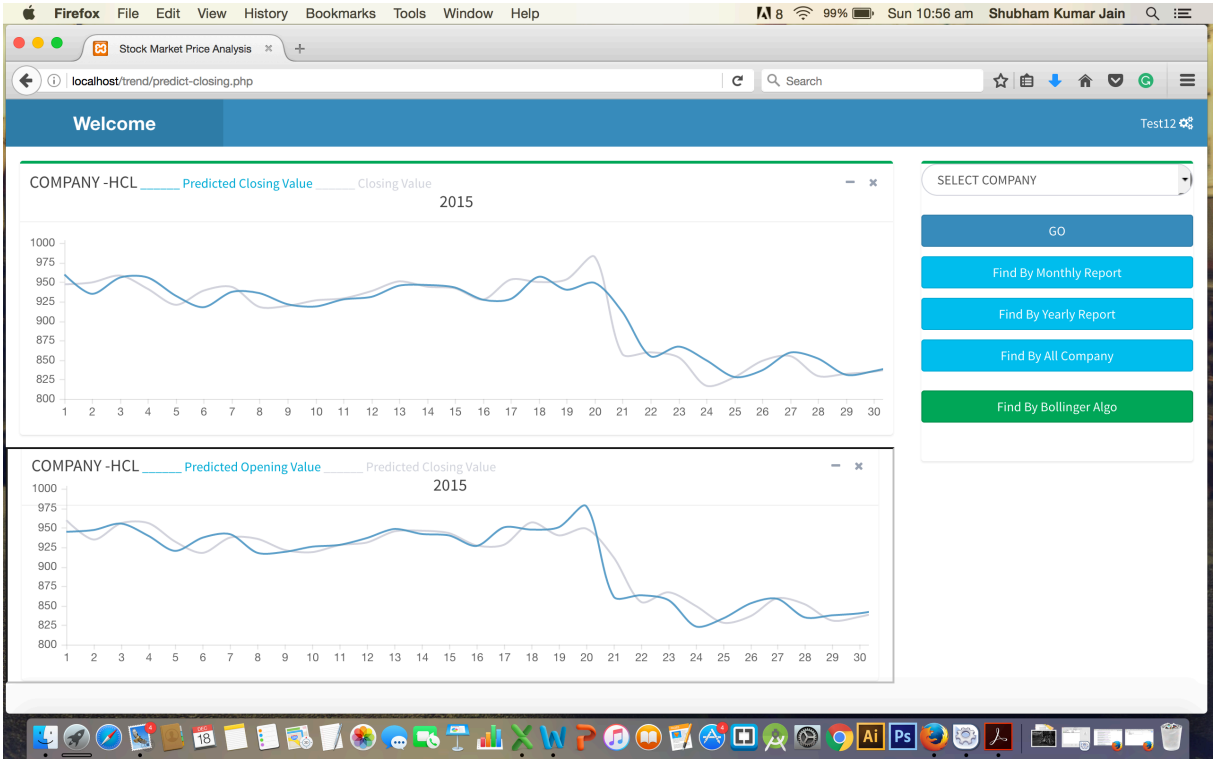

Fig. 4.1.7 – Predict Closing Opening

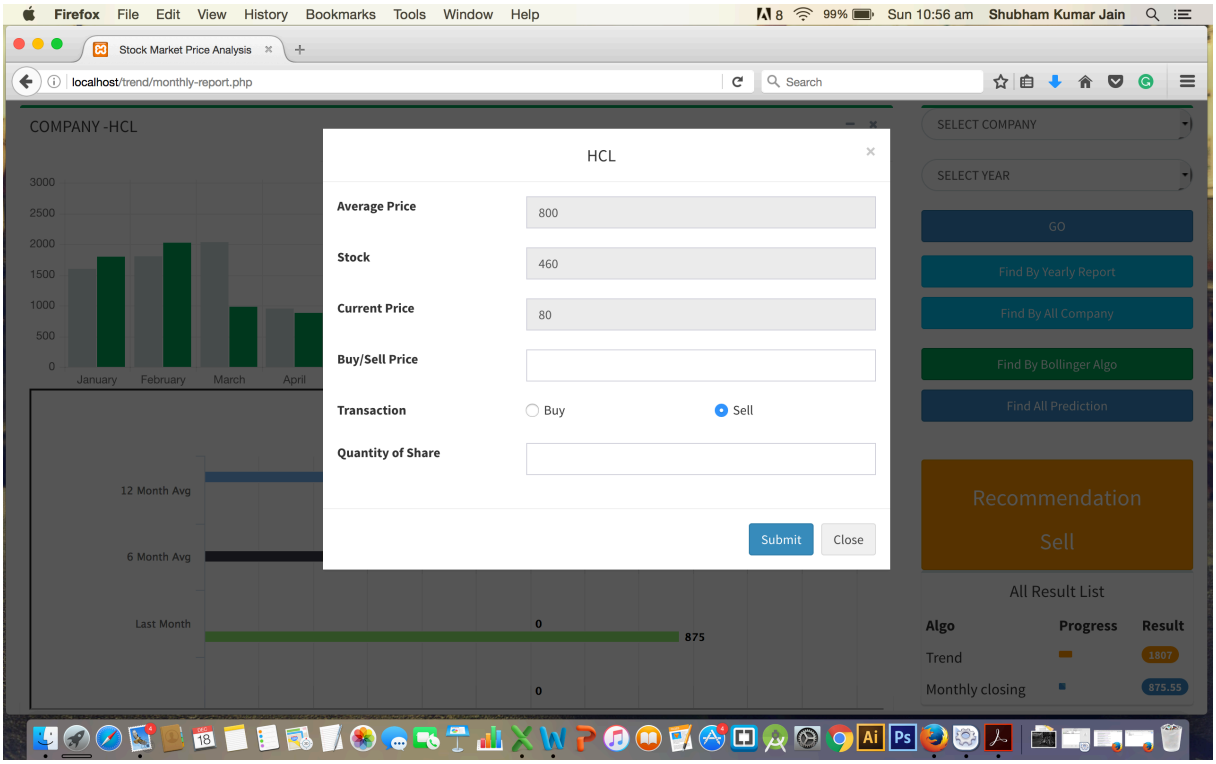

Fig. 4.1.8 – Buy or Sell Stocks

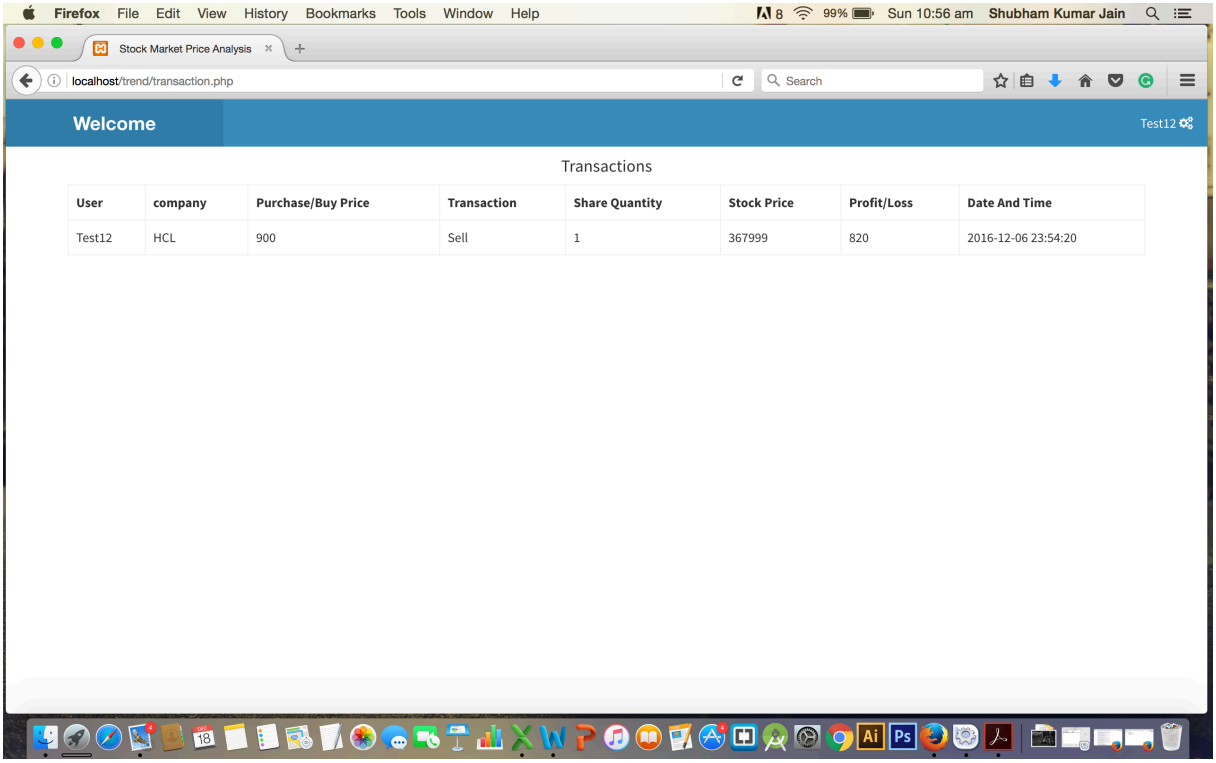

Fig. 4.1.9 – User Transactions

Issues dealt with while making this project was:

1) Picking the right algorithm which goes well with the industry.

2) The dataset which is valid for one company might not go well with the other as the general trend and company trends might have variations

3) Shares tend to split up with time and there is no difference between a split up share and a fresh float ,hence while calculating price change this has to be accounted for

For these issues we first did the analysis of different algorithms ourselves for this project, then we employed the best algorithm that we had.

4.2 Testing

4.2.1 Testing Plan

Type of Test	Will Test be Performed ?	Comments/Explanations	Software Components

Requirement Testing	Yes	Requirement testing is required because it will let us know the needs of the project, which will eventually help us in the better development of the project. We have to estimate the time required, the technology required, etc. for the project, so that we can properly start with the project.	Requirement Testing is applied before the project is started on the overall project. We estimate everything required for our project, like the time, budget, technology etc. required .
Unit Testing	Yes	Unit testing is the most important of all testing levels. It will help in finding the bugs during the progress of the project, which is much more economical to fix as compared to than after the completion of the project. Using it, we can test a code a unit of code for different scenarios as soon as it is developed by the programmer.	Unit testing will be performed on individual blocks of code like the interfaces, packages, etc.Unit testing will done each individual algorithm before merging it together.
Integration Testing	Yes	Integration testing will be performed after the all the components are test for their efficiency.In this part all the components are tested ,if they work in sync after being compiled together.	Integration testing is performed after unit testing taking as input the modules that have been unit tested. The modules are grouped in larger aggregates, and then they are integration tested.

Performance Testing	Yes	Performance testing helps in finding the response time, server response time, performance accuracy of the software. It will help in determining that whether the system meets the performance criteria or not in such a situation.	
Backtesting	Yes	This helps us have an better insight into the working of the project when it will be deployed in the real world. Here we test the algorithm on previously collected data and analyze the result.	
Security testing	Yes	Security testing covers the security concepts like confidentiality, integrity, authentication, availability, authorization and non-repudiation.	

Stress testing	No	Stress testing is normally used to understand the upper limits of capacity within the application landscape.	Here in our case ,it is the maximum variation result that the algorithm can generate.
Volume testing	Yes	Volume testing refers to testing a software application with a certain amount of data which can be the database size or the interface file.	

Table 4: Test Plan

Test Schedule			
Activity	**Start date**	**End date**	**Hours**
Information Gathering	17/09/16	08/10/16	15
Test planning	09/10/16	12/10/16	10
Test case development	12/10/16	17/10/16	10
Test execution	20/10/16	30/10/16	12
Implementation	3/11/16	19/12/16	40

Table 5: Test Schedule

4.2.2 Component decomposition and type of testing required

S.no	List of Various Components (modules) that require testing	Type of Testing Required	Technique for writing test cases
1	Login and respective security	Performance	White Box
2	Uploading company's data	Volume and performance	Black Box
3	Algorithm implementation	Performance	White box
4	Data analysis	Integration and performance	Boundary Value
5	Final result	Performance	Boundary Value

Table 6: Component decomposition & type of testing required

4.2.3 List of all test cases

- **Daily Prediction**

  For HCL -

Test case Id	Input (Previous closing price, next opening price)	Expected Output(buy,sell)	Status
1	958,961	Buy	Pass
2	944,941	Sell	Pass
3	919,925	Buy	Pass
4	929,931	Buy	Pass
5	947,965	Buy	Pass

Table 7: Test case - Daily Prediction for HCL

For Infosys -

Test case Id	Input (Previous closing price, next opening price)	Expected Output(buy,sell)	Status
1	1053,1044	Sell	Pass
2	1080,1085	Buy	Pass
3	1109,1115	Buy	Fail
4	1097,1102	Buy	Pass
5	1125,1113	Sell	Pass

Table 8: Test case - Daily Prediction for Infosys

- **Monthly Prediction**

For Wipro -

Test case Id	Input (month)	Expected Output	Status
1	February	Buy	Pass
2	January	Buy	Pass
3	March	Buy	Pass
4	April	Sell	Fail
5	December	Buy	Pass

Table 9: Test case - Monthly Prediction for Wipro

For Oracle -

Test case Id	Input (month)	Expected Output	Status
1	April	Sell	Pass
2	May	Sell	Pass
3	June	Buy	Pass
4	August	Sell	Pass
5	November	Sell	Pass

Table 10: Test case - Monthly Prediction of Oracle

- **Yearly Prediction**

For Oracle -

Test case Id	Input (year)	Expected Output	Status
1	2008	Buy	Pass
2	2010	Sell	Pass
3	2012	Buy	Pass
4	2014	Sell	Pass
5	2015	Sell	Pass

Table 11: Test case - Yearly prediction for Oracle

For Infosys -

Test case Id	Input (year)	Expected Output	Status
1	2009	Buy	Pass
2	2010	Buy	Pass
3	2014	Sell	Pass
4	2013	Buy	Pass
5	2015	Sell	Pass

Table 12: Test case - Yearly prediction for Infosys

- **Bollinger Band**

For HCL -

Test case Id	Input (closing price)	Expected Output	Status
1	857.9	Less Volatile	Pass
2	861.5	Less Volatile	Pass
3	854.95	More Volatile	Pass
4	835	Less Volatile	Pass
5	859.95	More Volatile	Fail

Table 13: Test Case - Bollinger band for HCL

For Infosys -

Test case Id	Input (closing price)	Expected Output	Status
1	1133.95	Less Volatile	Pass
2	1122.5	More Volatile	Pass
3	1137.5	Less Volatile	Pass
4	1180.5	More Volatile	Pass
5	1131.55	Less Volatile	Fail

Table 14: Test case - Bollinger band for Infosys

4.2.4 Limitations of the solution

While we tried our best to incorporate solution that minimises risk and produce accurate results .But even while doing that we had to neglect a few things ,starting with the stock prices also vary with price of underlying security or the particular market it is being traded on.This refers to the fact that shares of a particular company can vary abruptly if any of these markets experience unusual changes.

Secondly we don't take into account the splitting of shares which is ought to vary the profit results.Their is no difference between a fresh float and a split up share.They are both similar in price and trading .Hence when a share worth 1000 splits up into 10 shares worth 120 the price per share went down but this might actually yield profit for the company.

Thirdly the applicability of the algorithm in times of extremes of adverse situation that is during the crash period.In times when the stock market behaves very usually this algorithm cannot provide an alternative to invest in (i.e a different industry).

CHAPTER 5
FINDINGS AND CONCLUSION

5.1 Findings

After analyzing the data for 5 companies namely Infosys, Oracle, TCS, Wipro and HCL over 4 algorithms ,we came to the conclusion that an amalgamation based upon the weightage of each algorithm can fetch us results which will minimise risk and maximise profits.Stock market for the IT industry has seen phenomenal growth however in the past years growth hasn't been exponential.

Trend following can give absurd result if the time period is not proper or if the a sudden change is there. For bollinger bands however this does not because it follows almost the same upper and lower band gap for variations.

Also implementation of such technologies it only makes it simpler for the client to understand the trend the industry is to follow for coming years. However it can be seen that price variations among the industry is very high which is directly influenced by all the platforms where the stocks of a particular company is traded

5.2 Conclusion

After observing the test cases and their result it can be accurately said that above used 4 algorithm suit the IT industry. Backtesting results for 5 years show that the value predicted lies within permissible range and when accurately combined with human discretion can fetch profit for the individual.As SEC (2010) notes, “By any measure, Algorithmic Trading is a dominant component of the current market structure and is likely to affect nearly all aspects of its performance.” Computerized, high-speed order submission, cancellation, and trading has been riding a wave of technological momentum and innovation over the past decade which is an extension of many past improvements in trading technology and speed. While high-speed trading may have reached a recent peak in terms of volume and profit-making in the U.S. equity markets, due to competition, costs, and reaching the technological limits of speed, there is evidence to suggest that high-speed trading is expanding internationally into non-equity markets.

5.3 Future Work

- Validating more lines and rules.
- Increasing the dataset of already explored ones.
- Making plots more insightful for better comparisons.
- Making system more robust and scalable.
- More techniques for the visualization for the results.
- Adding more industry options
- Integrating project with live data feeds
- Comparison study of algorithms for particular stock prices

(IX)

REFERENCES

[1] Alan O. Sykes. An Introduction To Regression Analysis. The Inaugural Coase Lecture. 2014.

[2] Arun Bansal, Robert J. Kauffman And Rob R. Weitz. Comparing The Performance Of Regression And Neural Networks As Data Quality Varies: A Business Value Approach.

[3] Claudimar Pereira Da Veiga, Cássia Rita Pereira Da Veiga, Anderson Catapan, Ubiratã Tortato, Wesley Vieira Da Silva. Demand Forecasting In Food Retail: A Comparison Between The Holt-Winters And Arima Models. Wseas Transactions On Business And Economics, E-Issn: 2224-2899, Volume 11, 2014.

[4] Dr.Ajit More And Ca Aseema Dake Kulkarni. Development Of An Algorithm For Stock Market Trading. Ajit More Et Al, / (Ijcsit) International Journal Of Computer Science And Information Technologies, Vol. 5 (3) , 2014, 2907-2909.

[5] Ira G. Kawaller, Paul D. Koch, And Ludan Liu. Calendar Spreads, Outright Futures Positions, And Risk. The Journal Of Alternative Investments 2002.

[6] Jussi Kirves. Automated System Trading, Algorithms And Programming - To Buy Or To Sell The Trend, 2014, Pp. 1 – 33.

[7] Laurence Blumey, David Easley And Maureen O'hara. Market Statistics And Technical Analysis: Role Of Volume. Journal Of Finance, Volume 49, Issue 1, 1994, Pp. 153 - 181.

[8] Matthew Butler And Dimitar Kazakov. A Learning Adaptive Bollinger Band System. In Proceedings Of Ieee Computational Intelligence For Financial Engineering And Economics, 2015.

[9] Oliver Douglas Williams. Emperical Optimization Of Bollinger Bands For Profitability.

[10] Prajakta S. Time Series Forecasting Using Holt-Winters Exponential Smoothing. 2004.

[11] Simon Fong, Jackie Tai, Yain Whar Si. Trend Following Algorithms For Technical Trading In Stock Market. Journal Of Emerging Technologies In Web Intelligence, Vol. 3, No. 2, May 2011.

[12] Vinko Lepojević, Marija Anđelković-Pešić. Forecasting Electricity Consumption By Using Holt-Winters And Seasonal Regression Models. Economics And Organization Vol. 8, No 4, 2011, Pp. 421 – 431.

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APPENDICES

A. Project Plan as Gantt Chart

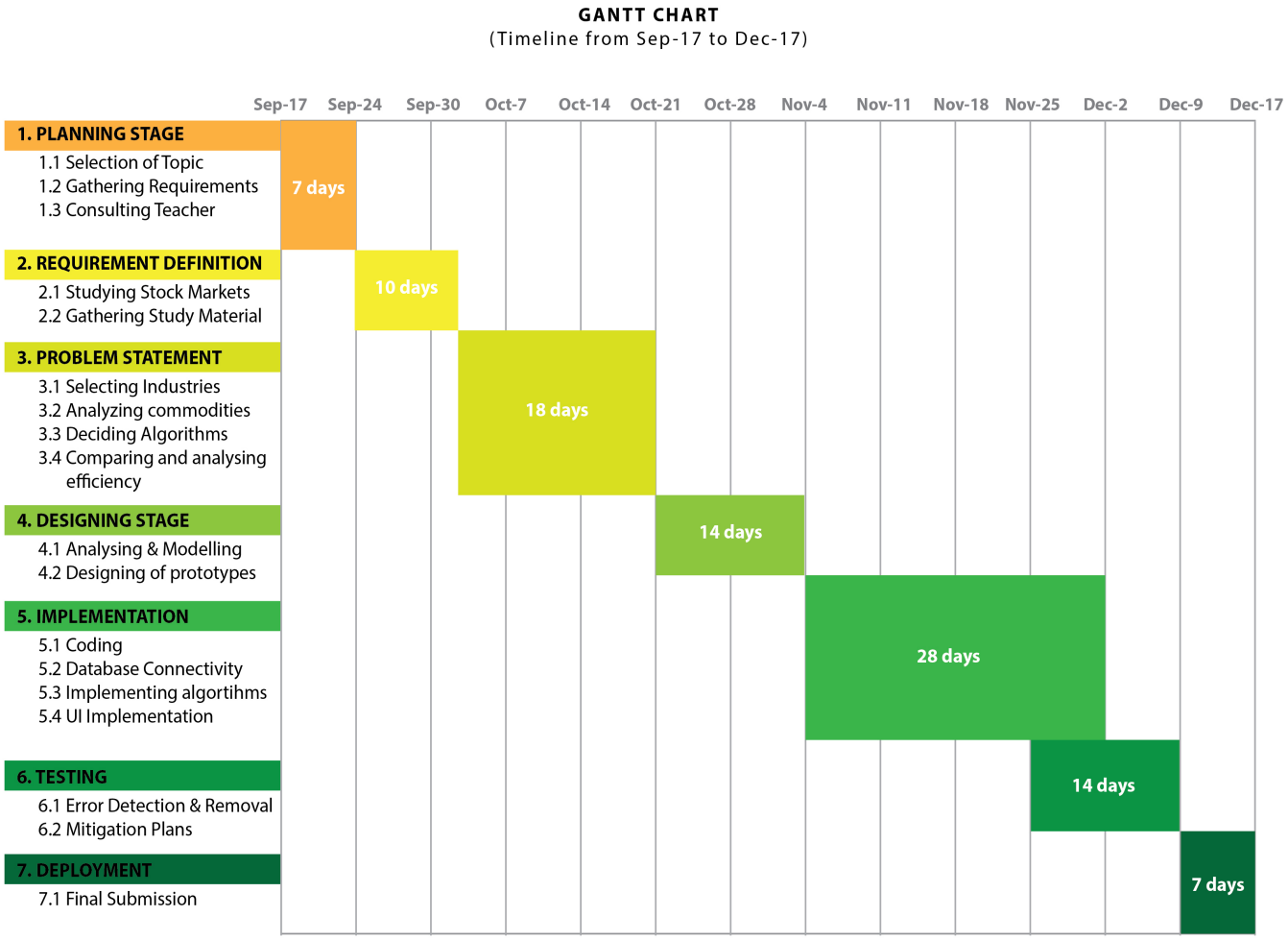

Fig. A – Gantt Chart

(XI)

BRIEF RESUME

1. Shubham Kumar Jain

SHUBHAM KUMAR JAIN

Undergraduate Senior,
Bachelor of Technology,
Computer Science and Engineering,
Jaypee Institute of Information Technology, Noida

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New Delhi - 110092
P +91- 9818533816
E shubham.jain2706@gmail.com

Education

Year	Degree	Institution	GPA / %
2013-2017	B.Tech	Jaypee Institute of Information Technology, Sector-62, Noida	8.0 (uptil 6th semester)
2013	XII	D.A.V.Public School, Shreshtha Vihar, Delhi	92.6%
2011	X	D.A.V.Public School, Shreshtha Vihar, Delhi	10

Work Experience

KitInfinet, Delhi
Web Development Intern, June 2016 to July 2016

I worked on the Medicine Reminder Application that never lets a user forget his or her prescription. The project engaged me in establishing the database connectivity using PHP and MYSQL. AngularJS was also an integral part of the web-based project to implement single page applications.

Boiban-it, Noida
UI/UX Designing Intern, December 2015 to January 2016

I worked on improving the user experience of the Android application by devising minimalistic icons to describe all the functionalities to the user without much text. Designing the User Interface for the application using Java and XML files was one of my job roles. I also designed the user interface for the website using CSS and Bootstrap.

D'mensio, Delhi
Co-founder, November 2014 to Novermber 2015

D'mensio was a digital marketing media startup that aimed to digitalize a company's presence by designing web-sites, portfolios, brochures, logos and merchandises with amazing ideas. I worked on to envisage the ideas of the clients using Adobe Illustrator to offer quality services in branding every possible domain.

Projects Undertaken

Stock Price Analysis using Data Science Algorithms: The project employed different data science algorithms first to analyse the future stock prices based on the current market trends and then compare for the better and much efficient solution for different companies. I also made use of HighCharts to present the current and the predicted trends graphically. I am planning to implement Neural Networks in the next phase.

Data Analysis and Encryption Transfer System (D.A.R.T.S): The Python-based software helped the clients to securely transfer data over a network by ciphering and deciphering different files. Image Steganography, AES were some of the algorithms used to code the same. The software apart from data transfer, also support a multi-client chatroom.

Personalized Interest Based News, Uprest (Web Based): The application intended to showcase news from different domains based on personal interests of the users. Data crawling and web scraping gave me the keywords that could be searched in the Built-in Search bar. Modal windows, Carousel, and a customized dashboard were some of the other features that I worked upon, using JavaScript and jQuery applets. I also made the layout of the website responsive so that it could be compatible with different screens and sizes.

Technical Skills

Programming/Languages: C, C++, Java, elementary Python
Web Languages: PHP, HTML, CSS, Bootstrap, JavaScript, AngularJS
Database: MYSQL
Graphic and Web Design: Adobe Photoshop, Adobe Illustrator, Adobe Dreamweaver

Positions of Responsibility

- JIIT Facebook Marketing Campaign
  Core Member, May 2015 to present
- Rotaract Club of Delhi South (NGO)
  Graphic Designer and Volunteer, June 2015 to June 2016
- Samvaad '15
  Extended OC Member, Digital Design, June 2015 to July 2015
- Khwahishein Foundation (NGO)
  Designer & Volunteer, January 2015 to March 2015
- Jaypee Model United Nations 2015
  Under Secretary General, Digital Media, October 2014 to February 2015
- Google Developers Group, JIIT Noida
  Core Member, October 2013 to October 2014
- D.A.V. Public School Shreshtha Vihar
  President of Techno Club, July 2012 to June 2013

Extra Curricular Activities

- Worked as a Content Writer at Icy Tales.
- Organized Blood Donation Drives under Rotaract and taught children in slums under Khwahishein Foundation.
- Worked as a freelance website developer and graphics designer at Sponsorhunt, and Whedia Technologies.
- Did several soft skill courses from various online websites.
- Participated in inter-college programming competitions.
- Worked as a graphic designer in many hubs in college.
- Won 2nd prize in Designing in Impressions 2015.
- Won the "Senior Whiz Kid Award" in 2012 for my considerable efforts in organizing the school's techno fest.
- Worked as a graphic designer to publish numerous editions of tech-magazine, brochures.
- Won several prizes in web-designing inter-school contests during my education in D.A.V Public School.

2. Chinmay Phutela

CHINMAY PHUTELA

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B-8, Mission Compound, Saharanpur-247001.U.P. **DOB:** 15th February 1995

Objective

Looking forward to having a learning experience with a leading organization.

Education

Year of Passing	Degree	Institute (Board/ University)	Score
2017	B. Tech. (C.S.E)	Jaypee Institute of Information Technology, Noida (Deemed University)	**CGPA – 7.3** (Till 6th Sem)
2012	Class 12th (Intermediate)	Pinewood School, Saharanpur (CBSE)	**87.00%**
2010	Class 10th (High School)	Pinewood School, Saharanpur (CBSE)	**CGPA – 9.8**

Experience

Corporate Internship - Summer'16 (10 weeks)

- **Analyst Intern, AON, Gurgaon (May-August'16):** Worked for the Selection and Assessment Team, which delivers all sorts of Pre Hiring and Post Hiring Assessments and 360 degree feedback surveys to AON global clients. Worked majorly on MS Excel and GATE (AON's Internal Tool) for data collation, trend analysis and setting up assessments. Took part in AON Global Conference in which representatives from five different countries discussed about the technology involved in latest tool of AON. Learnt and even implemented few statistical concepts in live projects.

Corporate Internship - Summer'15 (6 weeks)

- **Marketing Intern, Grades One Entertainment Pvt. Ltd., India (May-July'15):** Worked with the Marketing Team dedicated to implement marketing strategies for INTEL ® NUC. Was exposed to business processes, team meetings and social activities. Tried new Intel based technologies. Research work on how NUC can be showcased better in market and survey work on the marketing strategies of NUC's competitors was also allotted.

Projects Undertaken

Minor Projects

- **Cryptography [text and image] (Steganography)** (Feb-May'16)
  Wirelessly transferring data focusing on data security using different techniques of cryptography were the key areas of this project. Steganography, text chatting and video calling were add on features of the project.

- **Personal Interest News Magazine** (Sep-Dec'15)
  News aggregator platform to provide users an amazing experience of news reading where all the news from different sources was presented using data crawling techniques. News was displayed based on the user's interests.

Mini Projects

- **2048 Game (Data Structures)** (Nov'14)
  A replica of a famous game and a puzzle – 2048 using link list and other data structure related concepts.

Technical Skills

Major Tech. Skills	Hadoop (Beginner's Level), C, SQL, C++
Utilities	MS Excel, MS Word, MS PowerPoint

Awards and Honors in Academia and Leadership

Leadership Roles/ Positions of Responsibility

- Head, JIIT Facebook Marketing Campaign
- Core Member, JIIT Alumni Relations Team
- Director, Public Relations, Jaypee Model United Nations '16
- Member, Public Relations, Jaypee Model United Nations '15
- Director, Public Relations, Joust'15
- Organizer, Annual College Fest, Impressions '16
- House Captain, Pinewood School (2011-2012)