STOCK SUGGESTION PORTAL

A PROJECT REPORT

Submitted by

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of

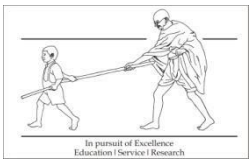
BACHELOR OF ENGINEERING

in

COMPUTER SCIENCE & ENGINEERING

Guided By

Mr. Atul V Dusane



Department of Computer Science & Engineering
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YEAR 2021-22

CERTIFICATE

This is to certify that the project report

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List of Abbreviations

Sr. No.	Abbreviations	Long form of Abbreviations
1	GDP	Gross Domestic Product
2	PCA	Principal Component Analysis
3	LSTM	Long Short Term Memory
4	ANN	Artificial Neural Network
5	RNN	Recurrent Neural Network
6	EMA	Exponential Moving Area
7	RSI	Relative Strength Index
8	MACD	Moving Average Conversions Diversions
9	SMA	Simple Moving Average
10	API	Application Programming Interface

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Abstract

The most popular financial management method, stocks, has attracted so many investors to participate. The risks of stock investment are relatively high as compared to different investments.

In the era of big data, deep learning and machine learning for analyzing and predicting stock market prices and trends have become even more popular than before.

We take live data from Yahoo Finance API and propose comprehensive customization of feature engineering and deep learning-based model for analyzing and predicting price trends of stock markets. Traditional stock forecasting models use forecasting models based on stock time series analysis. The proposed solution is comprehensive as it includes pre-processing of the stock market dataset, utilization of feature engineering techniques, combined with customized deep learning algorithms for stock market price trend prediction. We conducted comprehensive evaluations on frequently used deep learning models and conclude that our suggested solution outperforms due to the analysis part and different feature engineering that we built. The system achieves overall high accuracy and good result for stock market price prediction. With the detailed design and evaluation of prediction, trends, and data pre-processing methods, this work contributes both in the financial and technical domains.

1. INTRODUCTION

The stock market is a crucial part of the economy of every country. However, the way the stock market impacts that economy can be different from the way other countries' stock markets influence their economies. As a result, the influence of stock markets on the economy is determined by various factors, including the organization of stock exchanges, their relationship to other elements of the financial system, different institutional holders, and the governance system of the country. As all of these factors are distinct for each country, the impact of stock markets on their economies is also different. In the last few years, there have been major fundamental changes in the Indian capital market system that have reduced transaction costs and considerably boosted efficiency, transparency, and safety. Through the emergence of new technologies, products, and services innovation, economic expansion fueled by technological change has brought about the economic development of the stock market.

There's no getting around the fact that stock market trading accounts for only 4% of India's GDP. This is significantly less than the average for other developed countries like the USA, which is around 55%. Various methods of conventional stock price prediction are prone to failure, and the use of deep learning and machine learning can provide better accuracy. This section examines the shortcomings of conventional stock price prediction methods and the advantages of machine learning and deep learning.

A variety of parameters influence price movements in numerous sizes and layers of the stock market, making it highly variable and indeterministic. Market efficiency suggests that the market automatically adjusts its price to reflect the current total combined price, so that neither the low or high prices are excessive. Markets cannot be defeated, that is, they are unbeatable. However, existing evidence indicates otherwise. The ability to predict market movements can be gained by studying stock movement patterns. Typical approaches emphasize technical analysis and fundamentals to forecast the share market on a mass level, which rarely results in low-level recommendations for selected stocks. In contrast, a few stocks make a significant impact on the market's overall price movement.

Forecasting the stock market price is always a difficulty for many company experts and researchers. Estimating stock market values is both an intriguing and demanding field of study. It's difficult to predict the stock market with 100% precision.

Extrinsic factors such as social, psychological, political, and economic factors make it difficult.

It has a significant and positive impact on it. The most common characteristics of data connected with the stock market are temporal variation and nonlinearity. To make predictions about the future, many prediction techniques have been created.

There are a variety of traditional approaches for forecasting stock values (by analyzing past data).

Because the stock market is one of the most important sectors in which investors invest, stock market price trend prediction is always a hot issue for academics in both the financial and technological fields. Our goal in this study is to develop a state-of-the-art price trend prediction model that focuses on short-term price trend prediction.

Meanwhile, financial sector experts were studying stock market data using traditional statistical approaches and signal processing techniques.

Short-term stock price prediction was also done using optimization techniques like principal component analysis (PCA). Researchers have attempted to evaluate stock market transactions such as volume burst hazards in recent years, expanding the stock market analysis research area and indicating that this study domain still has a lot of promise.

Our work makes three major contributions:

- A fresh dataset that has been extracted and purified.
- Complete feature engineering.
- A customized deep learning model based on long short-term memory (LSTM).

It demonstrated that our suggested feature addition called feature engineering was effective. We then implemented our own bespoke LSTM model, which increased the prediction results across the board.

In earlier studies, the suggested method outperformed machine learning and deep learning-based models.

2. LITERATURE SURVEY

2.1.Prediction Techniques

Presented the recent methods for the prediction of stock market and give a comparative analysis of all these Techniques.

Major prediction techniques such as data mining, machine learning and deep learning techniques used to estimate the future stock prices based on these techniques and discussed their advantages and disadvantages. They are

- Artificial Neural Network
- Holt-Winters
- Hidden Markov Model
- ARIMA Model
- Time Series Linear Model
- Recurrent Neural Network
- Long Short Term Memory

Artificial Neural Network, Holt-Winters, and Hidden Markov Model are Machine Learning Techniques; ARIMA Model is Time Series technique while Recurrent Neural Network; Time Series Linear Model and Long Short Term Memory are Deep Learning Techniques.

2.1.1. Artificial Neural Network

An artificial neural network (ANN) is a technique inspired from biological nervous system, such as the human brain. It has a great ability to predict from large databases. On the basis of the back—propagation algorithm, ANN is generally used to forecast the stock market. In the back—propagation algorithm, a neural network of multilayer perceptron (MLP) is used. It consists of an input layer with a set of sensor nodes as input nodes, one or more hidden layers of computation nodes and computation nodes of the output layer. These networks often use raw data and data derived from the previously discussed technical and fundamental analysis. A

Multilayer Feed forward Neural Network is a neural network with an input layer, one or more hidden layers and an output layer. Inputs correspond to each training sample measured attributes. Inputs are passed to input layer simultaneously. The weighted outputs of these units are fed to the next layer of units that make up the hidden layer simultaneously. The weighted outputs of the hidden layers act as an input to another hidden layer, etc. The hidden layers number is an arbitrary design problem. The weighted output of the last the hidden layer acts as inputs to the output layer, which predicts the networks for certain samples. Important parameters of NN are learning rate, momentum and epoch. Back propagation is a neural network learning algorithm. The back propagation network learns by processing the sample set repeatedly and comparing the network prediction with the actual output. If the residual value exceeds the threshold value, the weight of the connections is modified to reduce the MSE between the forecast value and the original value. The weights are changed from the output layer to the first hidden layer in the opposite direction. Since the changes in the weights of the connections are made in the reverse direction, the name given to the algorithm is Back propagation. Use the back propagation algorithm to perform the calculations and compare the predicted output and target output. The predicted value is not closer to the actual value and the weights are modified.

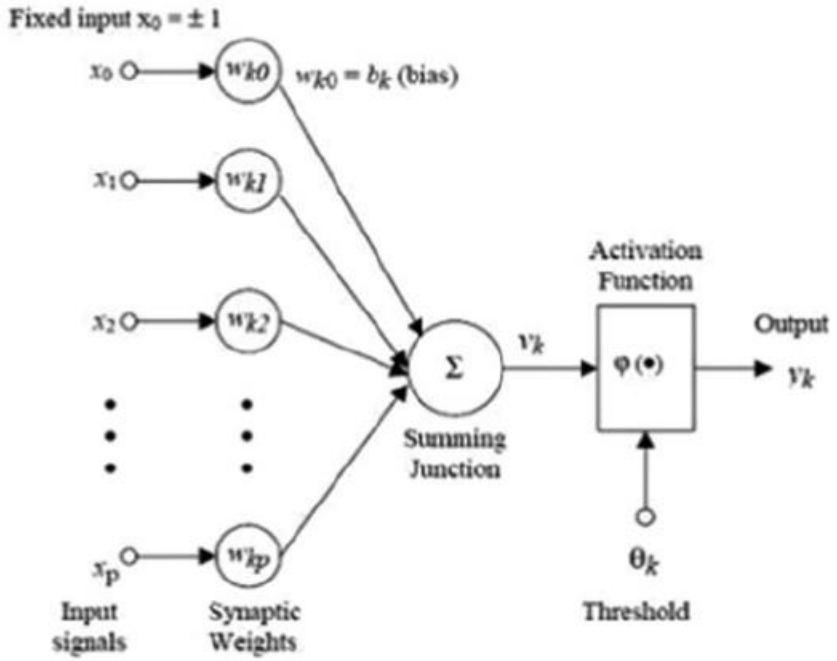

Figure 1 Graphical Representation of Artificial Neutron

Advantages

- ANN is one of the successfully developed and widely used methods for solving many prediction problems in various types of applications.
- ANNs has been used to solve various problems in financial time series forecasting and can predict the price with approximately 90% accuracy.

Disadvantages

- Neural Network is suffering from the BlackBox problem; it does not reveal the each variable's significance weight.
- The problem of overtraining is another major problem with Neural Networks. The system may lose the ability to generalize if Neural Networks fits the data too well.
- Overtraining is a major problem. It usually happens for two main reasons such as Neural Networks have too many nodes or too long training periods.

2.1.2. Holt-Winters

Holt-Winters is the appropriate or correct mode when the time series has trend and seasonal factors. The series was divided into three components or parts that are trend, basis and seasonality. Holt-Winters finds three trends: level, and seasonal smoothening parameters. It has two variants: Additive Holt Winters Smoothening model and Multiplicative Holt-Winters model. The former is used for prediction and the latter is preferred if there are no constant seasonal variations in the series. It is mainly popular for its accuracy and in the field of prediction it has outperformed many other models. In short—term forecasts of economic development trends, Holt-Winters exponential smoothing method with the trend and seasonal fluctuations is usually used. After removing the seasonal trends from the data, the following function is taken as an input and in return, the Holt-Winters makes the pre-calculations necessary for the purpose of forecasting. All parameters required for the forecasting purpose are automatically initialized based on the function data.

```
HWStock1_ng = HoltWinters(ds,gamma = FALSE)
predHW = predict(HWStock1_ng,n.ahead = 9)
```

2.1.3. ARIMA Model

This ARIMA model was introduced by Box and Jenkins in 1970. The Box—Jenkins methodology is also referred to as a set of activities to identify, estimate and diagnose ARIMA models with time series data. The model is the most important financial forecasting method. Models from ARIMA have been shown to be effective in generating short-term forecasts. The future value of a variable in the ARIMA model is a linear combination of past values and past errors.

Advantages

- Robust and efficient forecasting of financial time series.
- Has a relatively small standard error of regression.

Disadvantages

- This model is suitable only for short term predictions.

- ARIMA models provide investors with a short-term forecast that could help to make investment decisions.

2.1.4. Time Series Linear Model

One of the stochastic ways to implement a predictive model is the linear time series model (TSLM). In a linear time series model, an ideal linear model is primarily created and data is then incorporated into it so that the linear model reflects the properties of the actual data. The main advantage of this linear model of the Time series is that the actual data are incorporated into the ideal linear model. We can include both traditional trend sand seasonal data trends.

The function can be used to create the ideal linear model is in R programming istslm() and incorporates StlStock data that have removed seasonal trends. The value h indicates the number of predicted or to be predicted months. The tslm() function performs all pre-calculations required for the prediction used as an input for the pre-diction function.

2.1.5. Recurrent Neural Network

Humans don't start their thinking from scratch every second. As you read this essay, you understand each word based on your understanding of previous words. You don't throw everything away and start thinking from scratch again. Your thoughts have persistence. Traditional neural networks can't do this, and it seems like a major shortcoming. For example, imagine you want to classify what kind of event is happening at every point in a movie. It's unclear how a traditional neural network could use its reasoning about previous events in the film to inform later ones. Recurrent neural networks address this issue. They are networks with loops in them, allowing information to persist.

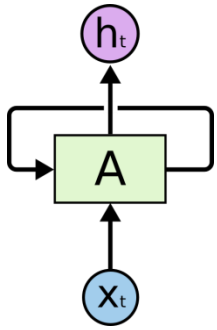

Figure 2 A loop in RNN

In the above diagram, a chunk of neural network, AA, looks at some input xtxt and outputs a value htht. A loop allows information to be passed from one step of the network to the next.

These loops make recurrent neural networks seem kind of mysterious. However, if you think a bit more, it turns out that they aren't all that different than a normal neural network. A recurrent neural network can be thought of as multiple copies of the same network, each passing a message to a successor. Consider what happens if we unroll the loop:

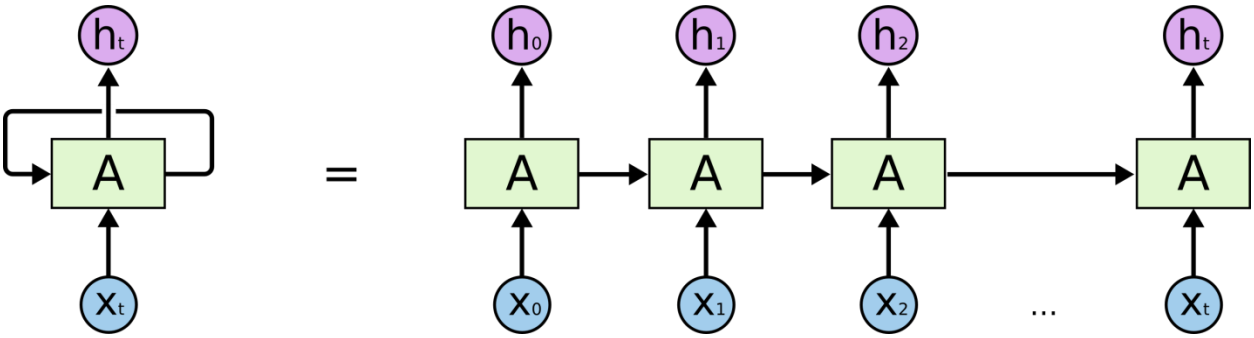

Figure 3 Unrolled RNN

This chain-like nature reveals that recurrent neural networks are intimately related to sequences and lists. They're the natural architecture of neural network to use for such data.

Essential to these successes is the use of "LSTMs," a very special kind of recurrent neural network which works, for many tasks, much better than the standard version.

Almost all exciting results based on recurrent neural networks are achieved with them. It's these LSTMs that this essay will explore.

2.1.6. Long Short Term Memory

Long Short Term Memory networks – usually just called "LSTMs" – are a special kind of RNN, capable of learning long-term dependencies. They were introduced by Hochreiter & Schmidhuber (1997), and were refined and popularized by many people in following work. They work tremendously well on a large variety of problems, and are now widely used. LSTMs are explicitly designed to avoid the long-term dependency problem. Remembering information for long periods of time is practically their default behavior, not something they struggle to learn! All recurrent neural networks have the form of a chain of repeating modules of neural network. In standard RNNs, this repeating module will have a very simple structure, such as a single tanh layer.

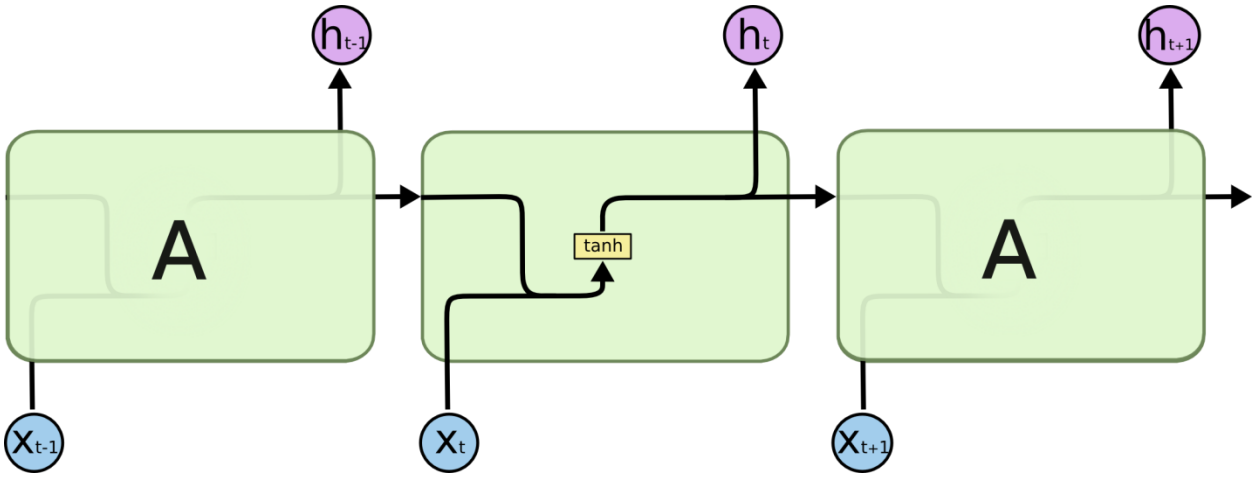

Figure 4 Repeating module in standard RNN Layer

LSTMs also have this chain like structure, but the repeating module has a different structure. Instead of having a single neural network layer, there are four, interacting in a very special way.

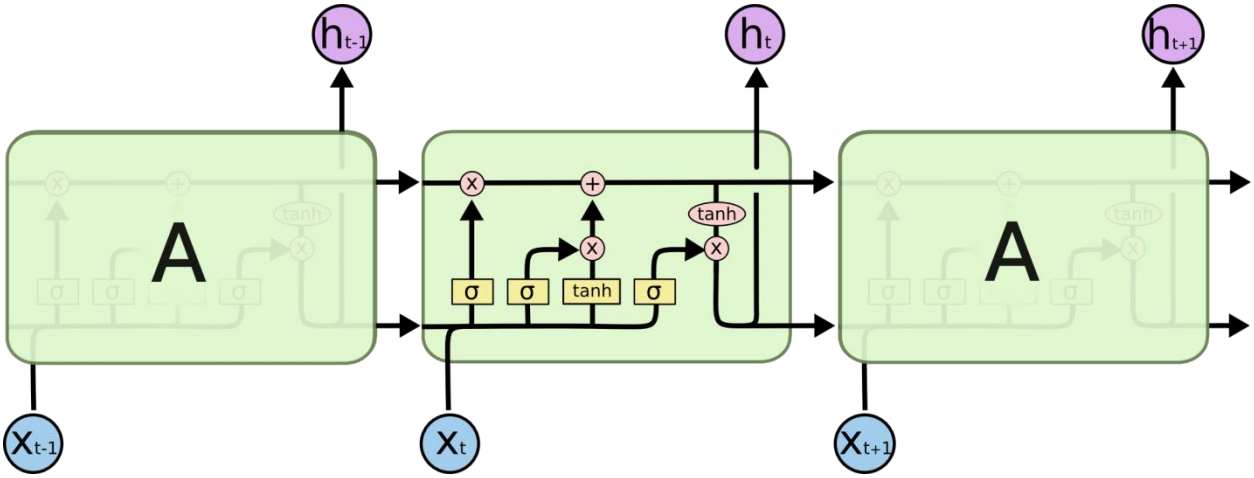

Figure 5 Repeating module in LSTM

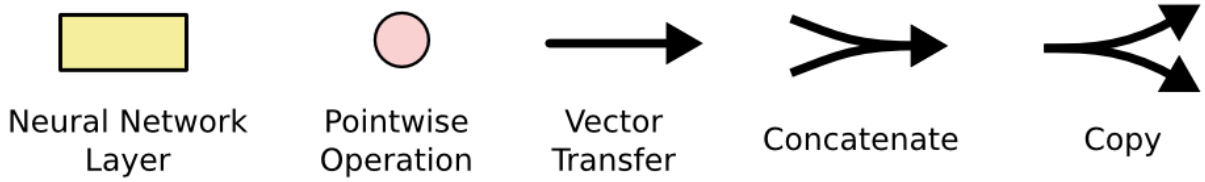

Figure 6 Notation

In the above diagram, each line carries an entire vector, from the output of one node to the inputs of others. The pink circles represent point wise operations, like vector addition, while the yellow boxes are learned neural network layers. Lines merging denote concatenation, while a line forking denote its content being copied and the copies going to different locations.

2.2. Comparison of Prediction Techniques

Sr. no.	Techniques	Advantages	Disadvantages	Parameter used
1	Artificial neural network	Better performance compared to regression. Lower prediction error	Prediction gets worse with increased noise variation	Stock closing price
2	Holt-Winters	Users to smooth a time series and use that data to forecast areas of interest	Smoothing cannot handle irregular pattern well	Trend and seasonal fluctuations
3	Hidden Markov model	Used for optimization purpose	Evaluation, decoding and learning	Technical indicators
4	ARIMA	Robust and efficient	It is suitable for short term predictions only	Open, high, low, close prices and moving average
5	Time series linear model	Integrate the actual data to the ideal linear model	Traditional and the seasonal trends present in the data	Data and number of months
6	Recurrent Neural	Previous time	It possible to feed	Input hidden and

	Network	points to input layer contains inputs	those words in through a much smaller set of input nodes	output layers
7	Long-short term memory	Large range of parameters such as learning rates, and input and output biases	Sensitive to different random weight initializations.	Stock open or close or high price.

Table 1 Comparison of Prediction Techniques

3. PROBLEM DEFINITION AND SRS

3.1. Problem Definition

3.1.1. Problem Statement

In data analysis, time series forecasting and modeling are crucial. Time series analysis is a subset of statistics that are widely employed in subjects like econometrics and operations research. In analytics and data science, time series are commonly employed. Stock prices are very volatile, and their value is determined by a variety of variables. The basic goal of this study is to use long short-term memory (LSTM) to anticipate stock values.

3.1.2. Objective

To predict stock prices, analyzing and visualizing of stock market previous data of any required company using graphs.

3.1.3. Input

- Time Period
- Stock Ticker : Search for the company for which you want the analysis

3.1.4. Output

- Detail and fundamentals of company
- Important charts for technical, fundamental analysis and predicted stock prices

3.1.5. Constraints

- Stock price fluctuations due to external factors like sentiments and market situations cannot be predicted.
- Absence of sentiment analysis makes prediction for intraday trading inaccurate.
- User must have stock market knowledge and must be familiar with relevant jargons.

3.1.6. Hardware Requirements

- RAM : 4GB

- Storage : 500GB
- CPU : 2GHz or faster
- Architecture : 32-bit or 64-bit

3.1.7. Software Requirements

- Python 3.5 or higher in Google Colab is used for data pre-processing, model training and prediction
- Operating System : Windows 7 or higher / Linus based OS / MACOS

3.1.8. Area of Project

- Data Science
- Deep Learning
- Python Libraries

3.2. SRS

3.2.1. Purpose

This application is useful for investor to invest in stock market based on various factors. The target of the project is to analyze previous stock data of companies and then determine the value of particular stock in future with suitable accuracy.

3.2.2. Scope

A system is essential to be built which will work with maximum accuracy and it should consider all important factors that could influence the result. The key factor each investor is to earn maximum profits on their investments

3.2.3. Advantages

- The research helps a lot of new investors in deciding when to buy or sell a particular stock
- It also helps in understanding the sentiments of experienced financial analysts and financial news data more quickly than doing the same manually

3.2.4. Features

- You can select any required company for analysis.

- Our solution uses many indicators such as EMA, RSI, MACD, SMA to get better results.
- We are plotting graphs for visualizing data.

4. SYSTEM DESIGN AND IMPLEMENTATION

4.1. Proposed System Architecture

The prediction methods can be roughly divided into two categories, statistical methods and artificial intelligence methods. Statistical methods include logistic regression model, ARCH model, etc. Artificial intelligence methods include multi-layer perceptron, convolutional neural network, naive Bayes network, back propagation network, single-layer LSTM, support vector machine, recurrent neural network, etc. They used Long short-term memory network (LSTM).

4.1.1. Preprocessing of Data

Figure 7 Preprocessing of Data

Raw stock price data is pre-processed before inputting into machine learning models. Pre-processing includes transforming the raw data into a format that models can take from and operate on, most likely feature matrix. It also attempts to extract some features, financial-domain-specific especially, manually to improve results, allowing the model to learn more abstractions.

4.1.2. Overall Architecture

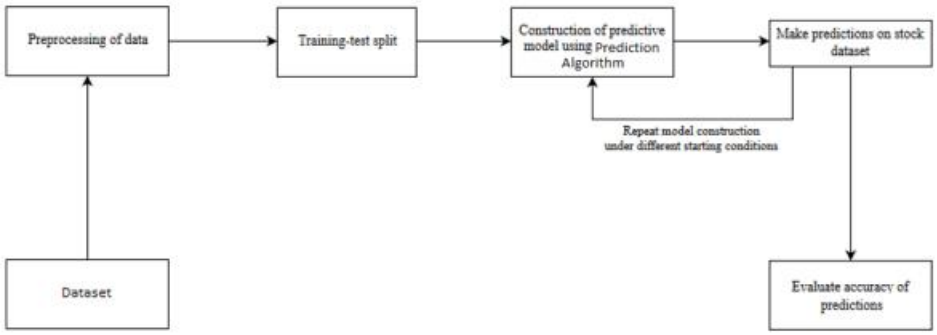

Figure 8 Overall Architecture

The dataset is taken from Yfinance API, the data is then preprocessed to make sure it is ready to be inputted into the ML model. The data is then split into train and test dataset for checking prediction accuracy. The predictive model is then constructed, prediction is made on the dataset and this process is repeated for multiple prediction algorithms. The prediction model with the best accuracy is then selected for further prediction purposes.

4.2. Proposed System Flow

A structure chart (SC) in software engineering and organizational theory is a chart which shows the breakdown of a system to its lowest manageable levels. They are used in structured programming to arrange program modules into a tree. Each module is represented by a box, which contains the module's name.

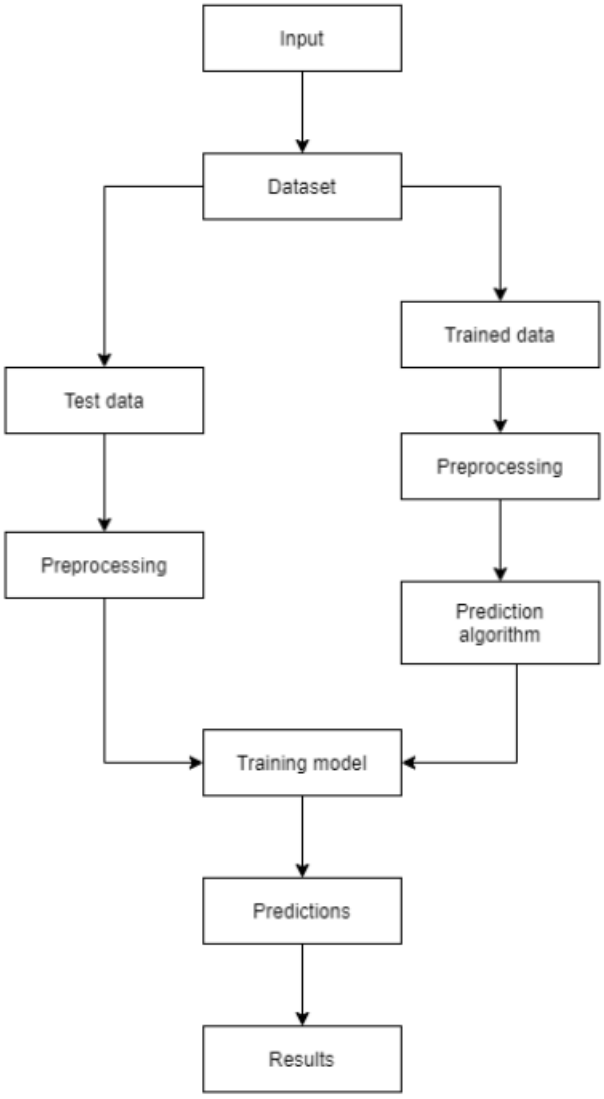

Figure 9 System Flow

4.3. UML Diagrams

A UML diagram is a partial graphical representation (view) of a model of a system under design, implementation, or already in existence. UML diagram contains graphical elements (symbols) - UML nodes connected with edges (also known as paths or flows) - that represent elements in the UML model of the designed system. The UML model of the system might also contain other documentation such as use cases written as template texts.

UML specification does not preclude mixing of different kinds of diagrams, e.g. to combine structural and behavioral elements to show a state machine nested inside a use case. Consequently, the boundaries between the various kinds of diagrams are not strictly enforced. At the same time, some UML Tools do restrict set of available graphical elements which could be used when working on specific type of diagram.

4.3.1. Use Case Diagram

In the Unified Modeling Language (UML), a use case diagram can summarize the details of your system's users (also known as actors) and their interactions with the system. To build one, you'll use a set of specialized symbols and connectors. An effective use case diagram can help your team discuss and represent:

- Scenarios in which your system or application interacts with people, organizations, or external systems.
- Goals that your system or application helps those entities (known as actors) achieve.
- The scope of your system.

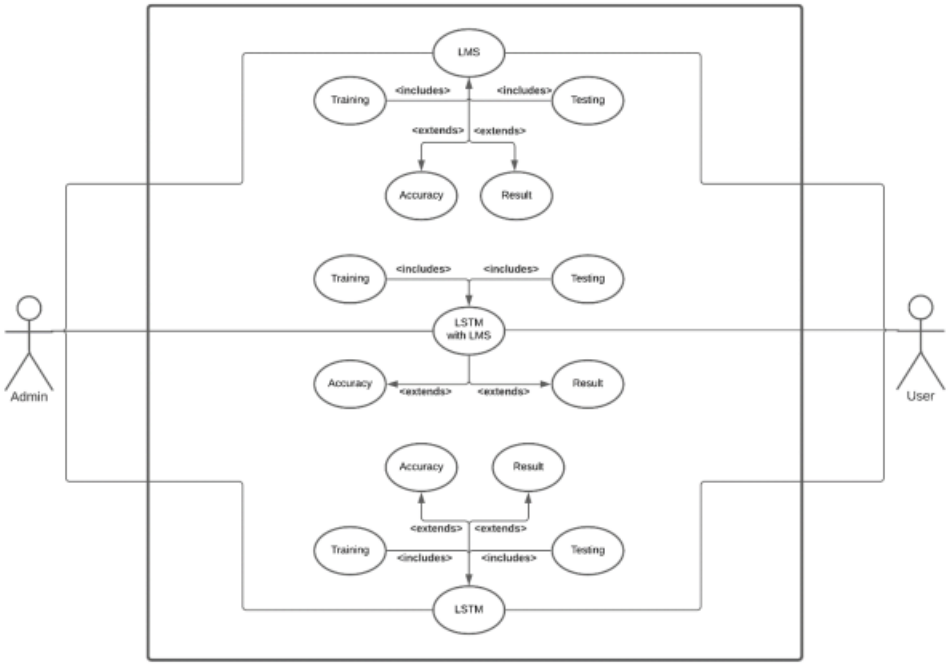

Figure 10 Use Case Diagram

4.3.2. Activity Diagram

An activity diagram is a behavioral diagram i.e. it depicts the behavior of a system. An activity diagram portrays the control flow from a start point to a finish point showing the various decision paths that exist while the activity is being executed.

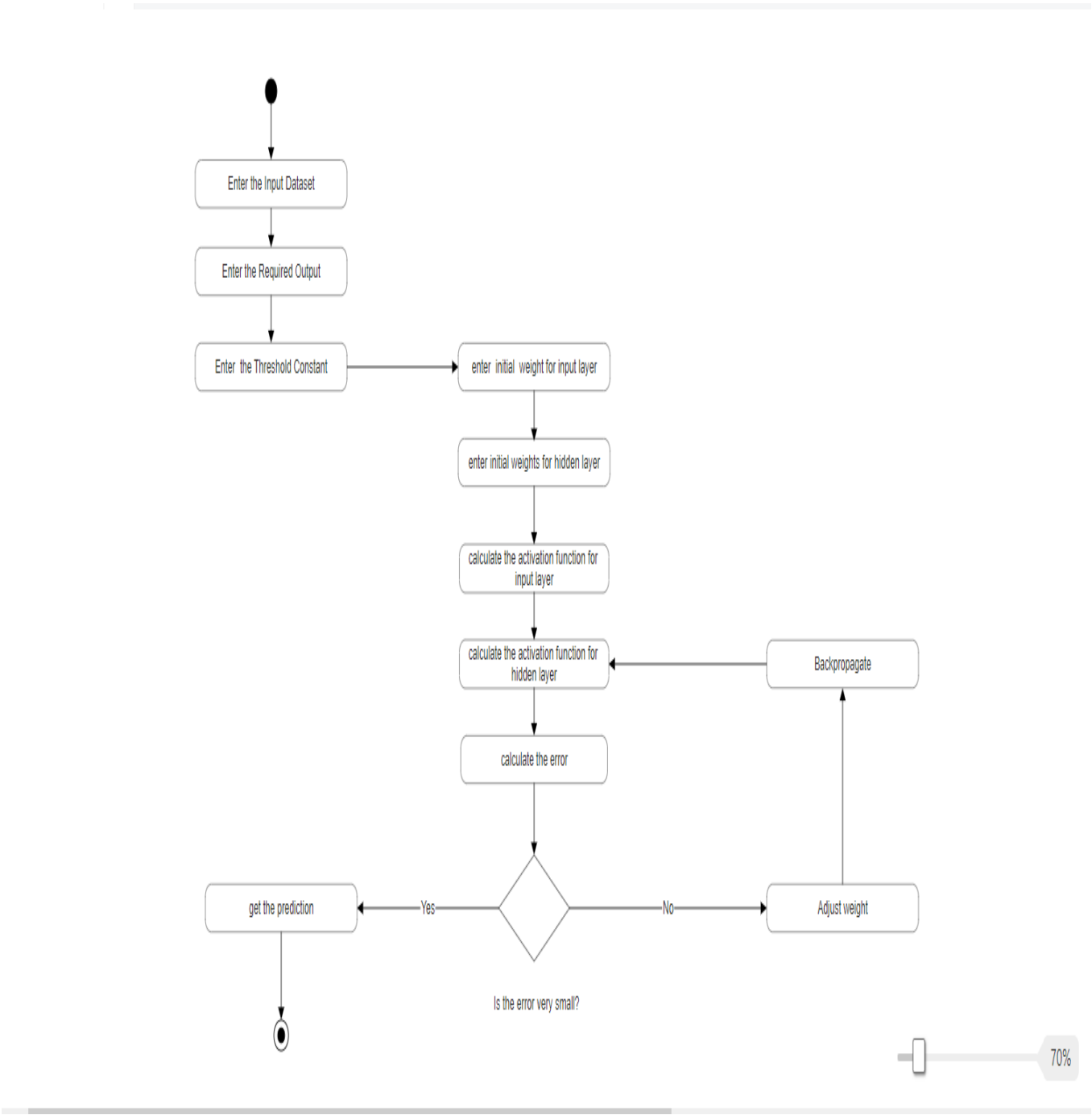

Figure 11 Activity Diagram

5. PERFORMANCE ANALYSIS

5.1. Deployment Framework

- Streamlit

Streamlit is an open-source Python library that makes it easy to create and share beautiful, custom web apps for machine learning and data science. In just a few minutes you can build and deploy powerful data apps. The library can help you create and deploy your data science solution in a few minutes with a few lines of code.

Streamlit can seamlessly integrate with other popular python libraries used in Date science such as NumPy, Pandas, Matplotlib, Scikit-learn and many more.

5.2. Output Screens

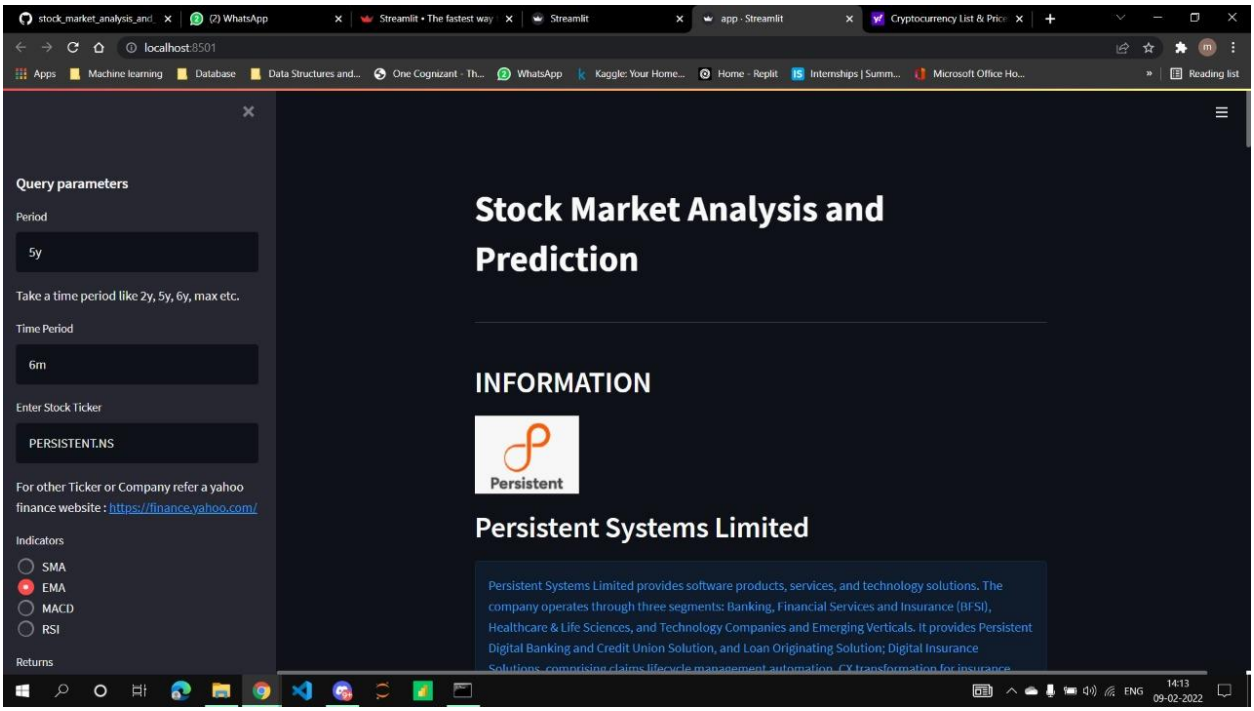

Figure 12 Home Screen

Home page is consisted of some parts like first analysis part and second the performance and result part.

In the analysis part some information, fundamentals, important charts, indicators, and the performance and result chart of stock is present.

A side bar for parameters is also present so that user can change it as per the requirements and see the performance of the stock.

Figure 13 Past Stock Performance

User can see the performance of stock with the help of candlestick chart.

Candlestick charts are a type of technical analysis that consolidates data from many time frames into a single price bar. This distinguishes them from standard open-high, low-close bars or simple lines connecting the dots of closing prices. Candlesticks create patterns that, if completed, forecast price direction.

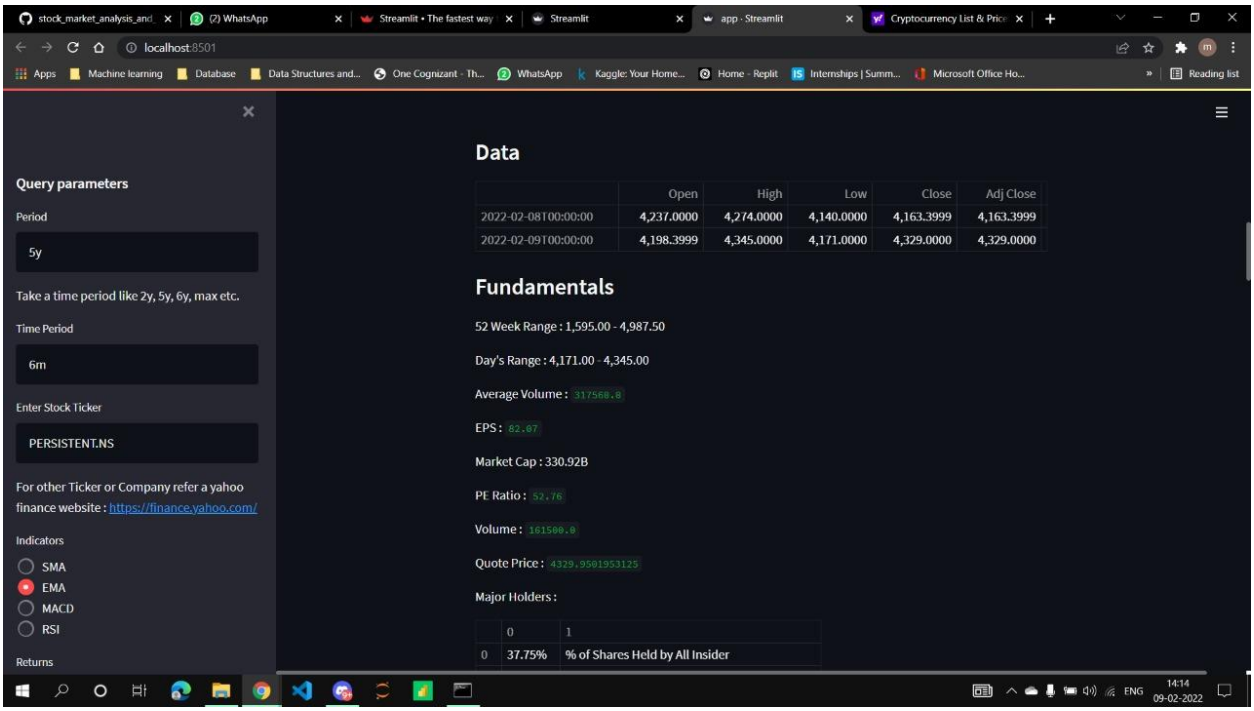

Figure 14 Fundamental Data of Stock

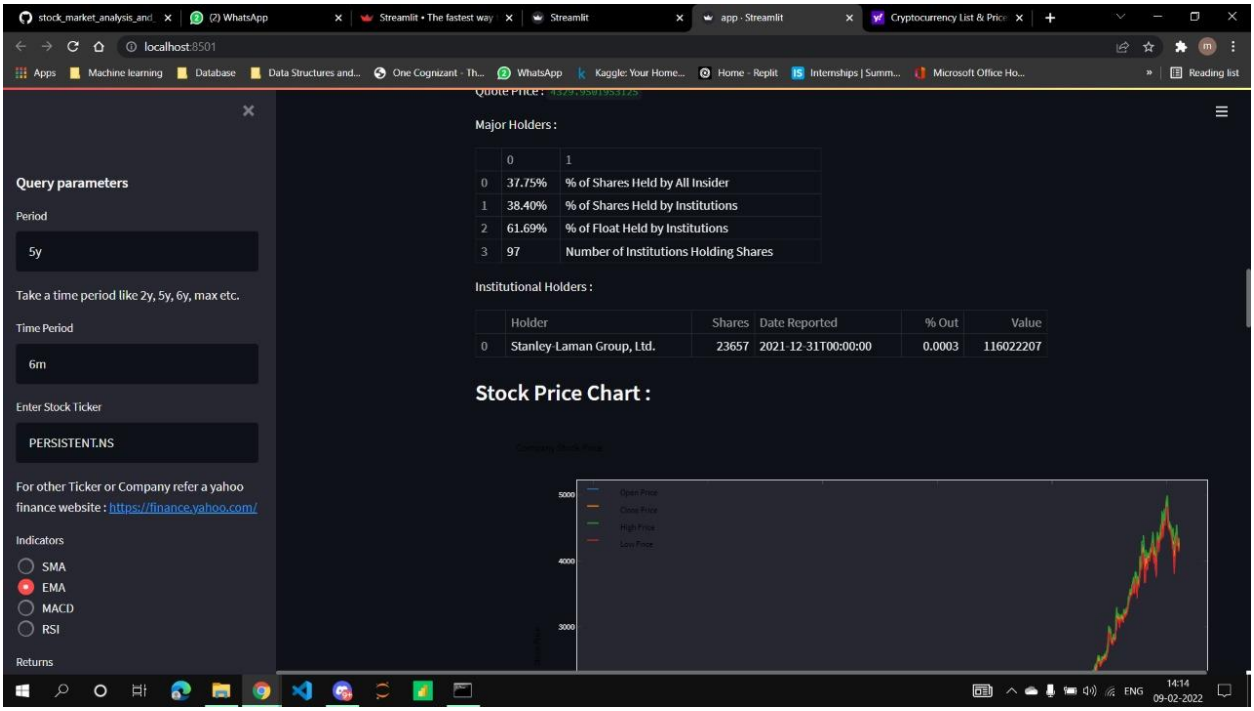

Figure 15 Additional Stock Performance

The fundamentals of a stock are the variables that are assumed to influence the underlying company's value or worth. Fundamentals can comprise both quantitative and qualitative information (such as cash flow and debt-to-equity ratio) (like business model and competitive advantage).

User can see all the important factors like average volume, EPS value, Market capitalization, PE ratio, volume and information of major holders and institutional holders.

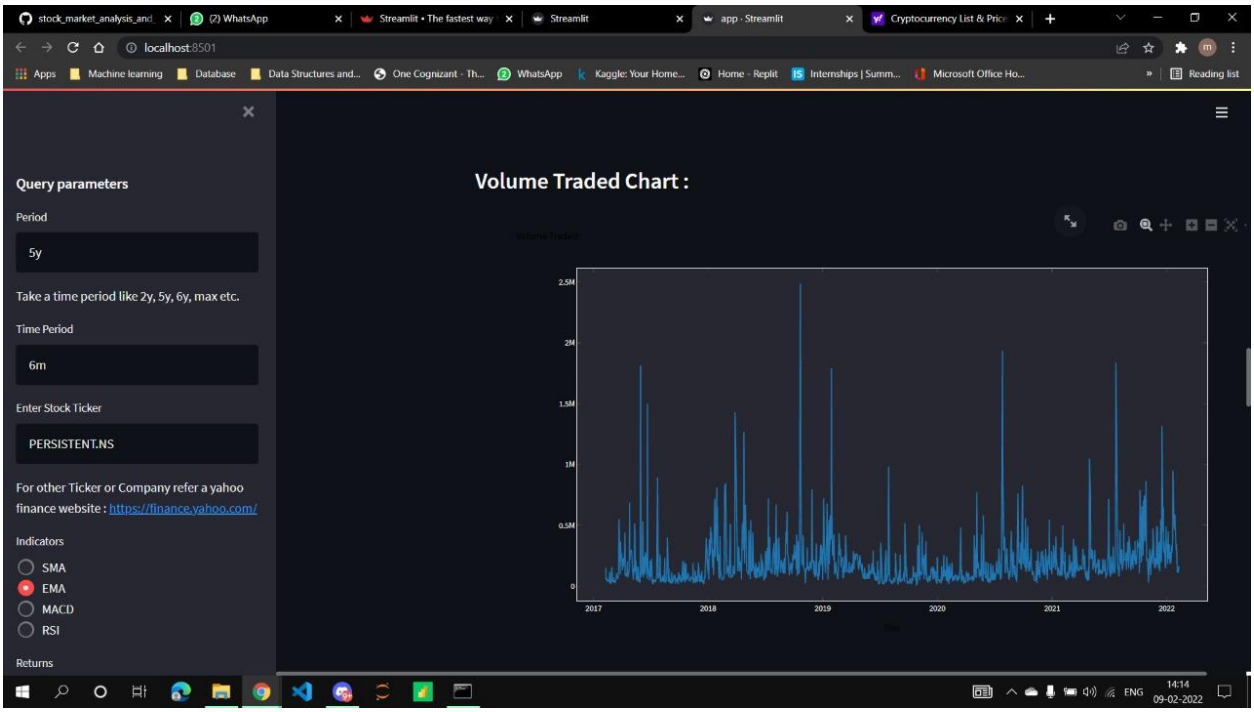

Figure 16 Volume Traded Chart

The trading volume of a financial asset is a measure of how much it has traded over a period of time. The number of shares traded is how volume is measured in equities. The volume of futures and options is determined by the number of contracts that have changed hands. Volume is used by traders to gauge liquidity, and variations in volume are used with technical indicators to make trading choices.

The level of conviction behind gains and losses in single companies and whole markets may be gauged by looking at volume trends over time. Trading volume is a sign of an option's current interest, and the same is true for options traders. Volume, in fact, plays a major part in technical analysis and is one of the most famous technical indicators.

The number of shares traded in a stock, or contracts exchanged in futures or options, is referred to as volume.

Rising markets on rising volume are often considered as robust and healthy, hence volume might reflect market strength.

When prices decline in conjunction with rising volume, the trend is skewed to the downside.

When prices achieve new highs (or no lows) on declining volume, be on the lookout for a reversal.

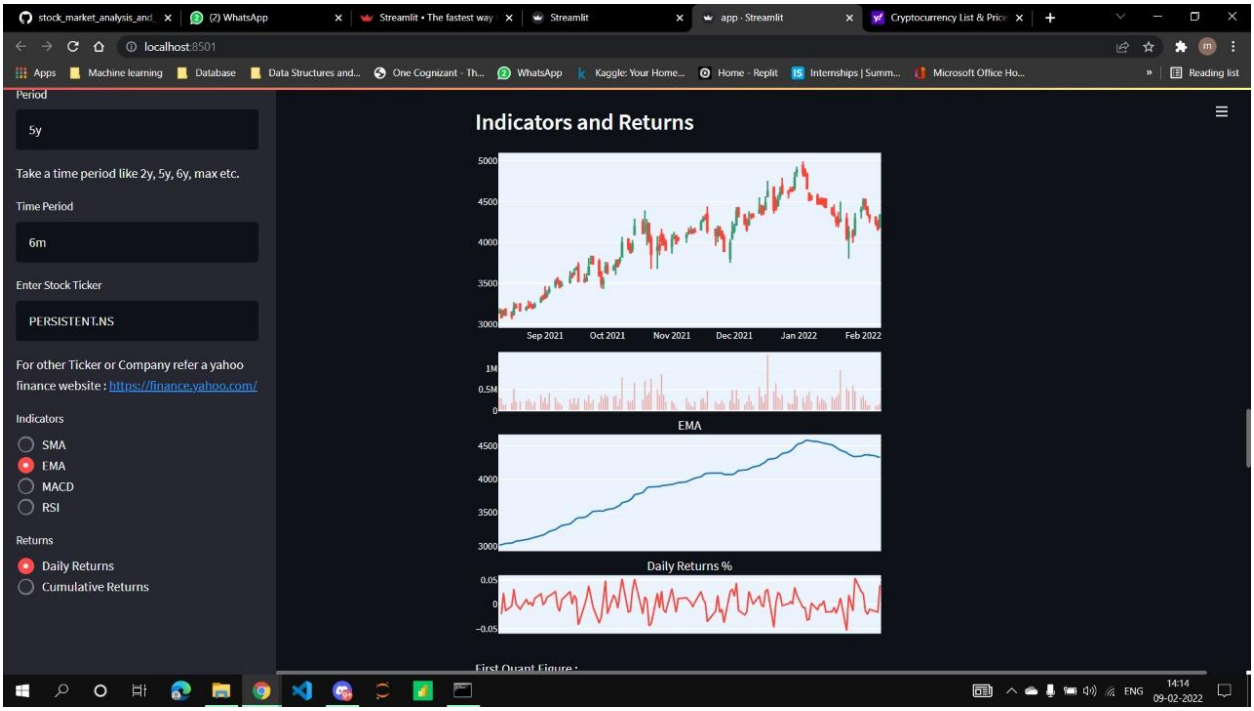

Figure 17 Indicators and Returns

Traders who trade trends try to pinpoint and benefit from them. Trend trading is a means of capturing profits by analyzing an asset's momentum in a certain direction; there are several ways to achieve this. Of course, no one technical signal can guarantee market success; traders must also understand risk management and trading psychology in addition to technical research. Certain tactics, on the other hand, have weathered the test of time and continue to be popular with trend traders who want to analyze certain market indications.

Figure 18 First Quant Figure

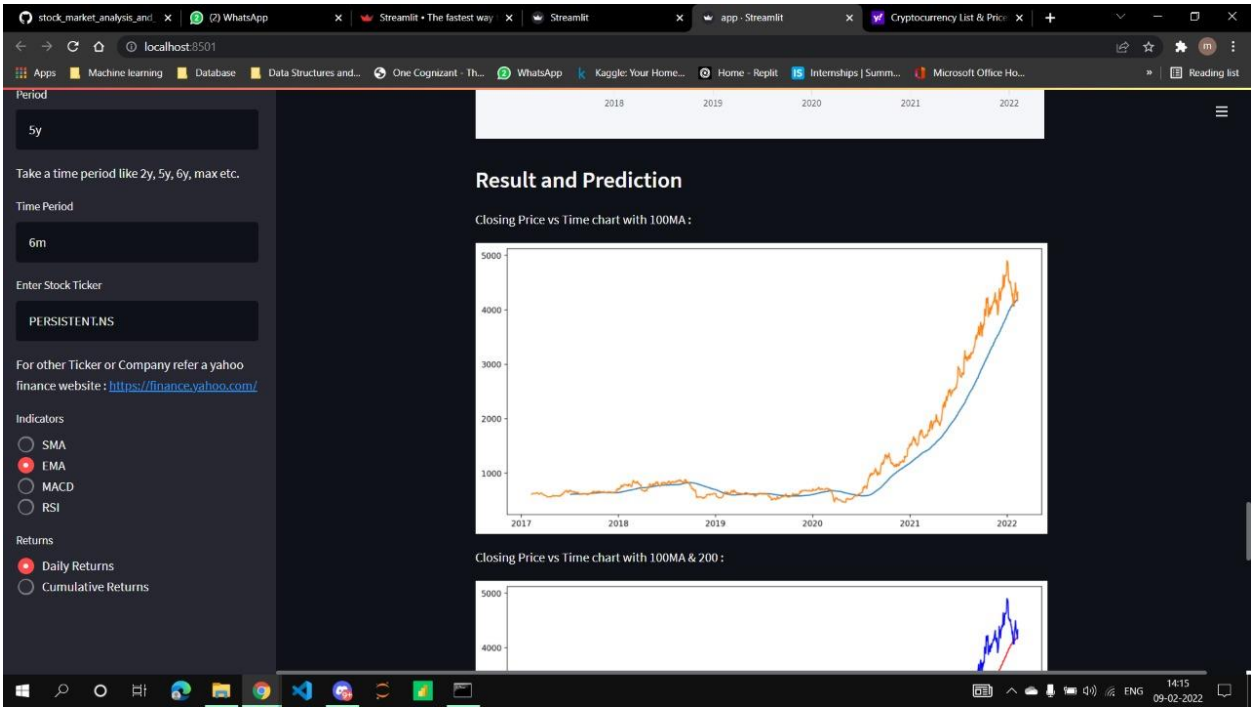

Figure 19 Result and Prediction

Closing price values against time is plotted , with 100 day moving average.

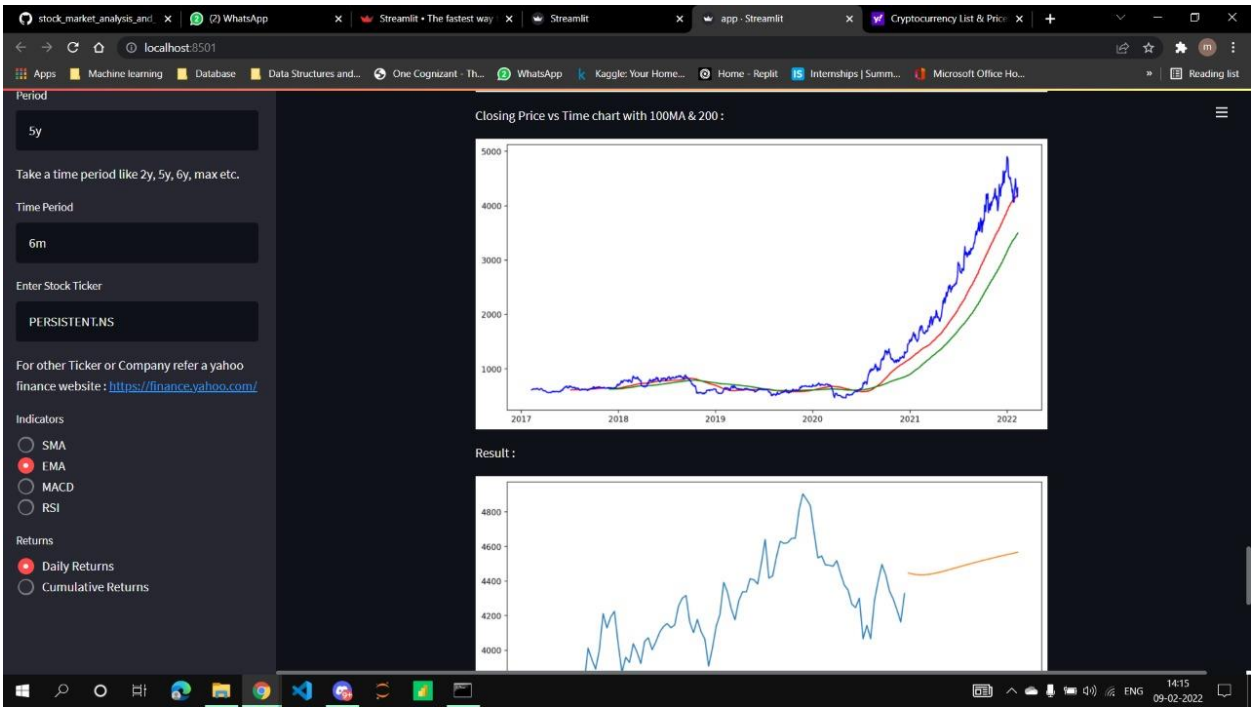

Figure 20 Closing Price

Closing price values against time is plotted, with 100 day & 200 day moving average.

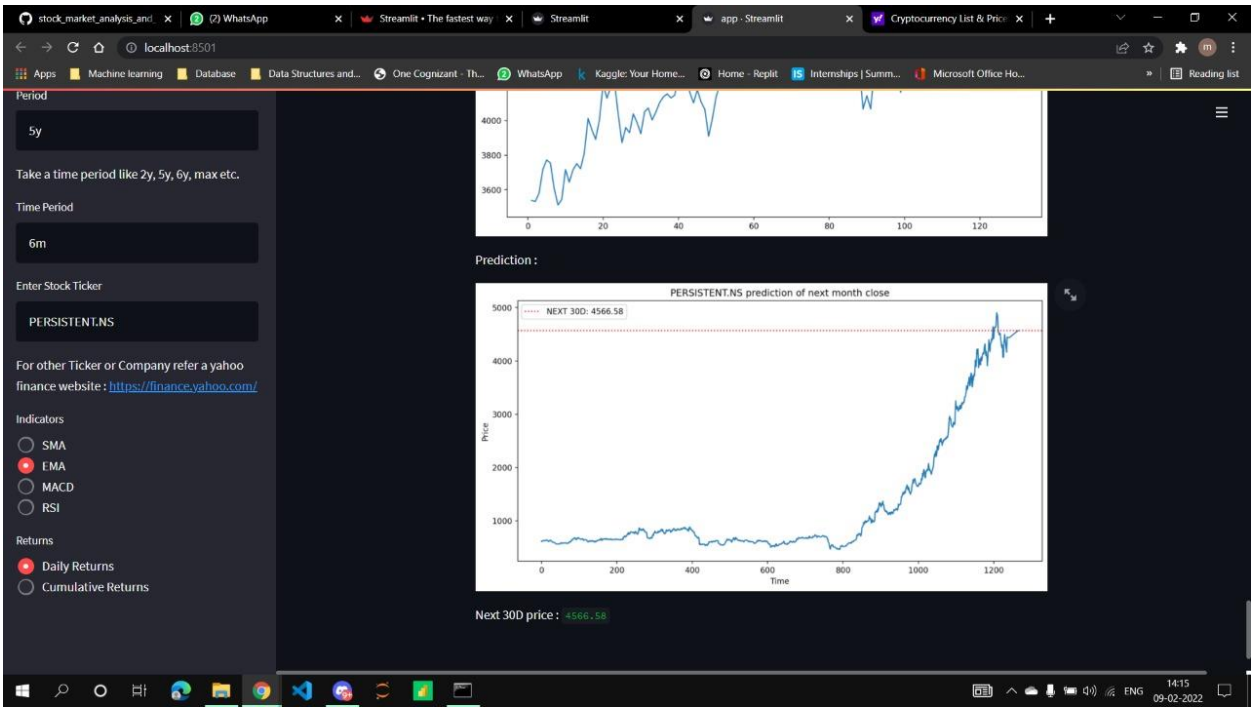

Figure 21 Final Prediction

Closing price of stock at the end of 30 days is predicted.

6. CONCLUSION

We are predicting the closing stock price of any given organization, we have developed a website for predicting closing price of various using LSTM algorithm. We have imported data using the yahoo finance API and achieved above 90% accuracy for these predictions.

Future Scope

- Adding sentiment analysis as a factor to contribute to prediction would make the results more accurate and the user would get more realistic results.
- Along with stock market, crypto currency prediction may also be integrated in order to make the website a one stop portal for various forms of investments.

Project Link:

https://share.streamlit.io/mayanknagar10/stock_market_analysis_and_prediction/main/app.py

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