Development of Electronic feed for Broker Statement

Submitted By

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Development of Electronic feed for Broker Statement

Major Project

Submitted in partial fulfillment of the requirements

for the degree of

Master of Technology in Information and Network Security (CSE)

Submitted By

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Certificate

This is to certify that the major project entitled **"Development of Electronic feed for Broker Statement"** submitted by **Kiran Dienshkumar Patel(14MCEI16)**, towards the partial fulfillment of the requirements for the degree of Master of Technology in Information and Network Security (CSE) of Nirma University, Ahmedabad is the record of work carried out by her under my supervision and guidance. In my opinion, the submitted work has reached a level required for being accepted for examination. The results embodied in this Seminar, to the best of my knowledge, haven't been submitted to any other university or institution for award of any degree or diploma.

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Statement of Originality

I, **Kiran Dienshkumar Patel**, Roll. No. **14MCEI16**, give undertaking that the Major Project entitled "**Development of Electronic feed for Broker Statement**" submitted by me, towards the partial fulfillment of the requirements for the degree of Master of Technology in **Information and Network Security (CSE)** of Institute of Technology, Nirma University, Ahmedabad, contains no material that has been awarded for any degree or diploma in any university or school in any territory to the best of my knowledge. It is the original work carried out by me and I give assurance that no attempt of plagiarism has been made.It contains no material that is previously published or written, except where reference has been made. I understand that in the event of any similarity found subsequently with any published work or any dissertation work elsewhere; it will result in severe disciplinary action.

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Endorsed by

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Abstract

According to survey of 200 hedge fund managers by likes of KPMG and Mckinsey (Big 4 auditing firm globally), hedge fund companies globally are spending around USD 3 billion as compliance cost. Hence compliance is becoming a major thrust area for Hedge funds in terms of developing software solutions and automation. There is third party product available that help monitor compliance requirements. Compliance system is to track, audit and oversee employee securities transactions and financial disclosure in real time. Compliance clears, approves, tracks, and ensures compliance for all processes. This is manually performed in current state which is take long time or may contain error. It is important to integrate feeds from brokers electronically to have seamless compliance management. The project is having multiple stages. First, Using existing capabilities of 3rd party product / develop customized solution to develop centralized security. Second, Integrate broker feeds electronically into the product. Third, Extend electronic feed integration across all other brokers. Comparison different algorithm accuracy for stock prediction.

Acknowledgements

Abbreviations

CUSIP	Committee on Uniform Securities Identification Procedures
CCO	Chief Compliance Officer
SQL	Structured Query Language
SEDOL	Stock Exchange Daily Official List
SEC	Securities & Exchange Commission
DBMS	Database Management System
HOD	Head of Department
SMA	Simple Moving Average
EMA	Exponential Moving Average
MACD	Moving Average Convergence Divergence
CCI	Commodity Channel Index
MFI	Money Flow Index
OBV	On-Balance volume
ROC	Rate of Change
RSI	Relative Strength Index
SVM	Support Vector Machine
K-NN	K-Nearest Neighbors

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Chapter 1

Introduction

1.1 Compliance system

Compliance is a system used by investment advisory firms to maintain legal records and documents. Compliance system is to track, audit and oversee employee securities transactions and financial disclosure in real time. Compliance clears, approves, tracks, and ensures compliance for all processes.

Investment firms must:

- Prevent insider trading- Insider trading relates to trading done for own advantage by accessing confidential information.

- Supervise all employee's personal trading

- Maintain records of general ledger, all transactions, related communications (email), quarterly and yearly reports, gifts and contributions, etc.

1.1.1 Compliance System flow

Client has developed a Compliance management product on top of third party product called Relativity, One of the largest E Discovery Software used by top 100 legal entities. [1] Product functionality gives the CCO (Chief Compliance Officer) and the

external legal advisor (Our Client) access to all the relevant document and information all the essential compliance related activities that typically takes place in a Hedge Fund Companies such as
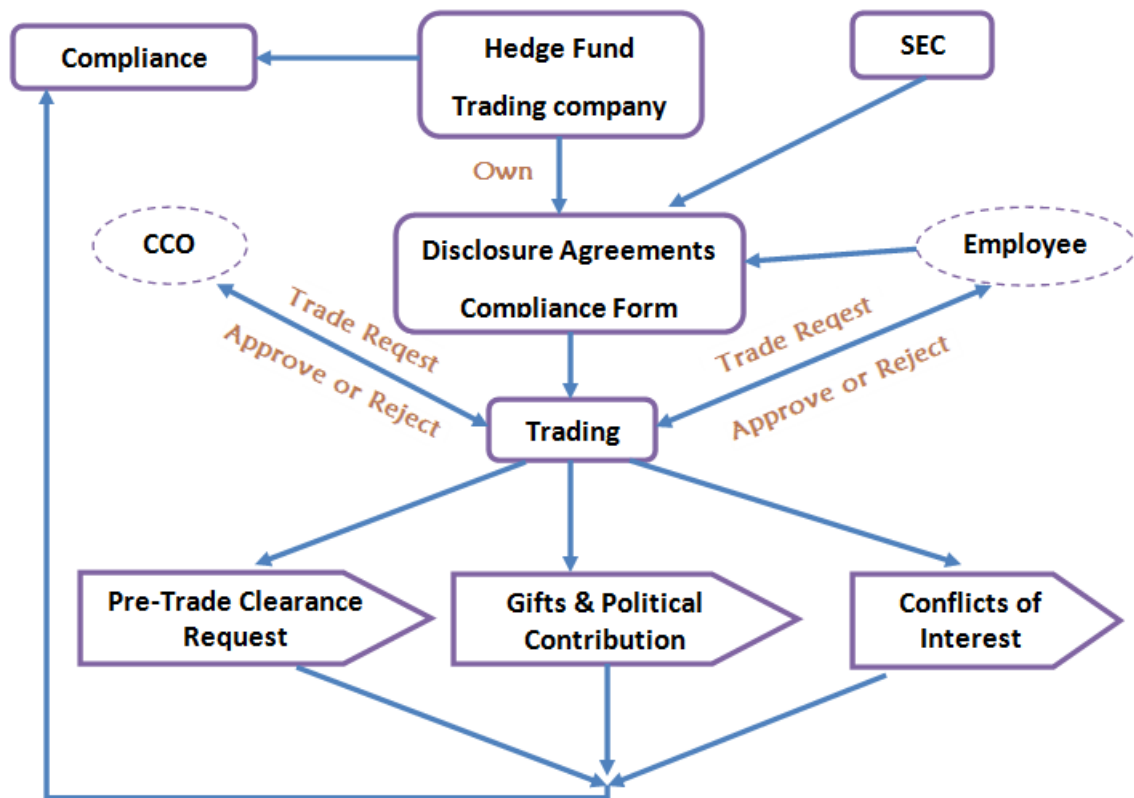
Figure 1.1: Flow Of Compliance

a. Pre-Trade Requests - It is a kind of request that is sent to the CCO before making any transaction.

b. Broker Account - It is a broker account for employee which deals with transactions.

c. Broker Statements - It contains holding and transactions made by client.

d. Gifts & Political contribution - Any gift or political contributions made by the employee must be showed in the compliance.

e. Conflict of Interest - Any other activity i.e. business or partnership with other financial companies' details must be submitted in the compliance.

f. Restricted/Watchlist Securities - These securities cannot be purchased or sold for a limited given period.

1.2 Need for electronic feed

Our Client Scan Broker Statement for each employee. After that they merge multiple Broker statements into one PDF or ZIP and upload on document room for each hedge fund company.

The statement is downloaded from the document room and broker statement is extracted from the pdf account wise.Later on all statement uploaded respective to each account for each hedge fund company. In figure 1.2 shows flow of manual transactions. [2]
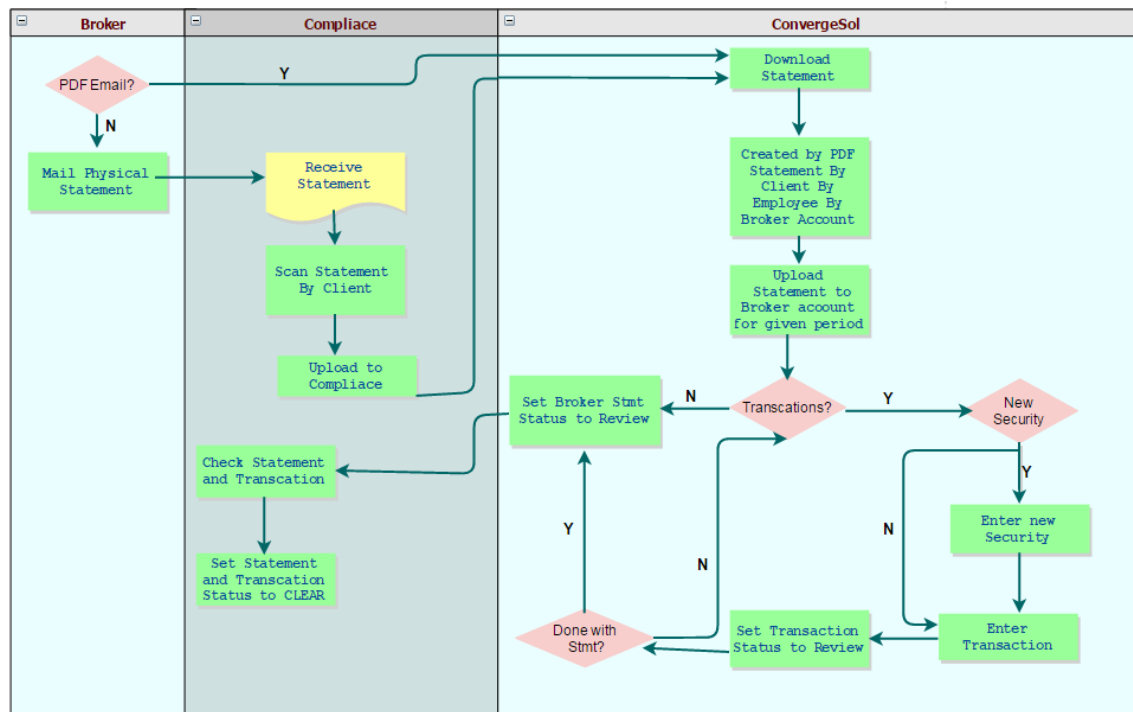
Figure 1.2: Flow of manual transaction

Basically two methods are used.

a. The broker statement is checked for security and ticker is obtained if exist in holdings.

b. If security is not in holding section then search for security in Bloomberg, yahoo finance or Google finance.

- Some Security (i.e. Bond) don't have ticker. So bond view site is used to know CUSIP.

Earlier, compliance is done manually with conventional method using paperwork between investment adviser and the firm. But it has following cons:

a. More staff is needed for paperwork.

b. Time consuming because of manual work.

c. Human Error.

1.3 Scope and Objective

Development of centralized security to avoid creating new security every time in different hedge fund company. Organize broker feeds electronically to avoid human error and time consuming manual transaction. Extend electronic feed integration across other brokers for automatically checking of rules for transaction. It also provides ease of access and record keeping of transactions anytime. The implementation of the project is limited to two brokers.

Chapter 2

Literature Survey

Leverages industry best practices and standard tool set for compliance.

- Relativity platform

- SQL Server

2.1 Technology

2.1.1 Relativity

Web based application built on top of application platform called Relativity. This is provided by kCura. Hosted in the cloud and can be accessed anywhere with an internet connection. It is well known for auditing and customization. [3]

They provide following facility:

- A proven platform for document management.

- The most developed platform and third-party ecosystem in its space.

- Built for heavily regulated, litigious industries and activities.

kCura are recommending for best experience of relativity developer documentation use following browsers:[3]

- Internet Explorer 8 or higher

- Firefox 10 or higher

- Google Chrome 13 or higher

- Safari 5 or higher

2.1.2 SQL Server

SQL Server is DBMS system provided by Microsoft SQL Server is sometimes mistakenly referred to as SQL. Microsoft SQL server 2008 is a full-featured relational database management system (RDBMS) that offers a variety of administrative tools to ease the burdens of database development, maintenance and administration.

2.2 Financial Terminology

2.2.1 Security

Security is financial instrument which is tradable. It is represents the state of being an owner in stock or bond. [4] Security has following attributes.

a. Security identifier - It is use to uniform identifies security. Example CUSIP ,Ticker

b. Security Name - It gives security description.

c. Security type - It is described which type of security.

d. Exchange - It is place where trader buy or sell security. Ex. NYSE, NASDAQ etc..

e. Industry - It is described in which industry security is belonged to. Ex. Retail, Oli & Gas Production, Banking etc..

    f. Sector - It is described in which sector security is belonged to. Ex. Financial, Healthcare, Technology etc.

There are different types of security.

- Equity

- ETF

- Options

- Bond

- Mutual fund

There are many identifiers for security.

- Ticker - It contains letters or numbers or combination of both.

- CUSIP - It stands for Committee on Uniform Security Identification Procedures. Nine digit combination alpha numeric number used to identify uniquely security.

- SEDOL - It stands for Stock Exchange Daily Official List. Seven digit combination alpha numeric number used to identify uniquely security.

2.2.2 Transaction

A transaction is a business event that has a monetary impact on an entity's financial statements, and is recorded as an entry in its accounting records.

Transaction has following attribute

- Transaction Type - It is described which type of transaction.

- Security - It is described security name.

- Quantity - Number of securities

- Price per share - Price for each share.

- Amount - It is total amount of transaction. Amount is calculated by quantity multiply price per share plus or minus commission fees.

- Trade Date - Day when order is book.

- Settlement- Day on which transfer of cash is completed.

There are four types of transaction

a. Buy

b. Sell

c. Cover short

d. Shell short

2.2.3 Holdings

Holdings contains list of securities which held by owner at last date of period. Holdings has following attribute

- Security

- Quantity At End Of Period - No of security at last day of period

- Price Per Unit At End Of Period - Price for each unit at last day of period

- Total Value Beginning of Period - Final amount on begin day of period

- Total Value End Of Period - Final amount on last day of period

2.3 Data Warehousing Approach

Data warehouse is similar to database that is separately maintained from firm's operational database. It has two operation initial loading of data and access of data. [5]
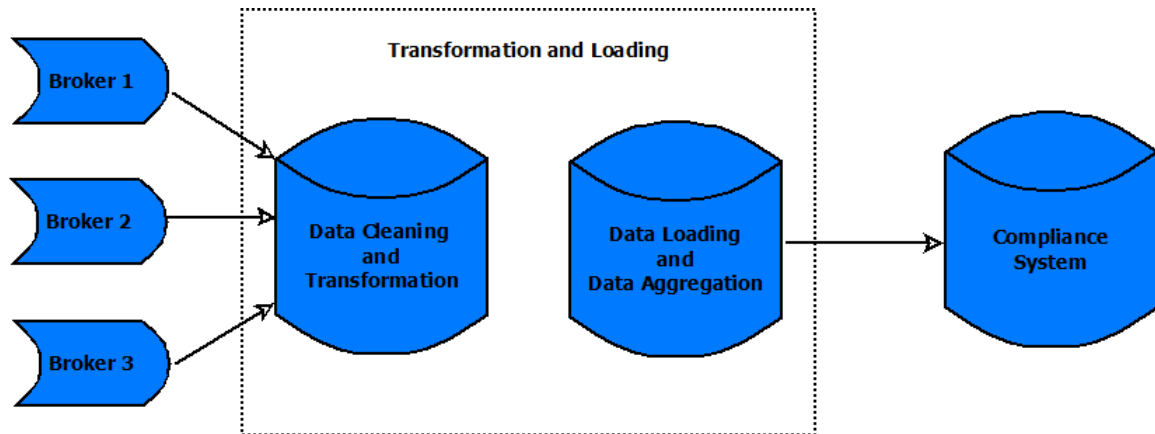
Figure 2.1: Data Warehouse

Data Warehouse allows to create consolidated repository that can be used for following reasons.[6]

- Establishing single source of truth or golden copy

- Decision support tool with multiple sources data

- Quicker access to data when you want it and how you want it

- Auditing as well as time series view of data

Data Warehouse allows to

- Extract information from multiple sources

- Tight integration (database, API)

- Loose integration (data feeds like CSV or XLS)

- Transform aggregated data using defined rules

- Load cleaned data into a single repository

2.4   Research Paper

No	Research paper	Algorithm	Details
1	Predicting direction of stock price index movement using artificial neural networks and support vector machines: The sample of the Istanbul Stock Exchange	ANN and SVM	They are predicting the price direction in the day by day Istanbul Stock Exchange (ISE) National 100 Index. There are two ways to improve performance of predication models. First is to adjust parameter and second is a used different input variable in the model.[7]
2	Analyzing and Predicting Software Quality Trends Using Financial Patterns	Regression Techniques	The utilization of an ordinal data type for predication rely on ranking system provides a different dimension for predicting outcomes. In stock price trend, compare effects of transforming data types in regression techniques. [8]
3	Stock Market Prediction model using TPWS and Association Rules Mining	Association rule mining	They customized the original stochastic algorithm and proposed typical price weighted stochastic (TPWS). They applied association rules mining on all the results and recognized some precise rules which lead us to a model with highest accuracy among all the studied techniques in their study. [9]
4	Predicting Stock Market Trends Using Random Forests: A Sample of the Zagreb Stock Exchange	Random Forest	They are predict rise and fall of stock price on next day.Constructing an algorithm for automated trading, based on predictive model, and use it for portfolio management. [10]
5	Dhaka Stock Market Timing Decisions by Hybrid	ANN model and the hybrid ANN model	stock prediction for the use of investors. It is true investors usually get loss because of unclear investment objective and blind investment. For better result of predication used genetic algorithm, Holtes algorithm [11]
6	A Binary Stock Event Model for stock trends forecasting	Bayesian Naive Classifier and a SVM	They propose a Binary Stock Event Model (BSEM) and generate features sets based on it in order to better predict the future trends of the stock market. They just focused on the Binary Stock Event Model due to its simplicity. [12]

No	Research paper	Algorithm	Details
7	A method for automatic stock trading combining technical analysis and nearest neighbor classification	k-NN(nearest neighbor)	To study the feasibility of the practical use of an intelligent prediction system exclusively based on the history of daily stock closing prices and volumes.[13]
8	Stock Market Prediction Using Hidden Markov Models	Hidden Markov Models	Predict stock price value using historical data. [14]
9	Stock market prediction using a hybrid neuro-fuzzy system	hybrid neuro-fuzzy system	Predict stock price value using historical data. [15]

Table 2.1: Research paper

2.5 Technical Parameter

Two values are important for technical analysis.First is Price and second is Volume.Technical indicator is some type of oscillation of the price or volume predicated on parameters that are predefined relying upon the business sector or the investor or speculator, and attempt to predict the future value, or just the general price direction, of a security by taking historical price.Three type of price are important High price, Close price, Low price. Ten indicators are used in this analysis.Technical indicator is selected

(I) which is the vast majority of utilized by trader while trading.

(II)Which is aected day by day base on trading.

Here C_t is the closing price, L_t the low price, H_t the high price at time t,V_t is the volume at time t,SMA= $\frac{C_t+C_{t-1}+.....+C_{t-n+1}}{n}$, Diff: $EMA(12)_t - EMA(26)_t$, EMA exponential moving average, $EMA(k)_t : EMA(k)_{t-1} + \alpha \times (C_t - EMA(k)_{t-1})$, α smoothing factor: $\frac{2}{1+k}$, k is time period of k day exponential moving average, LL_t and HH_t mean lowest low and highest high in the last t days,respectively, $M_t = \frac{H_t+L_t+C_t}{3}$; $SM_t : \frac{\sum_{i=1}^n M_{t-i+1}}{n}$, $D_t = \frac{(\sum_{i=1}^n |M_{t-i+1}-SM_t|)}{n}$, Up_t means the upward price change, Dw_t means the downward price change at time t.

Name	Formulas
Upperband (UB)	$SMA(n)_t + (SD(n)_t \times 2)$
Lowerband (LB)	$SMA(n)_t - (SD(n)_t \times 2)$
Bandwidth	$UB_t - LB_t$
Commodity Channel Index (CCI)	$\frac{M_t - SM_t}{0.015 D_t}$
Moving average convergence divergence (MACD)	$MACD(n)_{t-1} + \frac{2}{n+1} \times (DIFF_t - MACD(n)_{t-1})$
Money Flow Index(MFI)	$100 - \frac{100}{1 + MR_t}$
On-balance volume (OBV)	$OBV_{t-1} + V_t$ if $C_t > C_{t-1}$ $OBV_{t-1} - V_t$ if $C_t < C_{t-1}$
Rate of change (ROC)	$\frac{C_t}{C_{t-n}} 100$
Relative Strength Index (RSI)	$100 - \frac{100}{1 + (\frac{\sum_{t=0}^{n-1} UP_{t-i}}{n}) \div (\frac{\sum_{t=0}^{n-1} DW_{t-i}}{n})}$
Stochastic K%	$\frac{C_t - LL_{t-n}}{HH_{t-n} - LL_{t-n}} \times 100$
Stochastic D%	$\frac{\sum_{i=0}^{n-1} K_{t-i}\%}{n}$
Willams R%	$\frac{H_n - C_t}{H_n - L_n} \times 100$

Table 2.2: technical parameter

2.5.1   Bollinger Bands

Bollinger Bands are similar to moving average envelopes.

The only thing that make them different is that envelopes are plotted at a xed percentage above and below a moving average, whereas Bollinger Bands are plotted at standard devia-tion levels above and below a moving average. Since standard deviation is a measure of volatility, the bands act as self-adjusting: broaden during volatile markets and shrinks during calmer periods.

Bollinger Bands are demonstrated as three bands: Bollinger band characteristic is it's rely on volatility of prices in spacing between the bands.

2.5.2   Commodity Channel Index (CCI)

The Commodity Channel Index measures the variation of a security's price from its statistical mean. High values show that prices are unusually high compared to average prices whereas low values indicate that prices are unusually low. Contrary to its name, the CCI can be used effectively on any type of security, not just commodities. The CCI typically oscillates between 100. To use the CCI as an overbought/oversold indicator, readings above +100 imply an overbought condition (and a pending price correction) while readings below -100 imply an oversold condition (and a pending rally).

2.5.3   Moving Average Convergence/Divergence oscillator (MACD)

MACD is a trend following momentum indicator that shows the relationship between two moving averages of prices. The MACD is also useful as an overbought/oversold indicator. When the shorter moving average pulls away dramatically from the longer moving average (i.e., the MACD rises), it is likely that the security price is overextending and will soon return to more realistic levels. If the MACD line crosses the zero line from above, trend is bearish - sell signal; if the MACD moves above the zero line from below, trend is bullish- buy signal. [16]

2.5.4   Money Flow Index (MFI)

Money flow index is a momentum indicator that measures the strength of money flowing in and out of a security. It is related to the Relative Strength Index, but where the RSI only incorporates prices, the Money Flow Index accounts for volume. If the MFI is above 80 and it is falling it gives a buy signal, if it is below 20 and shows an upward trend, it signals buy decision.[16]

2.5.5 On Balance Volume (OBV)

OBV is a momentum indicator that relates volume to price change. It shows if volume is flowing into or out of a security.When the security closes higher than the previous close, all of the day's volume is considered up-volume. When the security closes lower than the previous close, all of the day's volume is considered down-volume. When the OBV changes to a rising or falling trend, a "breakout" has occurred. Since OBV breakouts normally precede price breakouts, investors should buy long on OBV upside breakouts. Likewise, investors should sell short when the OBV makes a downside breakout. Positions should be held until the trend changes. [16]

2.5.6 Rate-of-Change (ROC)

The Rate-of-Change (ROC) indicator, which is also referred to as simply Momentum, is a pure momentum oscillator that measures the percent change in price from one period to the next. The ROC calculation compares the current price with the price n periods ago. The plot forms an oscillator that fluctuates above and below the zero line as the Rate-of-Change moves from positive to negative. As a momentum oscillator, ROC signals include center line crossovers, divergences and overbought-oversold readings. Divergences fail to foreshadow reversals more often than not so this article will forgo a discussion on divergences. Even though centerline crossovers are prone to whipsaw, especially short-term, these crossovers can be used to identify the overall trend. Identifying overbought or oversold extremes comes natural to the Rate-of-Change oscillator.

2.5.7 Relative Strength Index (RSI)

RSI measures the internal strength of a single security. The period used in our study is 18 days. If the RSI is above 80 and it is falling it gives a buy signal, if it is below 20 and shows an upward trend, it signals buy decision. We will get back to our parameter selection criteria later.

2.5.8   Stochastic Oscillator %K & %D

The Stochastic Oscillator compares where a security's price closed relative to its price range over a given time period. The Stochastic Oscillator is displayed as two lines. The main line is called "%K." .The second line, called "%D,". For this study % k and % D, 14 days and 3 days period have been taken. The decision is buying when the Oscillator (either %K or %D) falls below a specific level (e.g., 20) and then rises above that level and the decision is selling when the Oscillator rises above a specific level (e.g., 80) and then falls below that level.

2.5.9   Williams R

William is a momentum indicator that measures overbought/oversold levels. The interpretation of Williams'%R is very similar to Stochastic Oscillator except that %R is plotted upside-down and the Stochastic Oscillator has internal smoothing. To display the Williams %R indicator on an upside-down scale, it is usually plotted using negative values (e.g., -20%). Ignoring the negative sign, readings in the range of 80 to 100% indicate that the security is oversold while readings in the 0 to 20% range suggest that it is overbought.

Chapter 3

Proposed System & Implementation

3.1 Working System

Employee and CCO are two roles in Hedge Fund Company. When employee joins hedge fund company they need to sign an agreement to send a copy of statement to the client as well. Agreement also includes sending a pre-trade request to CCO before any transaction and CCO will further approve or decline the request.

Brokerage account contains broker statement which contains holdings and transaction. There are different broker for brokerage account. Broker is a firm that charges commission or fees for every transactions performed by employee, tracks transaction of employee and provide statement for employee.

Clients manually upload statement in compliance system.Then they extract transaction manually and check if any rule is violated. There are two types of rules, SEC and hedge fund companys own rule.

In Compliance system, there are different hedge fund company. They are treated as individually in compliance system. They have their own database in system. Each client has own brokerage account, security, exchange, industry, sector. Compliance

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structure is shown in figure 3.1.
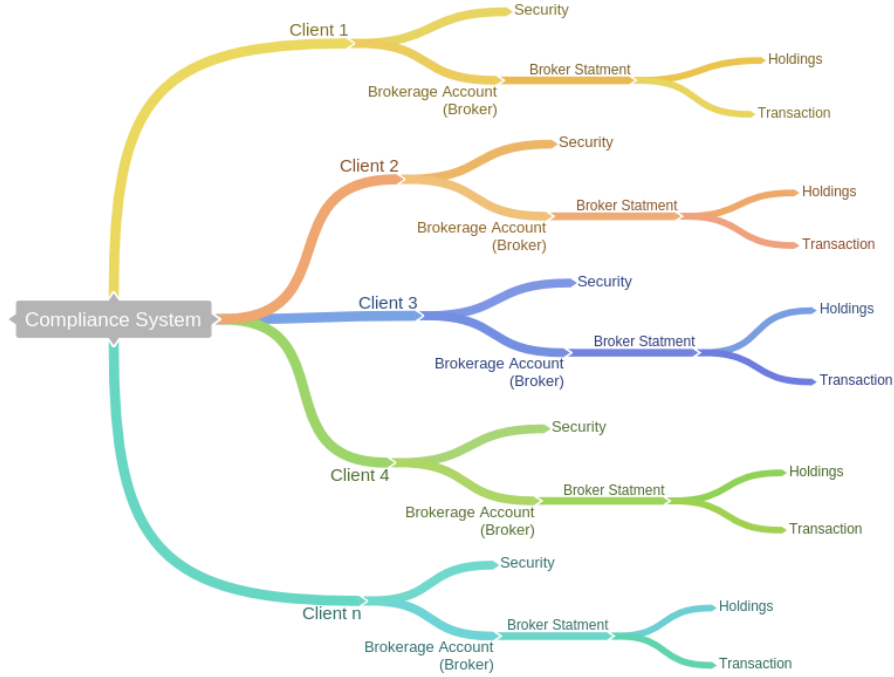
Figure 3.1: Compliance System Structure

3.2   Proposed solution

In current system,employee broker statement comes in paper or mail. While in electronic feed, compliance is talking with different broker to send employee statement in data form rather than paper. Our clients talk with brokers to transform hard copy statements into electronic system. This system is currently successfully established with one of broker and hoping for others soon.

Broker sends data into xlsx/csv format. File is pushed into company's data server

and is periodically checked for a particular path and loaded into data warehouse. Then after required data will be uploaded in compliance database with specific format.

There are number of brokers in compliance which increases with time. So data integration and data processing is required. Proposed system shown in figure 3.2.
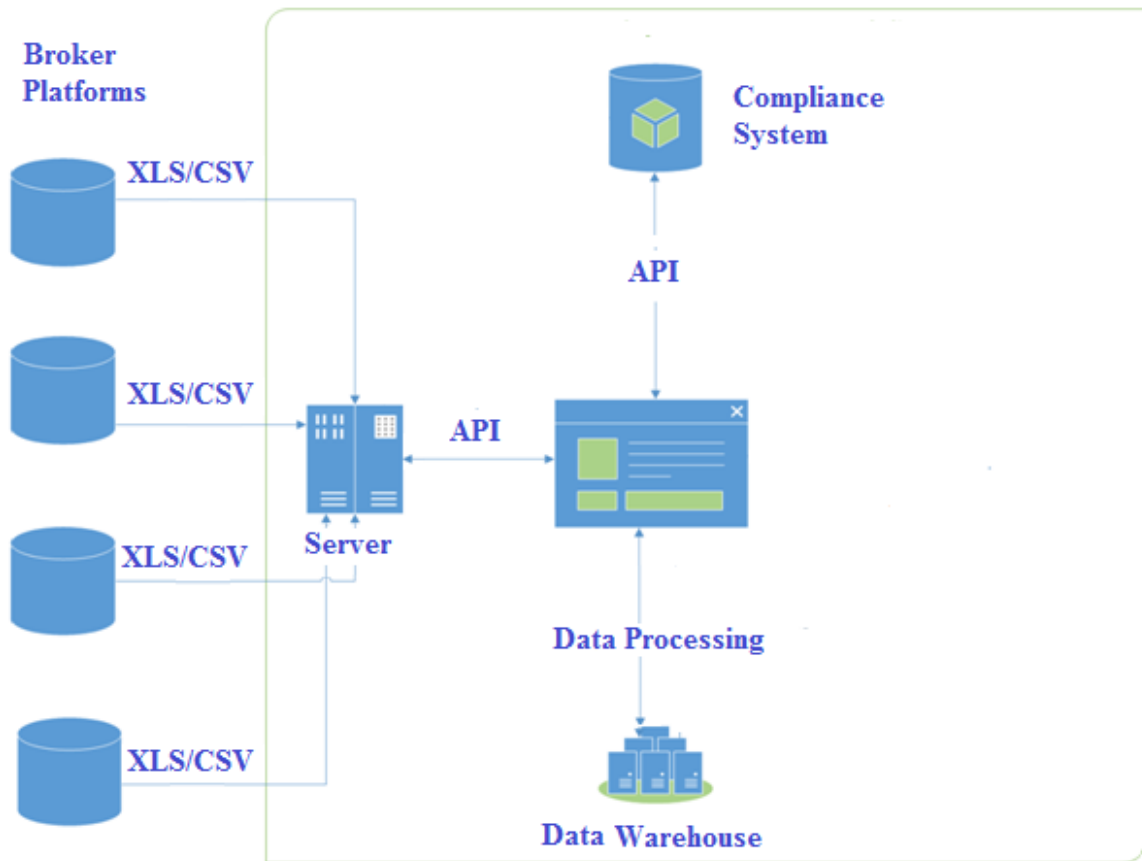
Figure 3.2: Proposed System

There are following issues in proposed system.

a. Decentralized security.

b. Brokers can have multiple account in different hedge fund company

c. Different formats for different brokers.

d. No monitoring process

For above issues, following are some projected solutions:

3.2.1 Centralized Security

In transaction and holding, security is important. So, whenever new transaction is added in compliance it is mandatory to have security in compliance. In compliance, for all hedge fund company they have their own security tables. Centralized security is must here. In compliance, there is compliance admin client. When new security comes it is added into compliance admin. In compliance function of an admin propagation agent is to create a new security or to update existing security. Admin propagation agent works shown in figure 3.3.
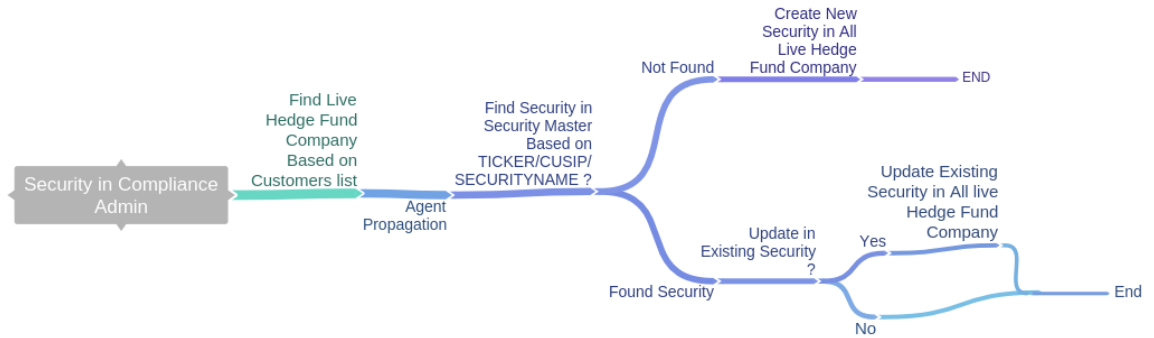
Figure 3.3: Admin Propagation Agent Work

So, when new security comes it is created first in compliance admin rather than create security into only one hedge fund company.

3.2.2 Mapping Tables

Brokers have different account in different hedge fund company. So mapping table is created for their account.For Example,

Account number	Hedge fund company
xxxx-899	Hedge fund company1
xxxx-900	Hedge fund company2
xxxx-345	Hedge fund company1
xxxx-621	Hedge fund company5

Table 3.1: Account Mapping table

It will help to improve performance as any transaction is added to an account, it only needs to know to which company this account belongs to.

3.2.3 Staging Table

When data arrives we load as it is in our staging table .A staging table is same as other tables in database. It is used to import data from some other data source into SQL. It is used when if you want to process that imports some data from say csv/xlsx files then you put this data in staging table. You may then decide to apply some data cleaning process or business rules to data and move it to different staging tables.

3.2.4 Monitor Process

Another problem while creating a new account in compliance. It is required to track exception or error. Also it is vital to monitor which account data was uploaded in last run, where it is left because of error and the cause of error.

3.3 E-feed

In e-feed , there are multiple brokers that provides data using push or pull files. In push, broker push files in the server location using SFTP over SSH. In pull , application pulls files from broker location and then copy all the files in the server location. E-feed architecture shown in figure 3.4

Data processor stores data in database. It stores a file and check if any data exist in the file and put them in staging database as per the format.

Data Pre-processing is divided into three sections: Data mapping, Data conversion , data translation. Data mapping is the process of mapping of broker's field with compliance's field. It matches broker's data with the compliance's word. Data conversion is process of changes required to move or convert data from one format to

data as per compliance's comfort. We change data type of data.Data translation is
the process of mapping broker data with Compliance choices. We want to transform
all dates to the same format internally .i.e.,CCYYMMDD to MM/DD/YYYY.
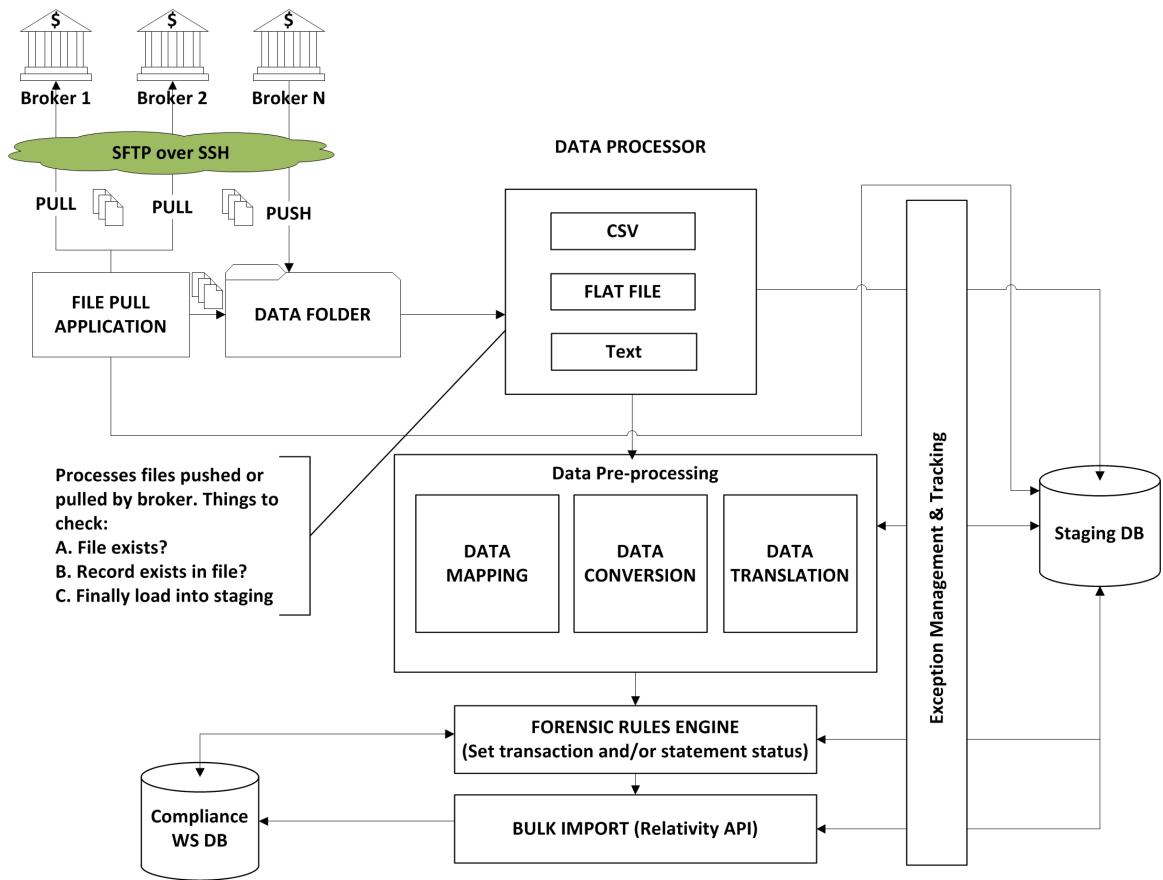
Figure 3.4: Efeed architecture

Forensic rules is a set of rules and instructions to be followed. It is different
for each client. Forensic rule engine is used to update the status of the transaction
according to the regulatory rules.

Using relativity API, transactions are uploaded into compliance. If there is any exception that obstacles the transaction, this system tracks and handle it using exception management tracking. It also tracks each record and monitor system shows details according to it.
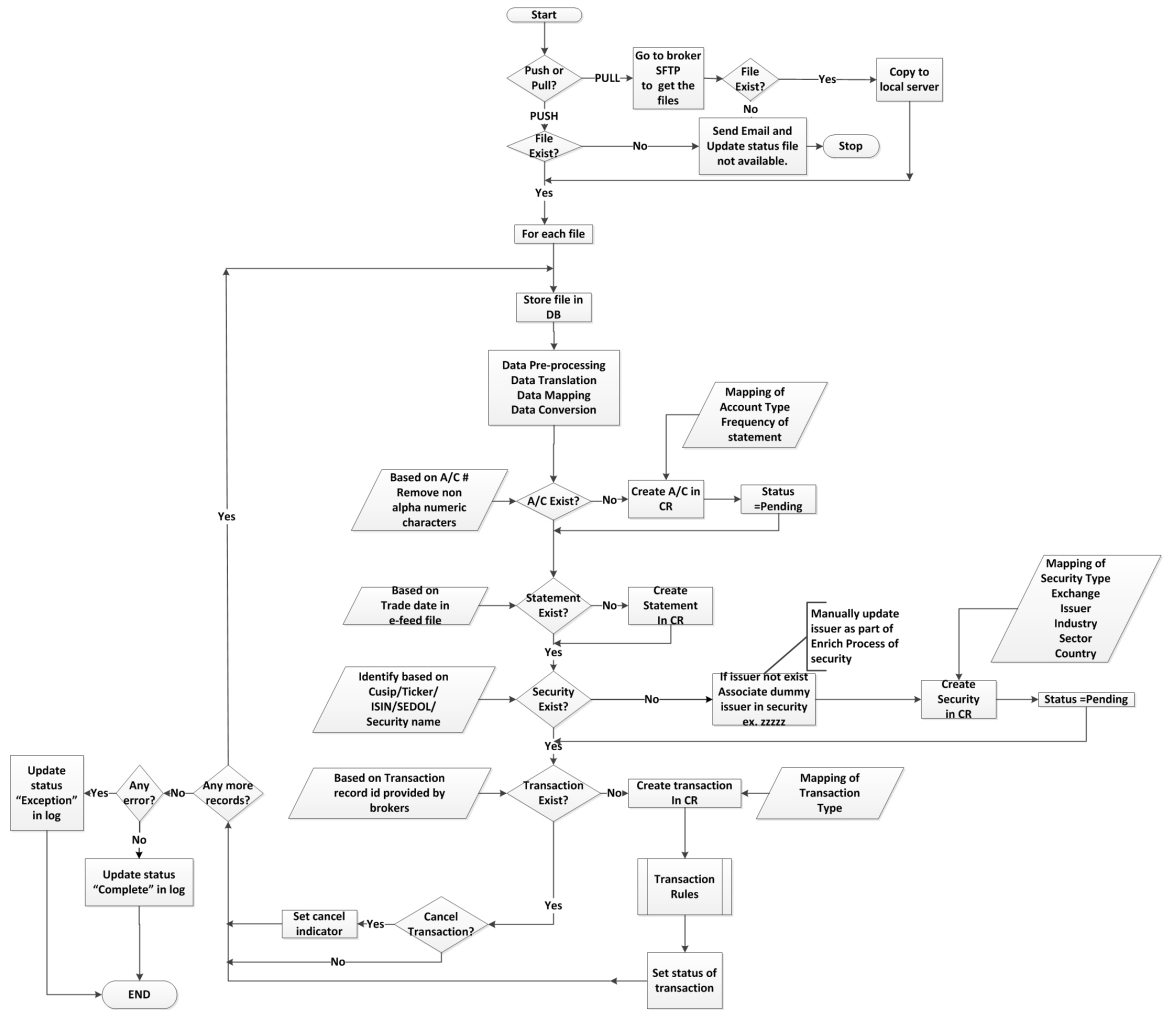
Figure 3.5: E-Feed Flow

E-feed flow shown in figure 3.5. E-feed process start then it is decided if push or pull for broker. If pull, then go to broker SFTP location to get the files. For that

first establish connection with broker SFTP location using SSH key. If file does not exist, an e-mail is sent to the broker and status is updated to file is not available. If does, then forwarded to local server. Same process applied to the push system but difference is only that we connect our location server. For each file, broker provides access code and client identifier at file name that CS can provide. In next step, existence of file is checked and if not, then an e-mail is sent saying no files found and if yes, it is stored in database. Data pre-processing is applied.[17] There are three steps Data mapping ,Data conversion, Data translation. Based on account number, non-alpha-numeric characters are removed. If no account exist, then new account is created with mapping of account type frequency of statement. Process proceeds with status pending tag for newly created account. If yes, then based on trade date e-feed file, statement is checked for its existence. If yes then process goes ahead but if no, then statement is created in CR and process goes on. Now security is checked based on Cusip/ Ticker/ ISIN/ SEDOL. If no, then a dummy issuer exist in security and a new security is created with mapping of security type, exchange, issuer, industry, sector or country. Status is changed to pending and forwarded. At last, based on transaction ID provided by the broker, transaction is checked if exist or not. If yes, then decided to keep or cancel the transaction. If there are no more records then errors are checked and field is updated to Completed in log. If more records are there, then whole process is repeated.

3.3.1   Exception

The following is a list of exceptions held by E-feed process:

   a. Employee not found. This exception is shown if new employee joins Hedge Fund Company and e-feed starts for that employee but employee is not created in compliance.

   b. Account number not found.   This exception is shown if employee opens a new account and e-feed start for that account but account is not created in

compliance.

c. Statement not found. It is shown when transactions are uploaded but not found any statement for that transaction.

d. Security not found. Shown when transactions are uploaded but no security is found for that transaction in compliance.

e. Trade date not proper Shown when date format is improper.

f. Settlement date not proper. Exception is shown for improper date format.

g. Amount not proper. This exception is shown for errors that cant be converted into decimal format.

h. Transaction Type not found. - If transaction type is not found in compliance then it shows transaction type not found.

3.4 Transaction rule

Transaction rule engine is used to set transaction status according set of rules. In compliance, there are restricted list, Watch list and PTC(Pre-Trade Clearance) objects. Using these three objects we can set transaction status. Restricted list contains all securities that are restricted for trading that hedge fund company. Watch list contains all issuers that are restricted for trading that hedge fund company. So, all securities are restricted for security issuer that are in watch list.PTC is used by the employee to send request for trading. Below is the list of transaction status.

a. Elevate - Restricted

b. Elevate Watch list

c. Elevate No Pre-clerance

d. Elevate Minimum Holding Period

e. Elevate Pre-Clearance Out of Range

f. Cleared
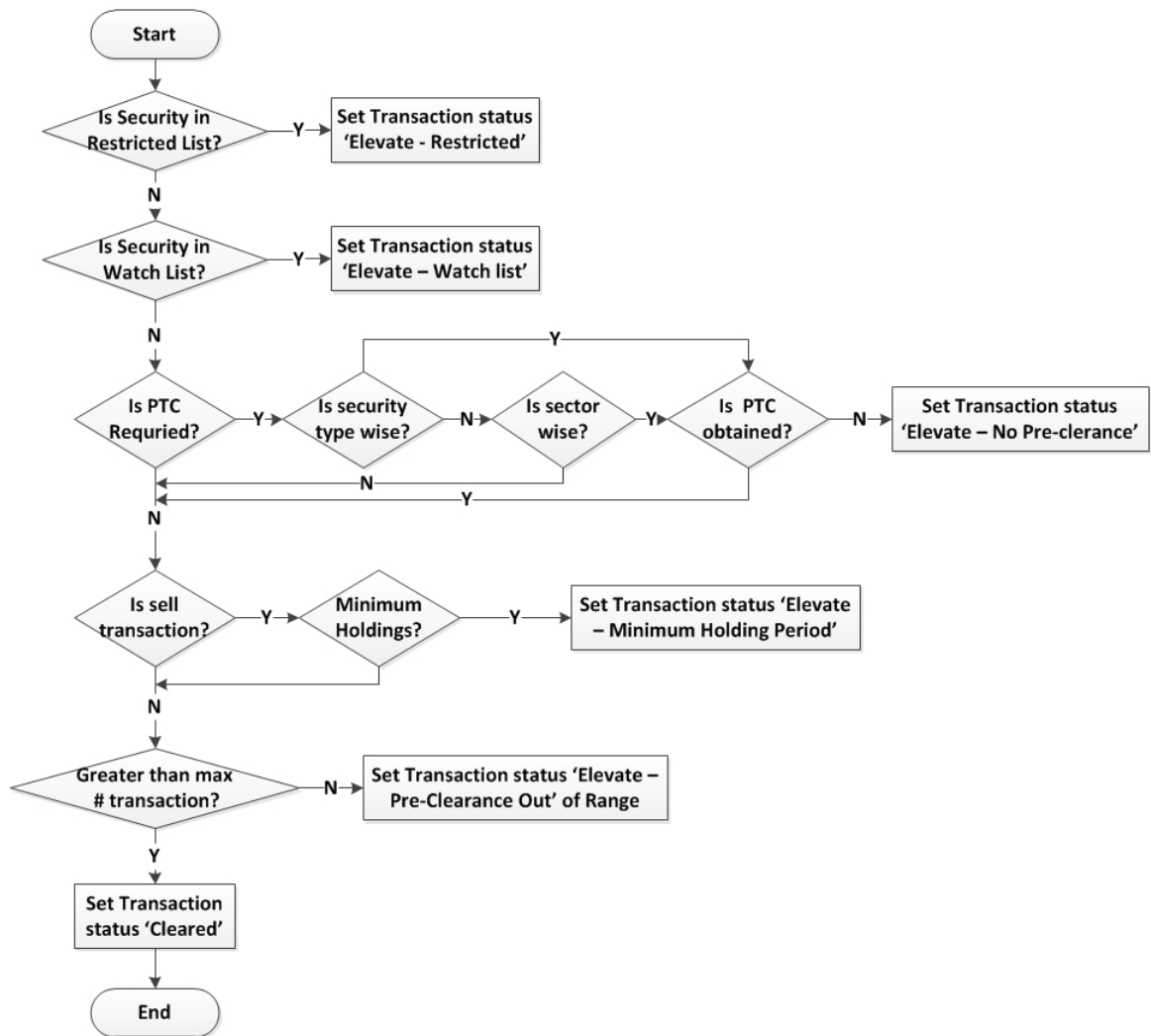
Figure 3.6: Transaction Rule

So, all security restricted which security issuer are in watch list. PTC is request that sent by employee for trading.

Status to set using transaction rule flow shown in figure 3.6. Transaction rules starts by checking if the security is in restricted list or not. If yes, transaction status

is set to Elevate restricted. If no, it is checked if security is in watch list or not. If yes, status is changed to elevate watch list. If the output is no, requirement for PTC is checked. Positive answer results to check security type is wise or not. Yes results a check of PTC obtained or not. Yes says checking of sell transactions. If security type is not wise then sector is wise or not is checked. If yes then PTC obtained or not is checked and no results sell transaction checking. Positive sell transaction ask for minimum holdings are available or not ad yes updates transaction status to Elevate Minimum holding period IF no sell transaction or no minimum holdings, transaction is set to Cleared and process ends here.

Chapter 4

Results

4.1 SSH

Data comes without header which is shown in figure 4.1.

Figure 4.1: Security Data

Data is entered with header manually. Security is mapped with compliance admin security. There are four cases in compliance admin security.

a. Ticker and Security name both exist.

b. Ticker Exist but Security name not exist.

c. Ticker not exist but Security name exist.

d. Ticker and Security name both not exist.

In cases a and b, security in compliance admin security is not added or updated. For case c, Security is updated in compliance admin security assuming improper information. For case d , new security is created in compliance admin security. All above cases are shown in figure.

Figure 4.2: Case A - Ticker and Security name both exist.

Figure 4.3: Case B - Ticker Exist but Security name not exist.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	JPM Security	Date of Se	CUSIP Nur	SEDOL Numbe	ISIN Nu	TickerS	Security Description 1	Ticker Exis	Securit	Securit	Securit	Securit	S	JPM M	JPM Minc
92	780259206	20120430	780259206	US7802592060		RDS A	ROYAL DUTCH SHELL PLC	Not exist	Exist	ADR				EQ & COI	ENERGY

Figure 4.4: Case C - Ticker not exist but Security name exist

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	JPM Se	Date of	CUSIP Nun	SEDOL Number	ISIN	TickerS	Security Description 1	Ticker Ex	Securit	Securit	Securi	Secu	S	JPM Ma	JPM Minc
71	8.55E+08	20120430	854502101	US8545021011		SWK	STANLEY BLACK & DECKER,INC.	Not exist	Not exist					EQ & COM	UNCLASSIFD
89	6.41E+08	20120430	641069406	US6410694060		NSRG Y	NESTLE S A	Not exist	Not exist	SPONS AD				EQ & COM	CONSUMER

Figure 4.5: Case D - Ticker and Security name both not exist.

4.1.1 Compliance Admin Security output

Output is implemented in console application in .net C#. Which take security csv
file as input.

As discussed earlier, firstly, ticker is checked for its existence in system. Same way,
security name and CUSIP are checked in order and according to that, new security
is created. If ticker or CUSIP is found, no further action takes place. If security
name exist but ticker is not than security is updated using broker details. If none of
them exist in compliance system, then new security is created in compliance admin
security.

For given data set compliance admin security output is show in figure.

#			Security Name	Ticker	CUSIP	Security Type	Exchange	System Created On	System Last Modified On ↑
1	☐	Edit	STANLEY BLACK & DECKER,INC.	SWK	854502101	Equity	NYSE	12/13/2015 11:55 PM EST	12/13/2015 11:55 PM EST
2	☐	Edit	NESTLE S A	NSRG Y	641069406	Equity	OTC	12/13/2015 11:55 PM EST	12/13/2015 11:55 PM EST
3	☐	Edit	Royal Dutch Shell PLC	RDS A	780259206	Equity	NYSE	12/16/2014 5:16 AM EST	12/13/2015 11:55 PM EST
4	☐	Edit	Zendesk, Inc.	ZEN	98936J101	Equity	NYSE	12/11/2015 8:00 AM EST	12/11/2015 8:00 AM EST
5	☐	Edit	Prudential Financial, Inc.	PRA	744320102	Equity	NYSE	12/11/2015 7:49 AM EST	12/11/2015 7:49 AM EST

Figure 4.6: Compliance Admin Security output

4.1.2 Admin Propagation Agent Output

It is implemented using relativity agent functionality. Relativity platform allow to
create and customize agent. Admin propagation agent is created to make security
centralized.

#			Security Name	Ticker	CUSIP	Security Type	Exchange	System Created On	System Last Modifi...↑
		(All) ⌄	(All)	(All)	(All)	(All) ⌄		(All) ⌄	(All) ⌄
1	☐	Edit	NESTLE S A	NSRG Y	641069406	Equity	OTC	12/14/2015 12:06 AM EST	12/14/2015 12:06 AM EST
2	☐	Edit	STANLEY BLACK & DECKER,INC.	SWK	854502101	Equity	NYSE	12/14/2015 12:06 AM EST	12/14/2015 12:06 AM EST
3	☐	Edit	Royal Dutch Shell PLC	RDS A	780259206	Equity	NYSE	7/10/2014 4:26 PM EDT	12/14/2015 12:06 AM EST
4	☐	Edit	Test	1		Equity	Test	7/10/2014 4:31 PM EDT	12/8/2014 7:19 AM EST
5	☐	Edit	Zweig Total Return Fund, Inc. (The)	ZTR		Equity	NYSE	7/10/2014 4:31 PM EDT	12/8/2014 7:19 AM EST

Figure 4.7: Admin Propagation Agent Output

Any addition or update in security is checked by admin propagation agent periodically in compliance admin and if found then added or updated in all other hedge fund company. Hedge fund company data is updated after compliance admin changes security table. Output is shown in figure.

4.2   E-Feed

4.2.1   December 2015 Transaction

For December 2015, number of transaction are 64. Transactions are created in 7 different workspace and 27 accounts were affected. In workspace 1, five transactions are created and two accounts are affected. In workspace 2, nine transactions are created and one account is affected. Workspace 3 has eleven transactions and five affected accounts. In workspace 4, three transactions are created with three affected accounts. In workspace 5, eight transactions are created and two accounts are affected. In workspace 6, nineteen transactions are created and ten accounts are affected. Workspace 7 has nine transactions with four affected accounts. All transactions are shown in figure 4.8 below.

#			Public Security	BrokerStatements	Transacti...	Transaction...	Price Per Unit	Quantity_	Trade Date	Settlement ...	IPO	Private or Li...	Description
		(All) ⌄		(All)	(All) ⌄	(All)	(All)	(All)	(All)	(All)	(All)	(All) ⌄	(All)
1	☐	Edit	3M Company	Broker Statement 12_31_2015	Sell	$25,831.64	$156.56	165.00	12/14/2015	12/19/2015	No	No	
2	☐	Edit	Zendesk, Inc.	Broker Statement 12_31_2015	Sell	$650.88	$27.12	24.00	12/9/2015	12/14/2015	No	No	
3	☐	Edit	Apple Inc.	Broker Statement 12_31_2015	Buy	$12,147.50	$107.50	113.00	12/23/2015	12/28/2015	No	No	
4	☐	Edit	River Valley Bancorp.	Broker Statement 12_31_2015	Buy	$580.89	$34.17	17.00	12/11/2015	12/16/2015	No	No	
5	☐	Edit	Coca-Cola Company (The)	Broker Statement 12_31_2015	Buy	$8,768.00	$43.84	200.00	12/16/2015	12/21/2015	No	No	

#			Public Security	BrokerStatements	Transacti...	Transaction...	Price Per Unit	Quantity_	Trade Date	Settlement ...	IPO		Private or Li...	Description
		(All) ▾		(All)	(All) ▾	(All)	(All)	(All)	(All)	(All)	(All) ▾	(All) ▾	(All)
1	☐	Edit	Perficient, Inc.	Broker Statement 12_31_2015	Buy	$293.59	$17.27	17.00	12/23/2015	12/28/2015	No		No	
2	☐	Edit	Terex Corporation	Broker Statement 12_31_2015	Buy	$1,843.70	$17.90	103.00	12/21/2015	12/26/2015	No		No	
3	☐	Edit	Imperva, Inc.	Broker Statement 12_31_2015	Sell	$7,366.47	$65.19	113.00	12/29/2015	1/3/2016	No		No	
4	☐	Edit	Acadia Healthcare Company, Inc.	Broker Statement 12_31_2015	Sell	$3,045.60	$63.45	48.00	12/14/2015	12/19/2015	No		No	
5	☐	Edit	Adobe Systems Incorporated	Broker Statement 12_31_2015	Buy	$34,918.52	$94.12	371.00	12/28/2015	1/2/2016	No		No	
6	☐	Edit	Airgas, Inc.	Broker Statement 12_31_2015	Buy	$60,262.30	$137.90	437.00	12/28/2015	1/2/2016	No		No	
7	☐	Edit	Hanesbrands Inc.	Broker Statement 12_31_2015	Buy	$16,799.16	$28.57	588.00	12/28/2015	1/2/2016	No		No	
8	☐	Edit	Aon plc	Broker Statement 12_31_2015	Buy	$78,457.80	$91.23	860.00	12/28/2015	1/2/2016	No		No	
9	☐	Edit	Apogee Enterprises, Inc.	Broker Statement 12_31_2015	Sell	$14,997.06	$44.37	338.00	12/28/2015	1/2/2016	No		No	

#			Public Security	BrokerStatements	Transacti...	Transaction...	Price Per Unit	Quantity_	Trade Date	Settlement ...	IPO		Private or Li...	Description
		(All) ▾		(All)	(All) ▾	(All)	(All)	(All)	(All)	(All)	(All) ▾	(All) ▾	(All)
1	☐	Edit	AtriCure, Inc.	Broker Statement 12_31_2015	Sell	$3,983.98	$21.89	182.00	12/28/2015	1/2/2016	No		No	
2	☐	Edit	Griffon Corporation	Broker Statement 12_31_2015	Sell	$5,942.80	$17.90	332.00	12/28/2015	1/2/2016	No		No	
3	☐	Edit	Bristol-Myers Squibb Company	Broker Statement 12_31_2015	Sell	$20,128.47	$69.17	291.00	12/28/2015	1/2/2016	No		No	
4	☐	Edit	Brookfield Asset Management Inc	Broker Statement 12_31_2015	Buy	$1,243.71	$31.89	39.00	12/23/2015	12/28/2015	No		No	
5	☐	Edit	Cempra, Inc.	Broker Statement 12_31_2015	Sell	$2,600.40	$29.55	88.00	12/15/2015	12/20/2015	No		No	
6	☐	Edit	Dow Chemical Company (The)	Broker Statement 12_31_2015	Sell	$4,312.90	$50.15	86.00	12/18/2015	12/23/2015	No		No	
7	☐	Edit	Chevron Corporation	Broker Statement 12_31_2015	Buy	$5,253.36	$93.81	56.00	12/23/2015	12/28/2015	No		No	
8	☐	Edit	CIENA Corporation	Broker Statement 12_31_2015	Buy	$930.60	$21.15	44.00	12/30/2015	1/4/2016	No		No	
9	☐	Edit	Clovis Oncology, Inc.	Broker Statement 12_31_2015	Sell	$269.20	$33.65	8.00	12/21/2015	12/26/2015	No		No	
10	☐	Edit	Colfax Corporation	Broker Statement 12_31_2015	Sell	$2,466.85	$23.95	103.00	12/24/2015	12/29/2015	No		No	
11	☐	Edit	CommVault Systems, Inc.	Broker Statement 12_31_2015	Buy	$5,822.92	$39.08	149.00	12/23/2015	12/28/2015	No		No	

#			Public Security	BrokerStatements	Transacti...	Transaction...	Price Per Unit	Quantity_	Trade Date	Settlement ...	IPO		Private or Li...	Description
		(All) ▾		(All)	(All) ▾	(All)	(All)	(All)	(All)	(All)	(All) ▾	(All) ▾	(All)
1	☐	Edit	Cornerstone OnDemand, Inc.	Broker Statement 12_31_2015	Buy	$519.27	$27.33	19.00	12/9/2015	12/14/2015	No		No	
2	☐	Edit	DaVita Inc.	Broker Statement 12_31_2015	Buy	$932.88	$71.76	13.00	12/10/2015	12/15/2015	No		No	
3	☐	Edit	DexCom, Inc.	Broker Statement 12_31_2015	Buy	$1,108.52	$79.18	14.00	12/15/2015	12/20/2015	No		No	

#			Public Security	BrokerStatements	Transacti...	Transaction...	Price Per Unit	Quantity_	Trade Date	Settlement ...	IPO		Private or Li...	Description
		(All) ▾		(All)	(All) ▾	(All)	(All)	(All)	(All)	(All)	(All) ▾	(All) ▾	(All)
1	☐	Edit	Chatham Lodging Trust (REIT)	Broker Statement 12_31_2015	Buy	$778.26	$22.89	34.00	12/1/2015	12/6/2015	No		No	
2	☐	Edit	Ebix Inc	Broker Statement 12_31_2015	Sell	$5,279.30	$34.06	155.00	12/29/2015	1/3/2016	No		No	
3	☐	Edit	Exxon Mobil Corporation	Broker Statement 12_31_2015	Buy	$767.63	$26.47	29.00	12/9/2015	12/14/2015	No		No	
4	☐	Edit	Fidelity National Financial, Inc.	Broker Statement 12_31_2015	Buy	$7,458.00	$33.90	220.00	12/24/2015	12/29/2015	No		No	
5	☐	Edit	Valmont Industries, Inc.	Broker Statement 12_31_2015	Buy	$2,342.20	$117.11	20.00	12/1/2015	12/6/2015	No		No	
6	☐	Edit	Generac Holdings Inc.	Broker Statement 12_31_2015	Sell	$440.30	$31.45	14.00	12/4/2015	12/9/2015	No		No	
7	☐	Edit	Chicago Bridge & Iron Company N.V.	Broker Statement 12_31_2015	Sell	$421.10	$42.11	10.00	12/22/2015	12/27/2015	No		No	
8	☐	Edit	H&E Equipment Services, Inc.	Broker Statement 12_31_2015	Buy	$2,948.82	$16.66	177.00	12/22/2015	12/27/2015	No		No	

#			Public Security	BrokerStatements	Transacti...	Transaction...	Price Per Unit	Quantity_	Trade Date	Settlement ...	IPO	Private or Li...	Description
	☐		(All) ▼	(All)	(All) ▼	(All)	(All)	(All)	(All)	(All)	(All) ▼	(All) ▼	(All)
1	☐	Edit	HMS Holdings Corp	Broker Statement 12_31_2015	Buy	$342.63	$12.69	27.00	12/30/2015	1/4/2016	No	No	
2	☐	Edit	HomeAway, Inc.	Broker Statement 12_31_2015	Buy	$6,116.60	$35.98	170.00	12/4/2015	12/9/2015	No	No	
3	☐	Edit	Imperva, Inc.	Broker Statement 12_31_2015	Buy	$3,931.95	$71.49	55.00	12/9/2015	12/14/2015	No	No	
4	☐	Edit	Infinera Corporation	Broker Statement 12_31_2015	Buy	$403.88	$17.56	23.00	12/22/2015	12/27/2015	No	No	
5	☐	Edit	Integrated Device Technology, Inc.	Broker Statement 12_31_2015	Buy	$3,022.14	$26.51	114.00	12/24/2015	12/29/2015	No	No	
6	☐	Edit	Intel Corporation	Broker Statement 12_31_2015	Buy	$1,550.12	$35.23	44.00	12/1/2015	12/6/2015	No	No	
7	☐	Edit	Chicago Bridge & Iron Company N.V.	Broker Statement 12_31_2015	Buy	$10,574.63	$42.13	251.00	12/1/2015	12/6/2015	No	No	
8	☐	Edit	Kinder Morgan, Inc.	Broker Statement 12_31_2015	Buy	$222.04	$15.86	14.00	12/17/2015	12/22/2015	No	No	
9	☐	Edit	Ebix Inc	Broker Statement 12_31_2015	Sell	$5,758.56	$33.48	172.00	12/29/2015	1/3/2016	No	No	
10	☐	Edit	China Xiniya Fashion Limited	Broker Statement 12_31_2015	Buy	$228.79	$1.67	137.00	12/22/2015	12/27/2015	No	No	
11	☐	Edit	Mohawk Industries, Inc.	Broker Statement 12_31_2015	Sell	$41,004.63	$192.51	213.00	12/29/2015	1/3/2016	No	No	
12	☐	Edit	LPL Financial Holdings Inc.	Broker Statement 12_31_2015	Buy	$4,425.52	$41.36	107.00	12/21/2015	12/26/2015	No	No	
13	☐	Edit	Hamilton Bancorp, Inc.	Broker Statement 12_31_2015	Sell	$2,023.00	$14.45	140.00	12/30/2015	1/4/2016	No	No	
14	☐	Edit	3M Company	Broker Statement 12_31_2015	Sell	$2,035.54	$156.58	13.00	12/1/2015	12/6/2015	No	No	
15	☐	Edit	Oceaneering International, Inc.	Broker Statement 12_31_2015	Sell	$630.87	$37.11	17.00	12/18/2015	12/23/2015	No	No	
16	☐	Edit	Integrated Device Technology, Inc.	Broker Statement 12_31_2015	Sell	$1,044.81	$26.79	39.00	12/23/2015	12/28/2015	No	No	
17	☐	Edit	Integrated Device Technology, Inc.	Broker Statement 12_31_2015	Buy	$2,345.20	$26.65	88.00	12/23/2015	12/28/2015	No	No	
18	☐	Edit	Oaktree Capital Group, LLC	Broker Statement 12_31_2015	Buy	$3,293.37	$47.73	69.00	12/30/2015	1/4/2016	No	No	
19	☐	Edit	Kinder Morgan, Inc.	Broker Statement 12_31_2015	Buy	$760.62	$18.11	42.00	12/9/2015	12/14/2015	No	No	

#			Public Security	BrokerStatements	Transacti...	Transaction...	Price Per Unit	Quantity_	Trade Date	Settlement ...	IPO	Private or Li...	Description
	☐		(All) ▼	(All)	(All) ▼	(All)	(All)	(All)	(All)	(All)	(All) ▼	(All) ▼	(All)
1	☐	Edit	Kinder Morgan, Inc.	Broker Statement 12_31_2015	Buy	$3,640.80	$15.17	240.00	12/18/2015	12/23/2015	No	No	
2	☐	Edit	Apple Inc.	Broker Statement 12_31_2015	Sell	$5,181.60	$107.95	48.00	12/24/2015	12/29/2015	No	No	
3	☐	Edit	Zumiez Inc.	Broker Statement 12_31_2015	Sell	$702.18	$14.94	47.00	12/1/2015	12/6/2015	No	No	
4	☐	Edit	DexCom, Inc.	Broker Statement 12_31_2015	Sell	$3,482.64	$82.92	42.00	12/23/2015	12/28/2015	No	No	
5	☐	Edit	Colfax Corporation	Broker Statement 12_31_2015	Sell	$8,436.00	$28.12	300.00	12/4/2015	12/9/2015	No	No	
6	☐	Edit	Chatham Lodging Trust (REIT)	Broker Statement 12_31_2015	Sell	$928.84	$21.11	44.00	12/14/2015	12/19/2015	No	No	
7	☐	Edit	Castle (A.M.) & Co.	Broker Statement 12_31_2015	Sell	$55.50	$2.22	25.00	12/10/2015	12/15/2015	No	No	
8	☐	Edit	Vodafone Group Plc	Broker Statement 12_31_2015	Buy	$1,927.20	$32.12	60.00	12/23/2015	12/28/2015	No	No	
9	☐	Edit	Netflix, Inc.	Broker Statement 12_31_2015	Sell	$7,369.69	$124.91	59.00	12/10/2015	12/15/2015	No	No	

Figure 4.8: Dec Transactions

4.2.2 January 2016 transaction

For January 2016 number of transactions are 41. Transactions were created in 6
different workspace and 18 different accounts. In workspace 1, there was one transac-
tion created and one account was affected. Workspace 2 has 4 transactions and there
affected accounts. Workspace 3 has nine transactions and four affected accounts.
Workspace 4 consists of six transactions and three affected accounts. In work space
5, four transactions were created and two accounts were affected. Workspace 6 has
seventeen transactions and five affected accounts. All transactions are shown in figure
4.9 below.

#			Public Security	BrokerStatements	Transacti...	Transaction...	Price Per Unit	Quantity_	Trade Date	Settlement ...	IPO	Private or Li...	Description
	☐		(All) ▼	(All)	(All) ▼	(All)	(All)	(All)	(All)	(All)	(All) ▼	(All) ▼	(All)
1	☐	Edit	Bed Bath & Beyond Inc.	Broker Statement 01_31_2016	Sell	$1,014.30	$48.30	21.00	1/5/2016	1/10/2016	No	No	

#			Public Security	BrokerStatements	Transacti...	Transaction...	Price Per Unit	Quantity_	Trade Date	Settlement ...	IPO	Private or Li...	Description
		(All) ▼		(All)	(All) ▼	(All)	(All)	(All)	(All)	(All)	(All) ▼	(All) ▼	(All)
1	☐	Edit	Coca-Cola Company (The)	Broker Statement 01_31_2016	Sell	$708.05	$41.65	17.00	1/19/2016	1/24/2016	No		No
2	☐	Edit	Boston Beer Company, Inc. (The)	Broker Statement 01_31_2016	Buy	$14,805.00	$164.50	90.00	1/26/2016	1/30/2016	No		No
3	☐	Edit	Prudential Financial, Inc.	Broker Statement 01_31_2016	Sell	$2,279.50	$48.50	47.00	1/25/2016	1/29/2016	No		No
4	☐	Edit	American International Group, Inc.	Broker Statement 01_31_2016	Buy	$17,229.24	$54.18	318.00	1/28/2016	2/2/2016	No		No

#			Public Security	BrokerStatements	Transacti...	Transaction...	Price Per Unit	Quantity_	Trade Date	Settlement ...	IPO	Private or Li...	Description
		(All) ▼		(All)	(All) ▼	(All)	(All)	(All)	(All)	(All)	(All) ▼	(All) ▼	(All)
1	☐	Edit	Yelp Inc.	Broker Statement 01_31_2016	Buy	$284.90	$25.90	11.00	1/8/2016	1/13/2016	No		No
2	☐	Edit	Coca-Cola Company (The)	Broker Statement 01_31_2016	Buy	$2,187.12	$42.06	52.00	1/22/2016	1/26/2016	No		No
3	☐	Edit	NewBridge Bancorp	Broker Statement 01_31_2016	Sell	$2,327.60	$10.58	220.00	1/20/2016	1/24/2016	No		No
4	☐	Edit	Krispy Kreme Doughnuts, Inc.	Broker Statement 01_31_2016	Buy	$607.64	$13.81	44.00	1/14/2016	2/19/2016	No		No
5	☐	Edit	BankFinancial Corporation	Broker Statement 01_31_2016	Buy	$523.74	$12.47	42.00	1/13/2016	1/18/2016	No		No
6	☐	Edit	iPass Inc.	Broker Statement 01_31_2016	Buy	$38.95	$0.95	41.00	1/22/2016	1/26/2016	No		No
7	☐	Edit	Dynex Capital, Inc.	Broker Statement 01_31_2016	Buy	$97.41	$5.73	17.00	1/29/2016	2/4/2016	No		No
8	☐	Edit	Coca-Cola Company (The)	Broker Statement 01_31_2016	Sell	$1,541.05	$41.65	37.00	1/19/2016	1/24/2016	No		No
9	☐	Edit	Prudential Financial, Inc.	Broker Statement 01_31_2016	Sell	$8,300.72	$48.26	172.00	1/25/2016	1/29/2016	No		No

#			Public Security	BrokerStatements	Transacti...	Transaction...	Price Per Unit	Quantity_	Trade Date	Settlement ...	IPO	Private or Li...	Description
		(All) ▼		(All)	(All) ▼	(All)	(All)	(All)	(All)	(All)	(All) ▼	(All) ▼	(All)
1	☐	Edit	Unifi, Inc.	Broker Statement 01_31_2016	Sell	$1,112.28	$24.18	46.00	1/22/2016	1/26/2016	No		No
2	☐	Edit	First Bancorp	Broker Statement 01_31_2016	Sell	$393.75	$18.75	21.00	1/29/2016	2/4/2016	No		No
3	☐	Edit	Atmel Corporation	Broker Statement 01_31_2016	Sell	$143.28	$7.96	18.00	1/22/2016	1/26/2016	No		No
4	☐	Edit	Electronic Arts Inc.	Broker Statement 01_31_2016	Buy	$1,384.90	$62.95	22.00	1/8/2016	1/13/2016	No		No
5	☐	Edit	Superior Uniform Group, Inc.	Broker Statement 01_31_2016	Sell	$1,542.45	$16.95	91.00	1/8/2016	1/13/2016	No		No
6	☐	Edit	BankFinancial Corporation	Broker Statement 01_31_2016	Sell	$5,019.65	$58.37	86.00	1/13/2016	1/18/2016	No		No

#			Public Security	BrokerStatements	Transacti...	Transaction...	Price Per Unit	Quantity_	Trade Date	Settlement ...	IPO	Private or Li...	Description
		(All) ▼		(All)	(All) ▼	(All)	(All)	(All)	(All)	(All)	(All) ▼	(All) ▼	(All)
1	☐	Edit	Neurocrine Biosciences, Inc.	Broker Statement 01_31_2016	Buy	$3,051.84	$46.24	66.00	1/8/2016	1/13/2016	No		No
2	☐	Edit	Acacia Research Corporation	Broker Statement 01_31_2016	Buy	$101.08	$3.61	28.00	1/29/2016	2/4/2016	No		No
3	☐	Edit	Guggenheim Strategic Opportunities Fund	Broker Statement 01_31_2016	Sell	$2,488.20	$15.95	156.00	1/29/2016	2/4/2016	No		No
4	☐	Edit	Zendesk, Inc.	Broker Statement 01_31_2016	Sell	$5,220.60	$22.60	231.00	1/14/2016	1/19/2016	No		No

#			Public Security	BrokerStatements	Transacti...	Transaction...	Price Per Unit	Quantity_	Trade Date	Settlement ...	IPO	Private or Li...	Description
		(All) ▼		(All)	(All) ▼	(All)	(All)	(All)	(All)	(All)	(All) ▼	(All) ▼	(All)
1	☐	Edit	Sun Communities, Inc.	Broker Statement 01_31_2016	Buy	$536.56	$67.07	8.00	1/7/2016	1/12/2016	No		No
2	☐	Edit	Layne Christensen Company	Broker Statement 01_31_2016	Buy	$69.60	$4.64	15.00	1/22/2016	1/26/2016	No		No
3	☐	Edit	Ebix Inc	Broker Statement 01_31_2016	Buy	$74.82	$12.47	6.00	1/13/2016	1/18/2016	No		No
4	☐	Edit	Apple Inc.	Broker Statement 01_31_2016	Buy	$507.65	$101.53	5.00	1/25/2016	1/29/2016	No		No
5	☐	Edit	Tri Continental Corporation	Broker Statement 01_31_2016	Buy	$568.00	$17.75	32.00	1/21/2016	1/25/2016	No		No
6	☐	Edit	Dreamworks Animation SKG, Inc.	Broker Statement 01_31_2016	Sell	$924.84	$25.69	36.00	1/28/2016	2/2/2016	No		No
7	☐	Edit	Xinyuan Real Estate Co Ltd	Broker Statement 01_31_2016	Buy	$54.30	$3.62	15.00	1/13/2016	1/18/2016	No		No
8	☐	Edit	Education Management Corporation	Broker Statement 01_31_2016	Buy	$0.16	$0.08	2.00	1/29/2016	2/4/2016	No		No
9	☐	Edit	Netlist, Inc.	Broker Statement 01_31_2016	Buy	$3.12	$1.04	3.00	1/29/2016	2/4/2016	No		No
10	☐	Edit	Bank of Nova Scotia (The)	Broker Statement 01_31_2016	Sell	$12,616.50	$38.82	325.00	1/28/2016	2/2/2016	No		No
11	☐	Edit	Tronox Limited	Broker Statement 01_31_2016	Sell	$251.56	$3.31	76.00	1/28/2016	2/2/2016	No		No
12	☐	Edit	QEP Resources, Inc.	Broker Statement 01_31_2016	Buy	$1,456.44	$13.74	106.00	1/5/2016	1/10/2016	No		No
13	☐	Edit	Investors Title Company	Broker Statement 01_31_2016	Buy	$63,281.86	$93.89	674.00	1/6/2016	1/11/2016	No		No
14	☐	Edit	Trina Solar Limited	Broker Statement 01_31_2016	Buy	$111.00	$9.25	12.00	1/22/2016	1/26/2016	No		No
15	☐	Edit	On Track Innovations Ltd	Broker Statement 01_31_2016	Buy	$7.38	$0.41	18.00	1/22/2016	1/26/2016	No		No
16	☐	Edit	Patrick Industries, Inc.	Broker Statement 01_31_2016	Buy	$101.04	$33.68	3.00	1/28/2016	2/2/2016	No		No
17	☐	Edit	Electronics for Imaging, Inc.	Broker Statement 01_31_2016	Buy	$272.22	$45.37	6.00	1/28/2016	2/2/2016	No		No

Figure 4.9: Jan Transactions

4.2.3 Results Transaction Rule

For March 2016 number of transactions are 23. Transactions were created in 6 different workspace and 11 different accounts. In workspace 1, there was five transactions created and two accounts was affected. Workspace 2 has two transactions and one affected account. Workspace 3 has one transaction and one affected account. Workspace 4 consists of five transactions and three affected accounts. In work space 5, six transactions were created and three accounts were affected. Workspace 6 has four transactions and one affected account. In JPM broker there are thirteen transactions. In Merrill Lynch broker, there are ten transactions. All transactions are shown in figure 4.10 below.

#		Public Security	Broker Statements	Brokerage Ac...	Transaction...	Transaction ...	Price Per Unit	Quantity_	Trade Date	Settlement D...	Status	IPO	Private or Li...	Description
		(All) ▼	(All)	(All)	(All) ▼	(All)	(All)	(All)	(All)	(All)	(All) ▼	(All) ▼	(All) ▼	(All)
1	Edit	New Mountain Finance Corporation	Broker Statement 3_31_2016	JP Morgan	Buy	$4,450.09	$14.82	300.00	3/14/2016	3/17/2016	Cleared	No	No	
2	Edit	Icahn Enterprises L.P.	Broker Statement 3_31_2016	JP Morgan	Buy	$4,604.99	$92.00	50.00	3/15/2016	3/20/2016	Elevate - No Pre-Clearance	No	No	
3	Edit	Monsanto Company	Broker Statement 3_31_2016	Merrill Lynch	Buy	$4,736.14	$118.00	40.00	3/24/2016	3/29/2016	Cleared	No	No	
4	Edit	Baxter International Inc.	Broker Statement 3_31_2016	Merrill Lynch	Sell	$4,261.47	$71.06	60.00	3/24/2016	3/29/2016	Cleared	No	No	
5	Edit	CME Group Inc.	Broker Statement 3_31_2016	JP Morgan	Sell	$6,663.12	$90.04	74.00	3/29/2016	4/1/2016	Cleared	No	No	

#		Public Secur...	Broker Statements	Brokerage A...	Transaction ...	Transaction ...	Price Per Unit	Quantity_	Trade Date	Settlement D...	Status	IPO	Private or Li...	Description
		(All) ▼	(All)	(All)	(All)	(All)	(All)	(All)	(All)	(All)	(All) ▼	(All) ▼	(All) ▼	(All)
1	Edit	McDonald's Corporation	Broker Statement 3_31_2016	JP Morgan	Buy	$8,581.46	$98.64	87.00	3/29/2016	4/1/2016	Cleared	No	No	
2	Edit	Willis Group Holdings Limited	Broker Statement 3_31_2016	JP Morgan	Buy	$5,482.68	$49.39	111.00	3/17/2016	3/22/2016	Cleared	No	No	

#		Public Security	Broker Statements	Brokerage Account	Transact...	Transaction ...	Price Per Unit	Quantity_	Trade Date	Settlement D...	Status	IPO	Private or Li...	Description
		(All) ▼	(All)	(All)	(All) ▼	(All)	(All)	(All)	(All)	(All)	(All) ▼	(All) ▼	(All) ▼	(All)
1	Edit	U.S. Silica Holdings, Inc.	Broker Statement 3_31_2016	Merrill Lynch	Buy	$3,679.28	$34.71	106.00	3/2/2016	3/7/2016	Cleared	No	No	

#		Public Secur...	Broker Statements	Brokerage Accou...	Transacti...	Transaction ...	Price Per Unit	Quantity_	Trade Date	Settlement ...	Status	IPO	Private or Li...	Description
		(All) ▼	(All)	(All)	(All) ▼	(All)	(All)	(All)	(All)	(All)	(All) ▼	(All) ▼	(All) ▼	(All)
1	Edit	Perrigo Company	Broker Statement 3_31_2016	Merrill Lynch	Sell	$3,680.05	$193.69	19.00	3/22/2016	3/25/2016	Cleared	No	No	
2	Edit	East West Bancorp, Inc.	Broker Statement 3_31_2016	JP Morgan	Buy	$2,230.60	$42.08	53.00	3/25/2016	3/28/2016	Cleared	No	No	
3	Edit	United Rentals, Inc.	Broker Statement 3_31_2016	JP Morgan	Buy	$1,078.91	$89.91	12.00	3/29/2016	4/1/2016	Cleared	No	No	
4	Edit	Fortinet, Inc.	Broker Statement 3_31_2016	Merrill Lynch	Sell	$646.24	$38.01	17.00	3/16/2016	3/21/2016	Elevate - Minimum Holding Period	No	No	
5	Edit	Flotek Industries, Inc.	Broker Statement 3_31_2016	Merrill Lynch	Buy	$729.70	$11.58	63.00	3/15/2016	3/18/2016	Cleared	No	No	

#			Public Secur...	BrokerStatements	Brokerage Accou...	Transacti...	Transaction ...	Price Per Unit	Quantity_	Trade Date	Settlement ...	Status	IPO	Private or Li...	Description
	☐		(All) ▼	(All)	(All)	(All) ▼	(All)	(All)	(All)	(All)	(All)	(All) ▼	(All) ▼	(All) ▼	(All)
1	☐	Edit	AT&T Inc.	Broker Statement 3_31_2016	Merrill Lynch	Buy	$103.23	$34.39	3.00	3/8/2016	3/11/2016	Cleared	No	No	
2	☐	Edit	BCE, Inc.	Broker Statement 3_31_2016	Merrill Lynch	Buy	$87.28	$43.62	2.00	3/22/2016	3/25/2016	Cleared	No	No	
3	☐	Edit	Chevron Corporation	Broker Statement 3_31_2016	Merrill Lynch	Buy	$103.39	$103.37	1.00	3/22/2016	3/25/2016	Cleared	No	No	
4	☐	Edit	Coca-Cola Company (The)	Broker Statement 3_31_2016	JP Morgan	Buy	$41.27	$41.25	1.00	3/14/2016	3/17/2016	Cleared	No	No	
5	☐	Edit	Duke Energy Corporation	Broker Statement 3_31_2016	JP Morgan	Buy	$75.92	$75.90	1.00	3/18/2016	3/21/2016	Cleared	No	No	
6	☐	Edit	Health Care REIT, Inc.	Broker Statement 3_31_2016	Merrill Lynch	Buy	$70.89	$70.87	1.00	3/3/2016	3/8/2016	Cleared	No	No	

#			Public Secur...	BrokerStatements	Brokerage Accou...	Transacti...	Transaction ...	Price Per Unit	Quantity_	Trade Date	Settlement ...	Status	IPO	Private or Li...	Description
	☐		(All) ▼	(All)	(All)	(All) ▼	(All)	(All)	(All)	(All)	(All)	(All) ▼	(All) ▼	(All) ▼	(All)
1	☐	Edit	PVH Corp.	Broker Statement 3_31_2016	JP Morgan	Buy	$2,101.60	$105.08	20.00	3/28/2016	3/31/2016	Cleared	No	No	
2	☐	Edit	Dick's Sporting Goods Inc	Broker Statement 3_31_2016	JP Morgan	Sell	$802.23	$53.48	15.00	3/25/2016	3/28/2016	Cleared	No	No	
3	☐	Edit	Esterline Technologies Corporation	Broker Statement 3_31_2016	JP Morgan	Sell	$1,683.56	$93.53	18.00	3/14/2016	3/17/2016	Cleared	No	No	
4	☐	Edit	Staples, Inc.	Broker Statement 3_31_2016	JP Morgan	Buy	$1,677.24	$16.28	103.00	3/2/2016	3/7/2016	Elevate - Pre-Clearance Out Of Range	No	No	

Figure 4.10: March transaction with status

4.2.4 Monitor

In following figure 4.11 shows that monitor process of the electronic feed. It shows following data.

- As of Date - Date on which the file was produced.

- Feed Platform - broker name which is provided information.

- Feed Process Status - Completed is set when all transaction are successfully uploaded in compliance. Exception is set when any transaction are not uploaded in compliance due to any exception.

- Total Transaction - number of total transaction for that file

- Uploaded Security - number of total security that need to create.

- Uploaded Transaction -number of uploaded transaction successfully for that file

- Exception Count - number of exception during uploading transactions.

Feed Process ID	As Of Date	Feed Platform	Feed Process Status	Total Transaction	Upload Security	Upload Transaction	ExceptionCount
10	04/30/2016	Merrill Lynch	Completed	10	3	10	0
9	04/30/2016	JPM	Completed	13	1	13	0
8	03/31/2016	JPM	Completed	1	1	1	0
7	03/31/2016	JPM	Exception	14	2	13	1
6	02/29/2016	JPM	Completed	6	0	6	0
5	01/31/2016	JPM	Completed	4	1	4	0
4	01/31/2016	JPM	Exception	41	18	37	4
3	12/31/2015	JPM	Completed	7	7	7	0
2	12/31/2015	JPM	Exception	15	5	8	7
1	12/31/2015	JPM	Exception	64	13	49	15

Figure 4.11: Monitor System

Details of exception shown when click on exception count. In following figure 4.12 shows that exception details. It shows following data.

- Feed Process Id - Date on which the file was produced.

- Workspace - Client name for that exception.

- Account number - account number for that exception.

- Details - Gives details of that exception.

- Row number - exception for that row .
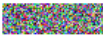
FeedProcessID	Workspace	Account Number	Details	Row Number
4	Whitheven		Security is not found.	8
4	Whitheven		Security is not found.	13
4	Hunting Hill		Account number not found	22
4	Hunting Hill		Account number not found	23

Figure 4.12: Exception

4.3   Stock Predication

Data set range is from 1-Jan-2005 to 31-Dec-2015. Different data sources such as yahoo finance and BSE india are considered for stock data. Same as that, different exchange such as NYSE, NASDAQ, BSE are taken in account for stock data and currency such as USD, INR. So, it is possible to check stock results for different currency, exchange and sources.

Purpose is to predict profit for given time frame using stock history. Prediction is ten percentage profit in thirty days. Six algorithms such as Neural Network, SVM Polynominal, SVM Radial, Random Forest, Navie Bayes, k-NN are used. Twelve attributes use in stock prediction algorithm which is generated from nine technical parameters. Hold and Buy are two class of this algorithm.

In following table describe data information.

Security	Source	Exchange	Currency
MCD	Yahoo Finace	NYSE	USD
AAPL.	Yahoo Finace	Nasdaq	USD
LGF	Yahoo Finace	NYSE	USD
RIIL	BSE India	BSE	INR
HDFCBANK	BSE India	BSE	INR
MOREPEN	BSE India	BSE	INR

Table 4.1: Data Set

4.4   Result of stock predication

For HDFC bank , results are shown in following figure for Naive Bayes, k-NN, Neural Network, SVM Polynomial, SVM Radial, Random Forest. [18, 19, 20]

4.4.1   Naive Bayes

```
.....................Naive Bayes.....................

Correctly Classified Instances          378                 71.5909
%
Incorrectly Classified Instances        150                 28.4091
%
Kappa statistic                              0.3256
Mean absolute error                          0.3484
Root mean squared error                      0.4268
Relative absolute error                     80.7764 %
Root relative squared error                 91.9233 %
Total Number of Instances               528
=== Confusion Matrix ===

   a    b    <-- classified as
 294   68 |    a = hold
  82   84 |    b = buy
=== Detailed Accuracy By Class ===

             TP Rate    FP Rate    Precision    Recall    F-Measure
ROC Area    Class
             0.812      0.494      0.782        0.812     0.797
0.751       hold
             0.506      0.188      0.553        0.506     0.528
0.751       buy
Weighted Avg.    0.716      0.398      0.71      0.716     0.712
0.751
```

Figure 4.13: NB

4.4.2   k-NN

```
.....................k-NN.....................

Correctly Classified Instances          460                 87.1212
%
Incorrectly Classified Instances         68                 12.8788
%
Kappa statistic                              0.7013
Mean absolute error                          0.1681
Root mean squared error                      0.2902
Relative absolute error                     38.9773 %
Root relative squared error                 62.4975 %
Total Number of Instances               528
=== Confusion Matrix ===

   a    b    <-- classified as
 328   34 |    a = hold
  34  132 |    b = buy
=== Detailed Accuracy By Class ===

             TP Rate    FP Rate    Precision    Recall    F-Measure
ROC Area    Class
             0.906      0.205      0.906        0.906     0.906
0.95        hold
             0.795      0.094      0.795        0.795     0.795
0.95        buy
Weighted Avg.    0.871      0.17      0.871      0.871     0.871
0.95
```

Figure 4.14: kNN

4.4.3   Neural Network

```
.....................Neural Network.....................

Correctly Classified Instances          401                  75.947
%
Incorrectly Classified Instances        127                  24.053
%
Kappa statistic                          0.3871
Mean absolute error                      0.2572
Root mean squared error                  0.4389
Relative absolute error                 59.6324 %
Root relative squared error             94.5342 %
Total Number of Instances               528
=== Confusion Matrix ===

   a    b    <-- classified as
 326   36 |    a = hold
  91   75 |    b = buy
=== Detailed Accuracy By Class ===

             TP Rate    FP Rate    Precision    Recall    F-Measure
ROC Area    Class
              0.901      0.548       0.782       0.901      0.837
0.779       hold
              0.452      0.099       0.676       0.452      0.542
0.779       buy
Weighted Avg.  0.759     0.407       0.748       0.759      0.744
0.779
```

Figure 4.15: Neural Network

4.4.4   SVM Polynomial

```
.....................SVM Polynomial.....................

Correctly Classified Instances          366                  69.3182
%
Incorrectly Classified Instances        162                  30.6818
%
Kappa statistic                          0.0454
Mean absolute error                      0.3068
Root mean squared error                  0.5539
Relative absolute error                 71.128  %
Root relative squared error            119.3069 %
Total Number of Instances               528
=== Confusion Matrix ===

   a    b    <-- classified as
 359    3 |    a = hold
 159    7 |    b = buy
=== Detailed Accuracy By Class ===

             TP Rate    FP Rate    Precision    Recall    F-Measure
ROC Area    Class
              0.992      0.958       0.693       0.992      0.816
0.517       hold
              0.042      0.008       0.7         0.042      0.08
0.517       buy
Weighted Avg.  0.693     0.659       0.695       0.693      0.584
0.517
```

Figure 4.16: SVM Polynomial

4.4.5   SVM Radial

```
......................SVM Radial......................

Correctly Classified Instances          422                 79.9242
%
Incorrectly Classified Instances        106                 20.0758
%
Kappa statistic                         0.4857
Mean absolute error                     0.2008
Root mean squared error                 0.4481
Relative absolute error                 46.5405 %
Root relative squared error             96.5075 %
Total Number of Instances               528
=== Confusion Matrix ===

   a    b    <-- classified as
 338   24 |    a = hold
  82   84 |    b = buy
=== Detailed Accuracy By Class ===

              TP Rate    FP Rate   Precision    Recall   F-Measure
ROC Area   Class
              0.934      0.494      0.805       0.934     0.864
0.72       hold
              0.506      0.066      0.778       0.506     0.613
0.72       buy
Weighted Avg. 0.799      0.36       0.796       0.799     0.785
0.72
```

Figure 4.17: SVM Radial

4.4.6   Random Forest

```
......................Random Forest......................

Correctly Classified Instances          484                 91.6667
%
Incorrectly Classified Instances        44                   8.3333
%
Kappa statistic                         0.8009
Mean absolute error                     0.1876
Root mean squared error                 0.256
Relative absolute error                 43.4879 %
Root relative squared error             55.1426 %
Total Number of Instances               528
=== Confusion Matrix ===

   a    b    <-- classified as
 349   13 |    a = hold
  31  135 |    b = buy
=== Detailed Accuracy By Class ===

              TP Rate    FP Rate   Precision    Recall   F-Measure
ROC Area   Class
              0.964      0.187      0.918       0.964     0.941
0.979      hold
              0.813      0.036      0.912       0.813     0.86
0.979      buy
Weighted Avg. 0.917      0.139      0.916       0.917     0.915
0.979
```

Figure 4.18: Random Forest

4.4.7   Comparison

Applying historical data compare the existing algorithms. Twelve technical parameter are used these different algorithms. Here total number of instances is 528. To calculate the correctness of different models we used confusion matrix with Buy and Hold. In following table shown accuracy of all six algorithm for that shares.

Share	Neural Network	SVM Polynomial	SVM Radial	Random Forest	Naive Bayes	k-NN
HDFC Bank	75.947	69.3182	79.9242	91.6667	71.5909	87.1212
LGF	77.881	70.4461	75.8364	89.9628	74.5353	86.9888
MOREPEN LAB	67.7358	57.9245	67.7358	88.3019	69.0566	80.7547
MCD	74.1636	67.8439	76.5799	91.2639	68.5874	88.1041
BABA	75	87.5	81.25	81.25	81.25	75
AAPL	74.9071	66.9145	78.6245	92.5651	69.145	87.7323
RILL	73.3962	68.8679	76.2264	91.8868	69.434	84.3396
Average	75.2158	71.8151	78.0735	89.7658	72.4237	84.881

Table 4.2: Comparison of different algorithm

From the results, it is seen that the random forest performs best compare to all others. Second best is k-nn model.Random forest and k-nn gives accuracy above 80 %. Neural network and SVM radial gives accuracy above 75%. Naive bayes and SVM Polynomial gives accuracy above 70%. In figures 4.19 shows comparison of accuracy algorithms using line graph.
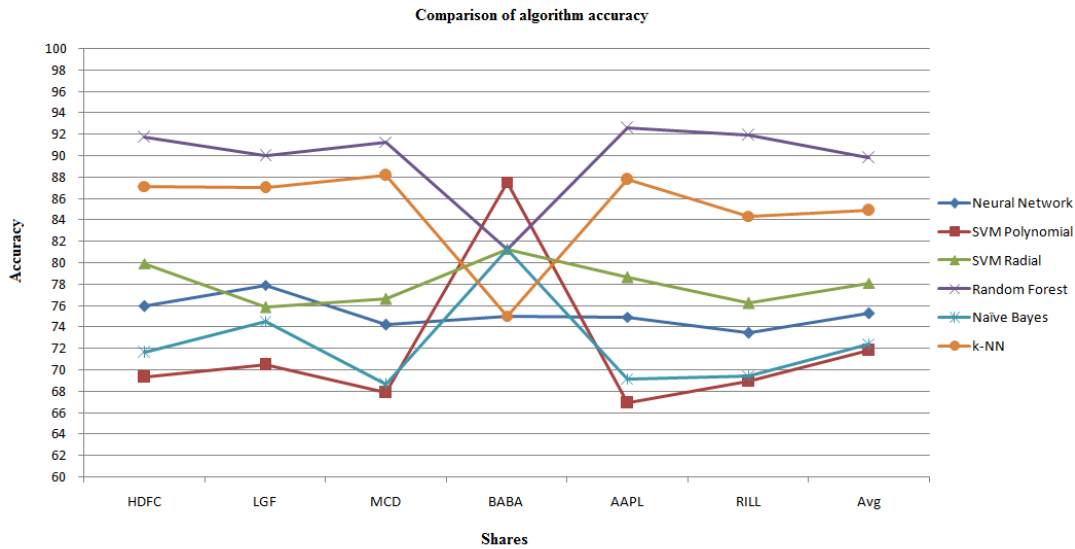
Figure 4.19: Comparison of algorithm in line graph

In figures 4.20 shows comparison of accuracy algorithms using column graph. In list Avg , which average accuracy of algorithm for all shares.
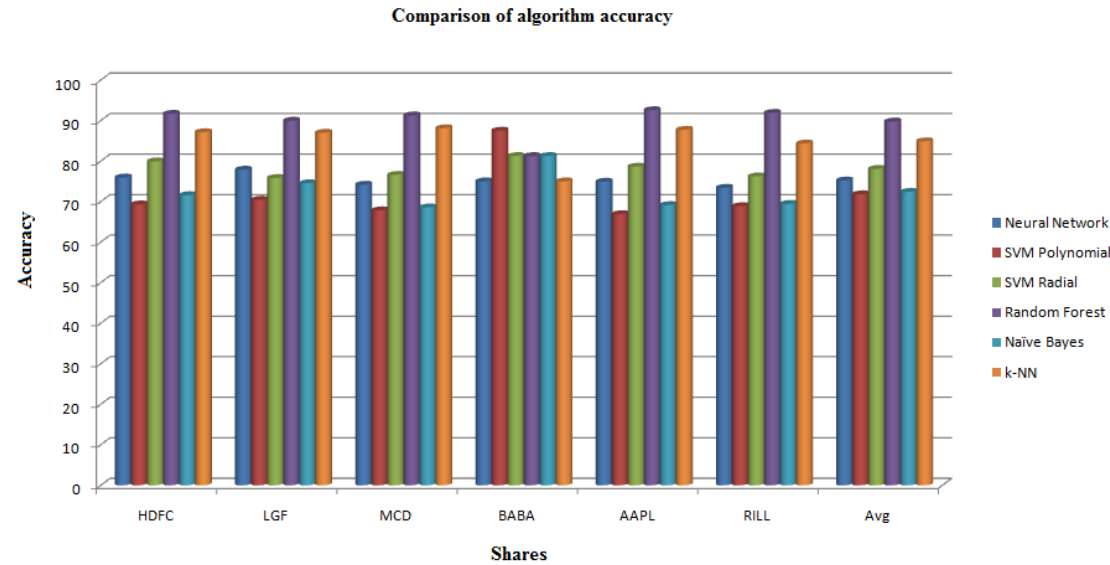

Figure 4.20: Comparison of algorithm in column graph

Chapter 5

Conclusion and Future plan

5.1 Conclusion

This project basically aimed to eliminate time consuming traditional methods by introducing electronic feed. By applying centralized security in compliance, the further incoming files will don't need to create security for the new files and they are easily accessible by searching. Moreover, violence of rules can be checked electronically which is being done manually in current system. It is also rise violation of rule.

There are several issues such as decentralized security, single broker have multiple accounts in different hedge fund company. Different formats for different broker. The proposed solution for them are centralized security, mapping tables, staging table, monitor process.

In Stock predication concluded that Random forest and k-NN are better performance compare to other algorithm. SVM polynomial gives worst performance compare to other algorithm.

5.2 Future plan

The electronic feed is currently implemented for two brokers only but in future it is planned to be applied through every broker. Frequency of two broker's file is monthly. It is also possible for some broker to provide files daily so it should be work properly. For broker with daily frequency , it should work daily as same as monthly. Create different reports using this transaction.

We can change technical parameter and apply different models. We have used only technical analysis for further research fundamental analysis used.

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