

FOUNDATION OF DATA ANALYTICS

CSE3505

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AI BASED AUTOMATED TRADING SYSTEM





Abstract

- ❑ Algorithmic trading is all about executing orders using automated trading instructions.
- ❑ The human brain has handled the analysis and decision making process of stock trading.
- ❑ An automated trading system (ATS), is a subset of algorithmic trading.
- ❑ It uses a computer program, mostly an AI algorithm, to create buy and sell orders
- ❑ Automatically submits the orders to a market center or exchange.

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- ❑ Using technical analysis, and statistical models
 - ❑ Carrying out algorithmic and automated trading processes.
 - ❑ The computer program will automatically generate orders
 - ❑ Based on a predefined set of rules using a trading strategy
 - ❑ Based on technical analysis, advanced statistical and mathematical computations
 - ❑ Exploring techniques and Artificial Intelligence algorithms

Introduction

- ❑ A stock market, equity market, or share market is the aggregation of buyers and sellers of stocks, which are also called shares. These shares or stocks represent ownership claims on businesses.
- ❑ A stock exchange, is a platform where stockbrokers and traders can buy and sell shares, bonds, and other securities.
- ❑ AI is being increasingly utilized in the algorithmic trading sector and offers many benefits.
- ❑ Trading strategies are usually verified by the process of back testing.



Automated trading systems use AI algorithms to create buy and sell orders

Problems with Manual Trading (Existing System)

- Manual trading involves a major amount of mental stress to the buyer.
- The user alone will not be able to perform backtesting efficiently.
- While trading manually, the speed required to attain the required orders might not be sufficient.





Why Analytics in This Project

A universal and efficient solution to all the problems mentioned before, is an “Automated Trading System”. Using various AI and ML algorithms and models, in depth analysis can be done, and decisions can be made according to user defined rules, without the constant intervention of the user.

- ★ Reduced stress and overthinking
- ★ Analysis and Backtesting
- ★ High speed due to automation

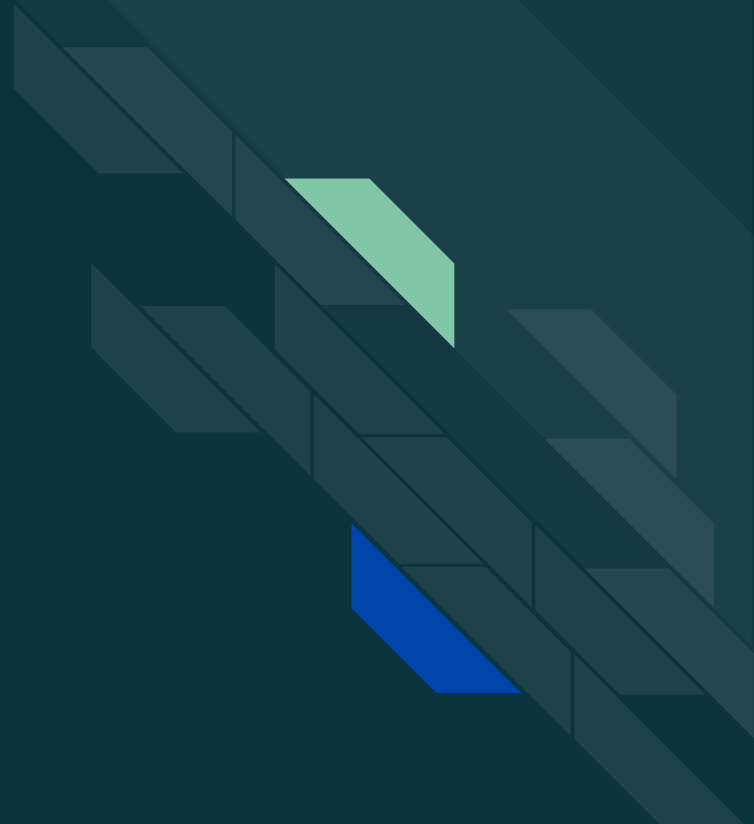




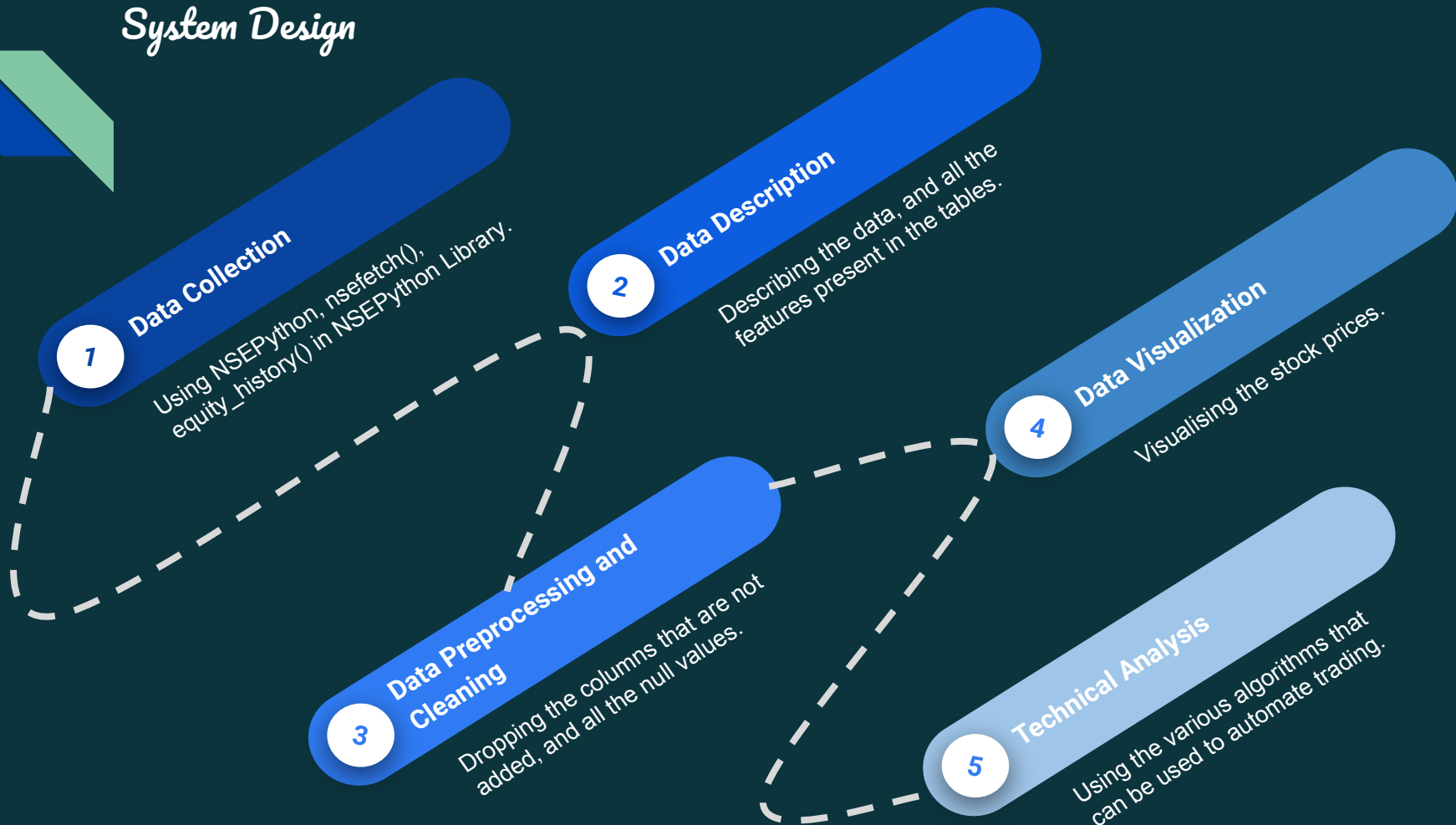
Proposed Methodology

- *“Technical analysis, is using charts to identify trading signals and price patterns, working as a window into market psychology to identify opportunities to profit.”*
- Focus on a particular trading approach and develop a disciplined strategy.
- Stochastics are a favored technical indicator
 - easy to understand
 - high degree of accuracy.
- Stochastics shows when a stock has moved into an overbought or oversold position.
- It is beneficial to use stochastics in conjunction with an oscillator.
- Using forecasting models like linear regression, is also useful.

WORKING MODULES



System Design



Dataset

	symbol	identifier	series	open	dayHigh	dayLow	lastPrice	previousClose	change	pChange	...	nearWKH	nearWKL	perChange365d	date365d
0	INDIGO		EQ	2164	2324.95	2160	2312	2147.45	164.55	7.66	...	0.557001	-62.245614	41.4	12-Nov-
1	ICICIPRULI		EQ	648.35	679.95	642.2	673.5	642.05	31.45	4.90	...	7.013668	-60.931900	56.62	12-Nov-
2	LTI		EQ	7000	7266	6954.4	7260	6948.75	311.25	4.48	...	0.082576	-150.344828	142.79	12-Nov-
3	NAUKRI		EQ	6169	6432.15	6120.05	6409.8	6147.6	262.20	4.27	...	14.139899	-85.780534	74.24	12-Nov-
4	STAR		EQ	493.5	512.5	485.55	507.8	487.25	20.55	4.22	...	49.169169	-4.701031	-23.53	12-Nov-
...
183	GMRINFRA		EQ	43.35	43.35	41.55	41.85	43.05	-1.20	-2.79	...	9.219089	-86.000000	72.34	12-Nov-
184	BAJAJ-AUTO		EQ	3782	3782	3615.7	3640	3749.95	-109.95	-2.93	...	16.540560	-21.879761	20.47	12-Nov-
185	RECLTD		EQ	150.9	150.9	144.8	145.4	149.8	-4.40	-2.94	...	13.888066	-30.579255	22.81	12-Nov-

NSEPython is a Python library to get publicly available data on NSE website ie. stock quotes, historical data, live indices, etc.



Data Description

Using the equity history function, we were able to derive the shown data for any company of our choice.

_id	object
CH_SYMBOL	object
CH_SERIES	object
CH_MARKET_TYPE	object
CH_TRADE_HIGH_PRICE	float64
CH_TRADE_LOW_PRICE	float64
CH_OPENING_PRICE	float64
CH_CLOSING_PRICE	float64
CH_LAST_TRADED_PRICE	float64
CH_PREVIOUS_CLS_PRICE	float64
CH_TOT_TRADED_QTY	int64
CH_TOT_TRADED_VAL	float64
CH_52WEEK_HIGH_PRICE	float64
CH_52WEEK_LOW_PRICE	float64
CH_TOTAL_TRADES	int64
CH_ISIN	object
CH_TIMESTAMP	object
TIMESTAMP	object
createdAt	object
updatedAt	object
__v	int64
VWAP	float64
mTIMESTAMP	object
CA	object
dtype:	object

PIIND



From the data derived from the equity history function, the above chart was plotted based on the dates of the past week, and each day's respective closing price for the company "PIIND".



Technical Analysis

- Technical analysis aims to predict the price movements by examining historical data
- Mainly price and volume.
- There are two ways of technical analysis: the top-down approach and the bottom-up approach.
- Here, we have used the bottom-up approach



Option 1 : Stochastic Oscillator with SMA

- The Stochastic Oscillator was first developed by Dr. George Lane in the 1950s .
- We have calculated the stochastic oscillator using the values from our historic data that we got from the equity history function. For this implementation, we need two new variables, %k and %d.
- We have used a candlestick chart that shows the pricing data over our trading period. The Stochastic Oscillator chart shows our %k, %d, and 80/20 lines over that same period.
- if k and d cross the 80 line, we sell, and if k and d cross the 20 line below and k is greater than d, then we initiate the buys signal to the API, otherwise we don't do anything.

Option 1 : Stochastic Oscillator with SMA





Option 2 : Forecasting

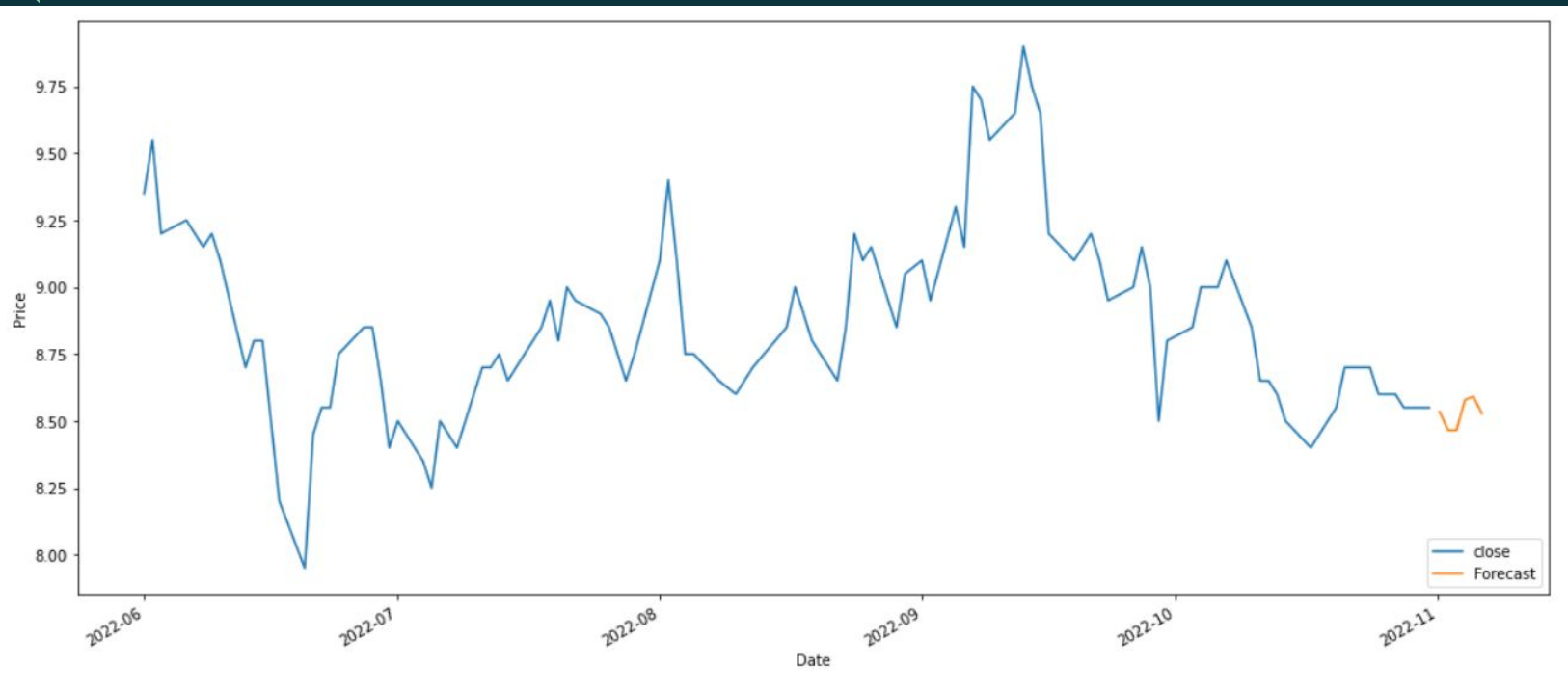
- We pick the features we need to work with by dropping a few columns in the dataset and define our required dataframe.
- Since we want to forecast the stock prices for days and months to come, we shift the close column to create room for the predictions of the days to come and use it as the labels, the target variable i.e, forecasted out values.
- We scale the data. We are making room for new predictions which is 5% of the entire dataset. So we pick all rows in the dataset excluding them as our training data, and use the excluded rows as the data to be predicted.



Option 2 : Forecasting

- We split the data as 80% train and 20% test to train and test our models.
- Different linear regression models are implemented and we choose the one which gives the best accuracy which is RandomForestRegressor.
- We add the predicted data to the dataframe with a new column name 'Forecast'.
- We take the high value and low value of amount the user defines as the user high and user low boundaries in our trading strategy, which is to sell the share if the forecast is greater than the user high and buy the share if the forecast is lower than the user low.

Option 2 : Forecasting





Option 3 : Exponential Moving Average

- Technical indicators are calculated values describing movements in historical pricing data for securities. Investors use these metrics to predict the movements of stocks to best determine when to buy, sell, or hold.
- To add our technical indicators we'll be using the `pandas_ta` library. We add exponential moving average (EMA) to our data.
- We will have a new column in our data titled "EMA_d." where the 'd' will be defined by the user. This is our newly-calculated value representing the exponential moving average calculated over a 'd'-day period.
- The NaN values that appears are dropped since in real time prediction taking an average and amending the value won't bring us any significant effects



Option 3 : Exponential Moving Average

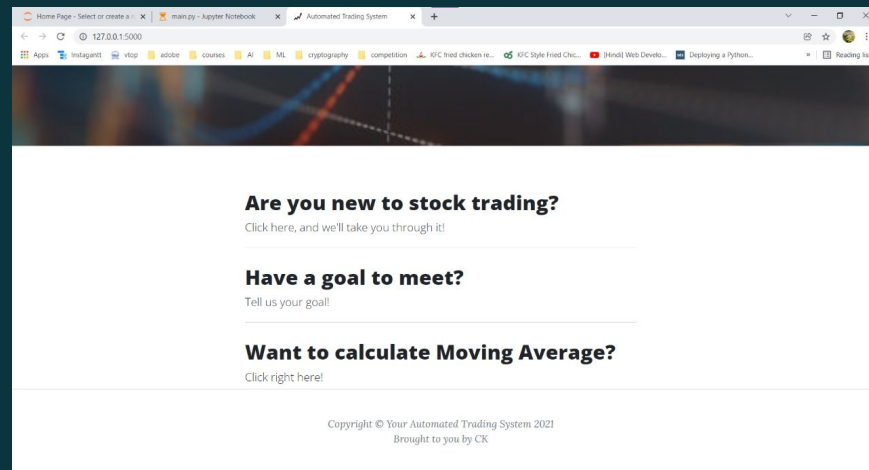
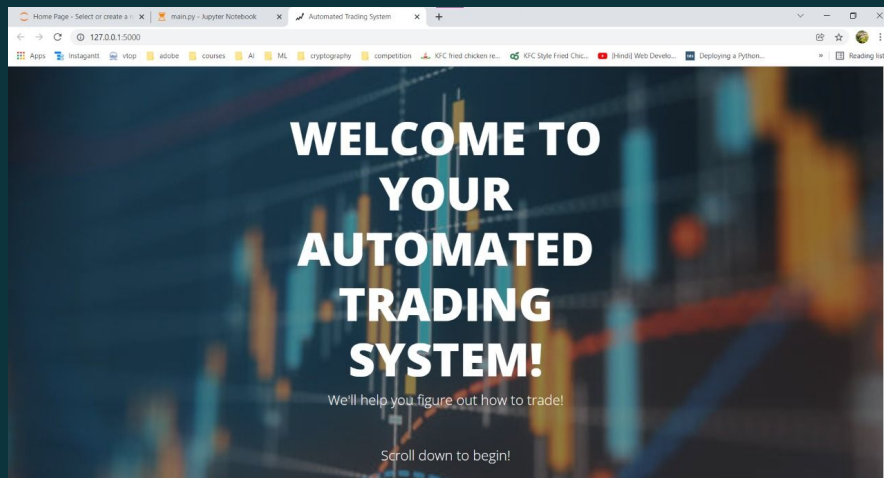
- We develop a regression model to see how effective the EMA is at predicting the price of the stock.
- The 80/20 split is done and linear model will be trained.
- We have developed a model that can use the EMA of any given day (dependent on pricing from the previous 'd' days) and accurately predict that day's closing price.
- If our model predicts a higher closing value than the opening value we make a trade for a single share on that day—buying at market open and selling just before market close.

Option 3 : Exponential Moving Average



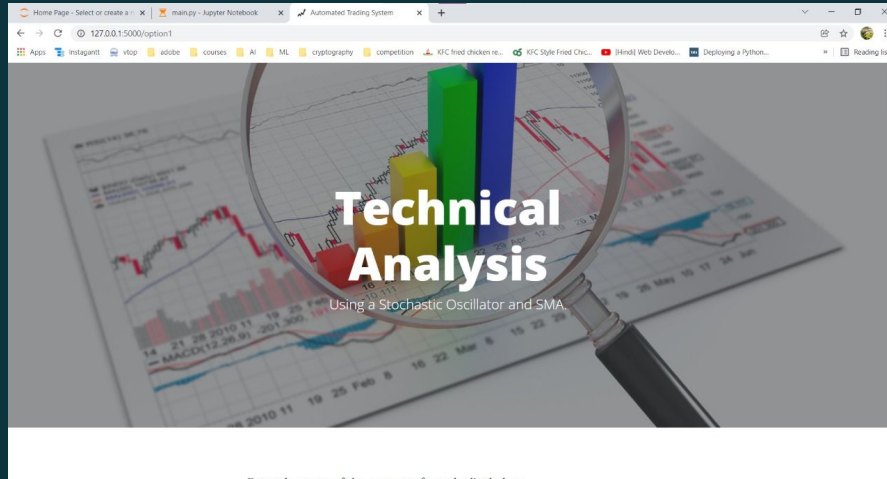
IMPLEMENTATION DETAILS - FRONT END

Home Page



Option 1

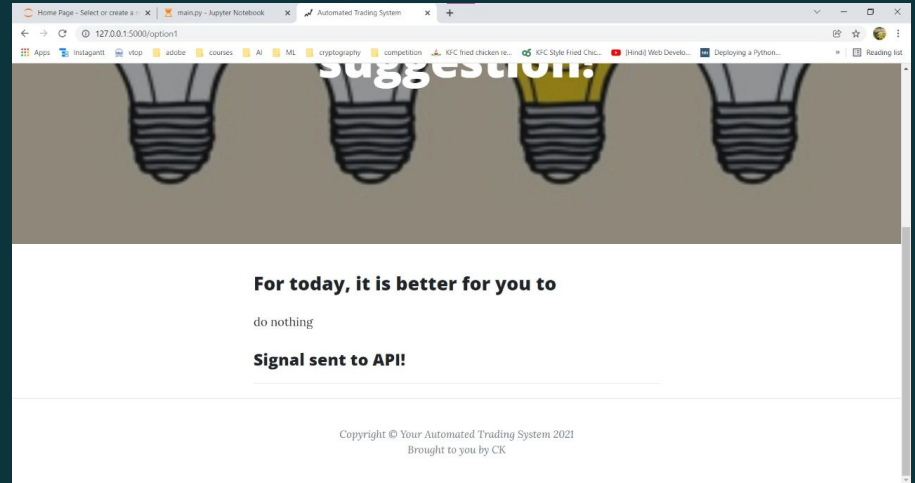
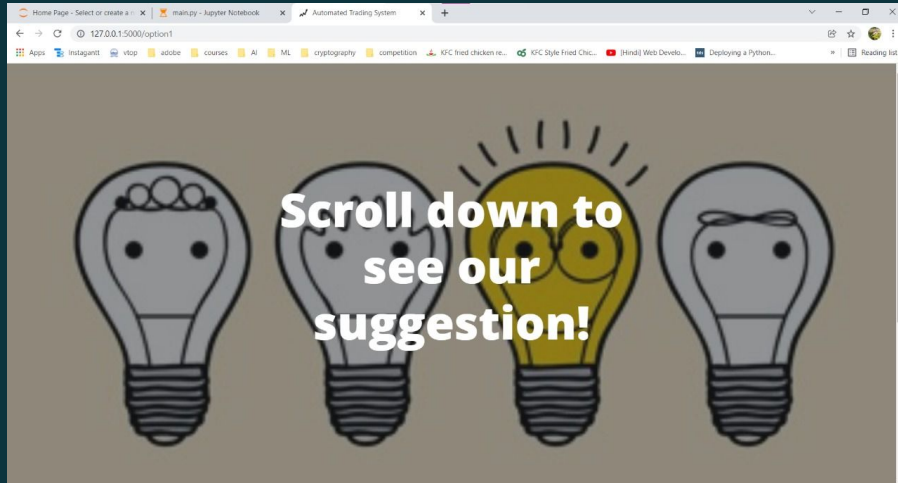
- shows the list of the companies
- tells the user to choose which company they want to check for
- tells them which signal would be best for today



The screenshot shows a web browser window with the URL `127.0.0.1:5000/option1`. The main content area displays a form with the text "Enter the name of the company from the list below:". Below this is a text input field containing "NESTLEIND". A "Send" button is located below the input field. Below the form, there is a section titled "List of companies on NSE's catalogue" which contains a table with a "Category" header and a list of companies.

	Category
1	IDEA
2	FSL
3	CANFINHOME
4	GMRINFRA
5	ZEEL
6	GODREJCP

Option 1



Option 2

Technical Analysis

Using Forecasting

Enter the name of the company from the list below:

Name of Company

NESTLEIND

Send

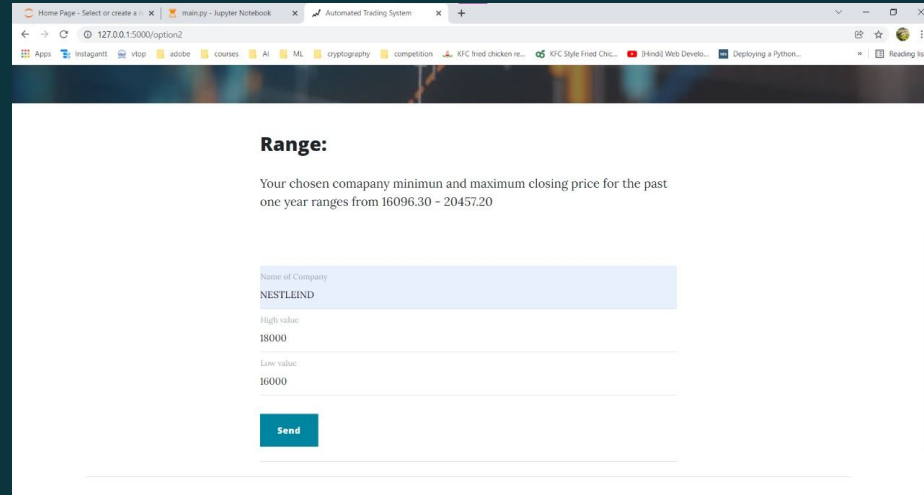
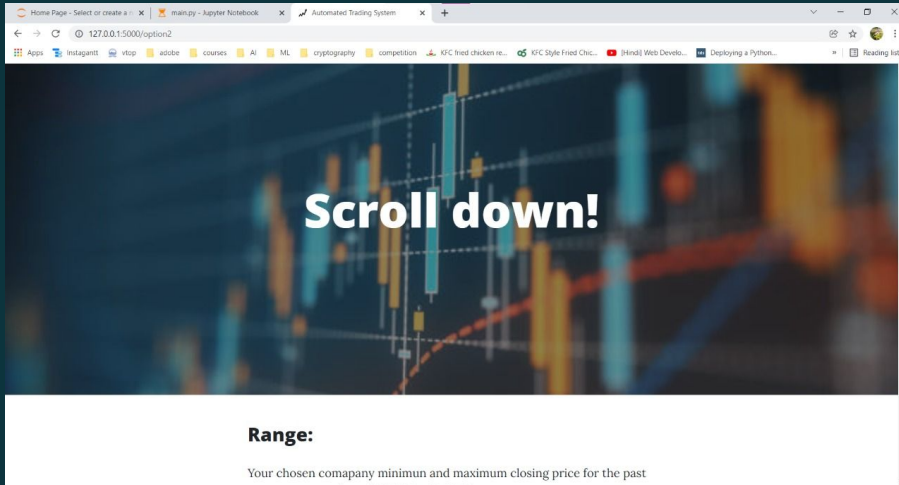
List of companies on NSE's catalogue

Category

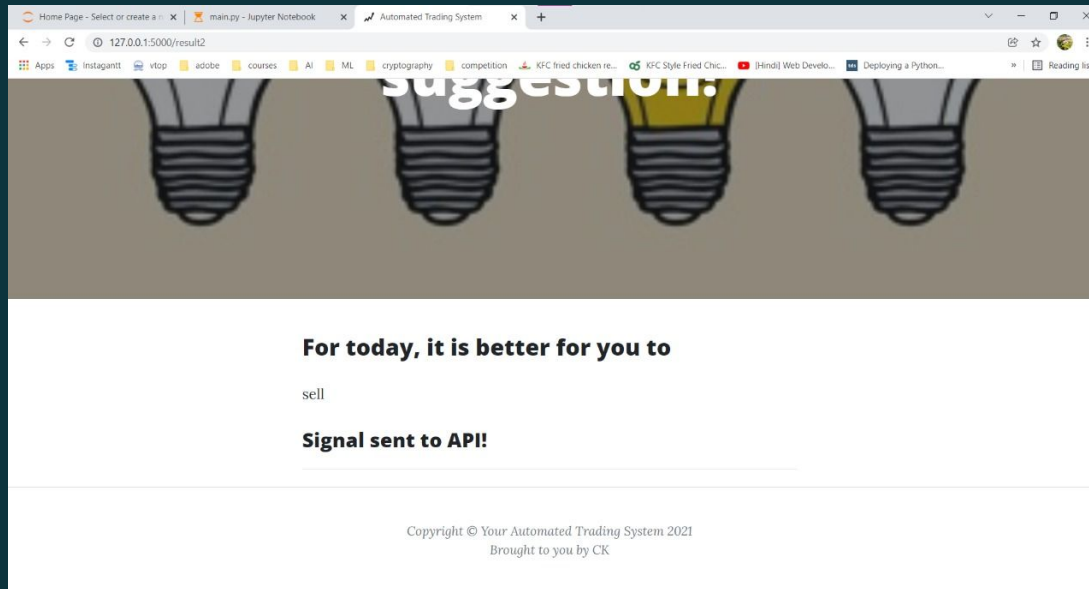
- 1 IDEA
- 2 ISL
- 3 CANFINHOME
- 4 GMRINFRA
- 5 ZEEL
- 6 GODREJCP

Option 2

- shows the list of the companies
- tells the user to choose which company they want to check for
- shows them the range
- they can enter their perceived high and low values
- the system compares the forecasted price

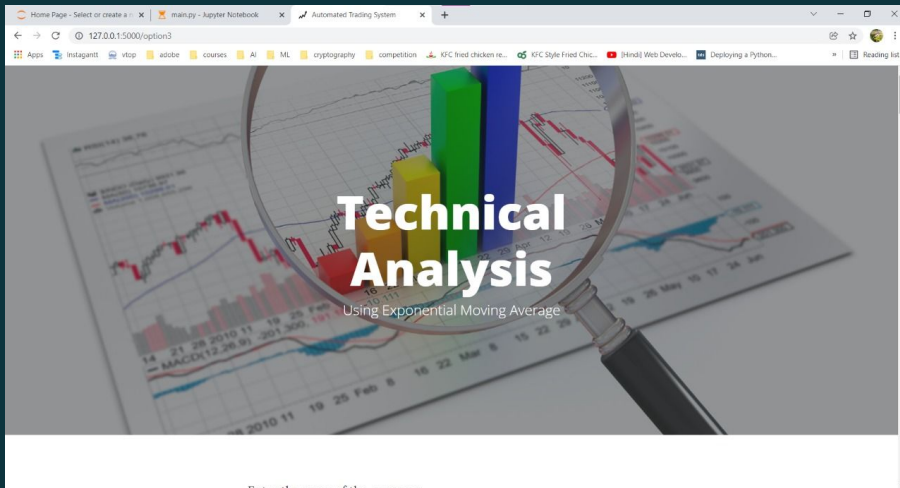


Option 2



Option 3

- shows the list of the companies
- tells the user to choose which company they want to check for
- and also the number of days that they want to calculate the Exponential Moving Average for
- the calculated gain for that day is shown to them based on the results of the EMA



The screenshot shows a web browser window with the URL '127.0.0.1:5000/option3'. The form contains the following elements:

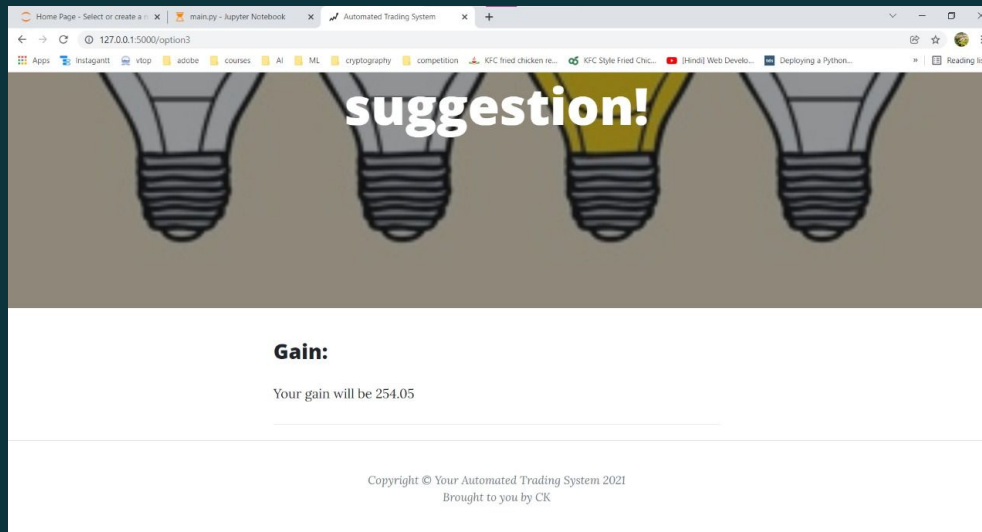
- A text input field labeled 'Enter the name of the company:'.
- A text input field labeled 'Scroll down for the list of companies'.
- A text input field labeled 'Name of Company:' with the value 'NESTLEIND' entered.
- A text input field labeled 'Enter the number of days over which you would like to calculate the EMA'.
- A text input field labeled 'Days for EMA calculations:' with the value '10' entered.
- A blue 'Send' button.

Below the form, there is a paragraph of text explaining the Exponential moving average (EMA):

Exponential moving average, EMA, is a technical chart indicator that tracks the price of an investment over a period of time.

For example, The 21-day EMA places a 9.0% weight on the most recent price, whereas the 100-day EMA only places a 1.9% weight.

Option 3





Conclusion

The major benefits we have acquired of using AI in algorithmic trading includes

- Fast trading speeds and improved accuracy
- Elimination of human error
- The possibility of mistakes by human traders, solely based on emotional and psychological factors, is reduced.
- High speed is acquired due to automation resulting in attaining gains at a faster rate.



Performance

The performance of our Automated Trading system, will be determined by:

- The efficiency of our prediction system, which will forecast the future stock price.
- The net worth of the user before and after using the system for trading.
- The difference in profits and losses that the user faces while the system runs.

We expect our system to have an accuracy of at least 80%.

Finally we reached an accuracy of 92%.



Future Work



The future implementation of our project:

- ❖ A more structured web application
- ❖ Full scale visualization of real time trends in the stock market
- ❖ A more convenient and easily accessible platform for stock trading.
- ❖ Live connection to APIs in order to automate the entire process in real time.



References

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Evaluation

1. *What is your system claiming:* Carrying out algorithmic and automated trading processes with at least 80% accuracy.
2. *How much have we achieved:* We reached an estimation accuracy of 92%. Project is 90% complete, API connection to the actual stock market has to be purchased, that is the next step.
3. *PPT and report in LMS:* Submitted.
4. *Contribution:* Each worked on one algorithm and discussed and taught one another.
Christina - Stochastic Oscillator Analysis
Aisha - Forecasting and time-based prediction
Kiran - Exponential Moving Average Analysis
5. *Publicity of project:* <https://github.com/aishasamah>
<https://github.com/kiran-benny>
<https://github.com/christina-pandian>



THANK YOU

Hope it was worth the effort!