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STOCK RECOMMENDATION SYSTEM

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Abstract

Predicting the stock market is one of the most difficult tasks in the field of computation. There are many factors involved in the prediction – physical factors vs. physiological, rational and irrational behavior, investor sentiment, market rumors, etc. All these aspects combine to make stock prices volatile and very difficult to predict with a high degree of accuracy.

The Stock Recommendation system aims to suggest to the user whether the particular stock is worth investing in or not. It is achieved by predicting the closing price of the stock by using the historical data of that stock. It uses Bagging Classifier i.e., the type of ensemble machine learning approach which combines the output of many algorithms to improve performance and pass the result through a series of logical conditions, and the output of the project is displayed to the user.

Keywords:

Machine Learning, Stock Price Prediction, Stock Market, Stock Recommendation, ensemble method.

I. Introduction

A stock market is a public market where you can buy and sell shares for publicly listed companies. The stocks, also known as equities, represent ownership in the company. The stock exchange is the mediator that allows the buying and selling of shares. When a company issues stocks, it is essentially selling a portion of ownership in the form of shares. Investors who buy these shares become shareholders and own a part of the company. The term "share" is often used to refer to stocks in general or to specific stocks that an investor owns**.** We all have heard the word stock at least once. Stocks are especially related to associates and companies starting on a commercial path. People even term it as an investment plan and it's something people see as a long-term investment that secures and provides abundant funds during retirement age.

In India, the stock market is regulated by the Securities and Exchange Board of India (SEBI). India's two main stock exchanges are the Bombay Stock Exchange (BSE) and the National Stock Exchange (NSE). To start investing in the stock market in India, you will need to open a brokerage account with a registered broker. You can choose between a full-service broker, who will provide you with research and advice in addition to the execution of trades, or a discount broker, who will only execute trades on your behalf for a lower fee. Once you have opened a brokerage account, you will need to complete the necessary paperwork and provide identification and proof of address. You will also need to link your account to a bank account for funding and to facilitate the transfer of money when you buy and sell stocks. There are several ways to buy and sell stocks in India, including through a broker, through a mutual fund, or through an exchange-traded fund (ETF). It is important to do your research and understand the risks and potential rewards of each investment option before making a decision. It is also a good idea to diversify your portfolio by investing in a mix of asset classes, rather than just stocks

The market is unpredictable so are the resources and the factors that are taken to drive it off or on the set. It's never been on the same level and the pattern of the same is still unpredictable at the time. Some closeness and prediction methods have been derived and approximate values and rough figures are generated hoping for the best but all of the resources can’t be trusted and are still unpredictable.

Stock market prediction and analysis are some of the most difficult jobs to complete. There are numerous causes for this, including market volatility and a variety of other dependent and independent variables that influence the value of a certain stock in the market. These variables make it extremely difficult for any stock market expert to anticipate the rise and fall of the market with great precision.

However, with the introduction of Machine Learning and its strong algorithms, the most recent market research and Stock Market Prediction advancements have begun to include such approaches in analyzing stock market data.

The probable stock market prediction target can be the future stock price or the volatility of the prices or market trends. Using these methods in any combination depending on the need, provides the possibility of looking into the future of the stock and seeing if it is recommendable to other people using various features extracted during analysis. It is possible for even beginners to have a decent return on investment if they receive a timely recommendation.

II. Literature Survey

- **Stock Price Prediction System**, published by S. Radhakrishnan, Tavva Monika Rani, Prattipati Kavya, Tadepalli Madhu Chandrika, Sk. Salma Rahimunnisa, in IJARCCE in 2022. This paper focuses on predicting the future price of the stock by using the LSTM algorithm and it displays the value to the user.

- **An Automated Stock Recommendation System from Stock Investment Research using Domain Specific Information Extraction**, published by Tayida Tapjinda, Potsawee Vechpanich, Nutchaya Leelasupakul, Nakornthip Prompoon, and Chate Patanothai in IEEE in 2015. This paper focuses on recommending the stock to newcomer investors and helping them to make their decision based on information from stock investment research published by the brokers.

- **Comparative Analysis of Various Stock Prediction Techniques**, published by Aakanksha Sharaff, Meenakshi Choudhary, in IEEE in 2018. This paper focuses on finding the most effective ML algorithms such as the ARIMA model, Artificial Neural Network, Holt-Winters model, and Recurrent Neural Network to predict the closing stock.

- **Stock price prediction using Data Analytics,** published by Shashank Tiwari, Akshay Bharadwaj, Sudha Gupta, in IEEE in 2017. This paper focuses on predicting the stock price using Linear regression and support vector machine along with some more algorithms.

- **A Survey on Machine Learning for stock prediction: algorithms and techniques**, published by Mehtabhorn obthong, Nongnuch Tantisantiwong, Watthanasak Jeanwatthanachai, Gary wils in scite press

in 2020. This paper focuses on different machine learning techniques that help to increase the accuracy of stock price prediction.

- **Stock price prediction using RNN and LSTM,** published by Janki patel, Miral patel, Mittal darji in JETIR in 2018. This paper focuses on predicting the price of stocks using RNN and LSTM algorithms.

III. Existing system

The existing stock recommendation system aims to predict the stock performance of a company by analyzing its internal communication patterns. The early detection of these patterns is seen as crucial in avoiding potential risks in the securities market and safeguarding the interests of stakeholders. The system has demonstrated high predictive values in certain time periods, but this heavily depends on the time frame selected for the experiments. One major limitation of the system is its reliance on a single data source, which can result in a biased outcome. Furthermore, the system may not perform well in changing operating environments and may not provide accurate predictions in such scenarios. To overcome these limitations and improve the overall performance of the system, it may be necessary to incorporate additional data sources and implement more advanced algorithms. This could include incorporating market trends, financial statements, news articles, and other relevant information to provide a more comprehensive and accurate analysis. Additionally, the system should be designed to adapt to changing operating environments and be flexible enough to accommodate new data as it becomes available.

IV. Drawbacks

The stock market data is susceptible to non-economic factors such as natural disasters and political decisions, making it inherently noisy and unpredictable. The stock data's unpredictability is also due to the lack of complete information on the past behavior of the stock market, which limits the ability to capture the relationship between future and previous prices. Existing systems often have a bias toward historical data and struggle to incorporate new information. With the rapid growth in trade and investment, there is a growing need for effective tools and methods to manage risks and maximize gains in the stock market.

V. Proposed method

Stock value prediction is a major task in the current machine learning domain. Several approaches have been proposed to solve this problem. Most of them are based on a Time Series analysis of a stock value, others are based on the news sentiments to be used to predict a particular stock value. This system is proposed to analyze the current value of the stock in consideration and predict its profitability, as well as its future closing price to help beginners invest in the stock for it, using the historical data of the stock. This project is implemented using a

method known as the Bagging classifier which utilizes two or more predictive algorithms to get the future closing price of the stock into consideration. In the Bagging classifier, this system implements three predictive algorithms such as Random Forest Classifier, Decision Tree Classifier, and Gradient Boosting Regressor from the Gradient Tree Boosting method. After predicting the future closing price of the stock, certain logical calculations are implemented to determine whether the stock may or may not yield profitable returns.

- Bagging Classifier

  A Bagging classifier is an ensemble meta-estimator that fits base classifiers each on random subsets of the original dataset and then aggregates their individual predictions to form a final prediction. Such a meta-estimator can typically be used as a way to reduce the variance of a black-box estimator by introducing randomization into its construction procedure and then making an ensemble out of it.

- Random Forest Classifier

  In the random forests Random Forest Classifier, each tree in the ensemble is built from a sample drawn with replacement from the training set. It creates a set of decision trees from a randomly selected subset of the training set. It is basically a set of decision trees from a randomly selected subset of the training set and then it collects the votes from different decision trees to decide the final prediction. The algorithm uses a divided dataset that consists of nearly n lines of data. The random forest will randomly choose "k" features where k < n. Now, the algorithm will calculate the root node among the k features by picking a node that has the highest information gain. After that, the algorithm splits the node into child nodes and repeats this process "n" times. Now you have a forest with n trees. Finally, you'll perform bootstrapping, ie, combine the results of all the decision trees present in your forest.It's certainly one of the most sophisticated algorithms as it builds on the functionality of decision trees.

- Decision Tree Classifier

  A Decision Tree is a Supervised learning technique that can be used for both classification and Regression problems, but mostly it is preferred for solving Classification problems. It is a tree-structured classifier, where internal nodes represent the features of a dataset, branches represent the decision rules and each leaf node represents the outcome. In a decision tree, for predicting the class of the given dataset, the algorithm starts from the root node of the tree. This algorithm compares the values of the root attribute with the record (real dataset) attribute and, based on the comparison, follows the branch and jumps to the next node. For the next node, the algorithm again compares the attribute value with the other sub-nodes and moves further. It continues the process until it reaches the leaf node of the tree.

- Gradient Boosting Regressor

  Gradient Boosting Regression algorithm is used to fit the model which predicts the continuous value. Gradient boosting builds an additive mode by using multiple decision trees of fixed size as weak learners or weak predictive models.

- Logical Phase

  Through the study that has been conducted, a few values have been considered to be key values in predicting the profitability of the stock. The values are PEG Ratio, ROE, Intrinsic value, and VWAP.

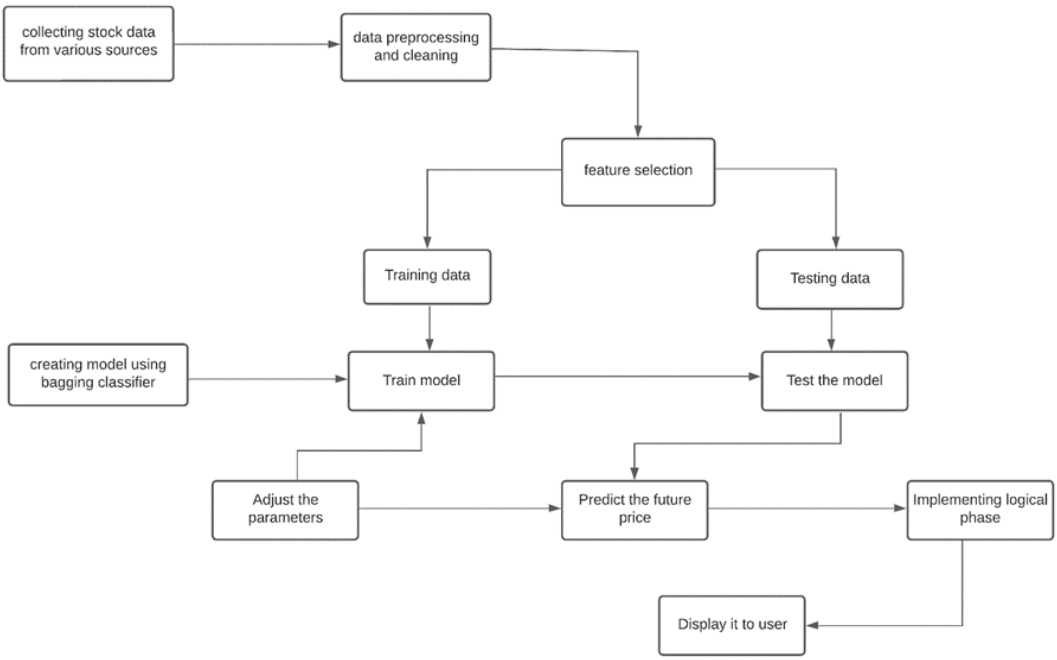

Fig1. Stock Recommendation System Architecture

This system recommends to users whether to invest in a particular stock in a particular time period or not. For that purpose, this system will take the historical data of that stock to predict the next day's closing price. The historical data which is imported as a dataset is divided among the Random Forest Classifier, Decision tree Classifier, and Gradient Boost Regressor which is used as a Base learner for the Bagging Classifier which is created, and the next day closing price is predicted by using the testing dataset. The result is then displayed to the user. After implementing the logic phase to check certain key conditions of the stock the result is finalized. The final outputs are displayed to the user by a simple user Interface.

This system is also plagued by stock market data that is inherently noisy and unpredictable due to non-economic events like natural catastrophes and political actions. Even with the aid of artificial intelligence, it is difficult to anticipate how future events will turn out.

VI. Methodology

The aim of this project is to develop a system that recommends whether or not a user should invest in a particular stock at a specific time period. To predict the closing price of the next day, the system will utilize the historical data of the stock and apply the Random Forest Classifier, Decision Tree Classifier, and Gradient Boost Regressor as a learner for the Bagging Classifier to process the downloaded dataset. Upon completion, the result will be presented to the user and, after implementing the logic phase to verify certain key conditions of the stock. In the final phase, the output is finalized from the results of the logic phase. The logic phase is implemented from the values, whose formulas are:

- PEG Ratio - P/E Ratio / Earnings Growth Rate
- ROE - Net Income / Shareholders' Equity
- Intrinsic value - (eps) * (1 + r) * pe
- VWAP - (Typical Price x Volume) / cumulative volume

A simple user interface is used to display the final outputs to the user

VII. Experimental Analysis

The output of our stock recommendation system includes the predicted and actual closing values for a particular stock over a 7-day period. These values are presented in a table and line chart for easy visualization and analysis. Figure 6 uses a candlestick chart to represent the live share price evolution of the selected stock. This type of chart is commonly used in technical analysis and provides a clear visual representation of the stock's performance over time. It includes information on the stock's opening and closing prices, as well as the high and low prices for the day.

SBI stock data

Table I: 7 day values of SBI stock

Date	10 Am(₹)	3.30 Pm(₹)	Predicted Closing(₹)
23-11-2022	605.6	607.65	602.53
24-11-2022	610.35	609.35	602.13
25-11-2022	612.5	607.4	601.96
28-11-2022	603.85	608.6	600.25
30-11-2022	606.7	602.45	608.0
01-12-2022	603.2	608.1	603.94
02-12-2022	606.35	607.55	606.0

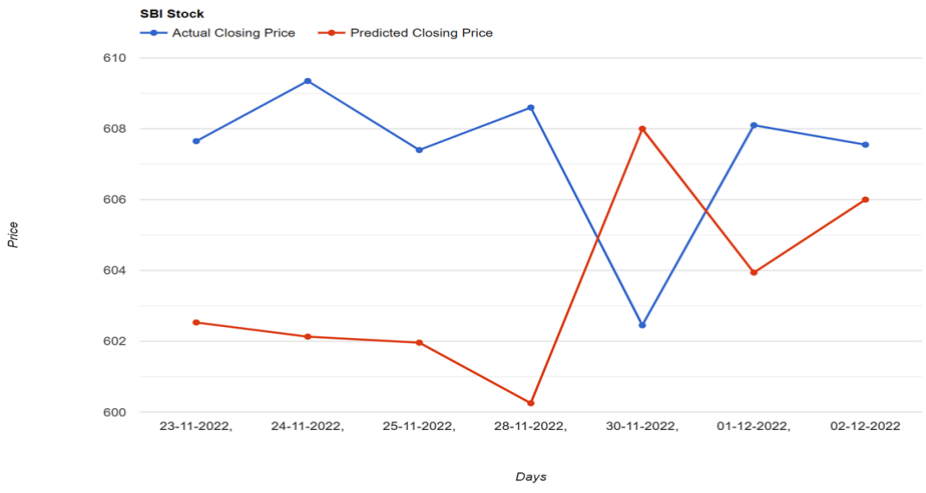

Fig2: Visual representation of SBI Stock

Wipro Stock data

Table II: 7 day values of WIPRO stock

Date	10 Am(₹)	3.30 Pm(₹)	Predicted Closing(₹)
23-11-2022	390.05	388.75	393.11
24-11-2022	389.5	398.25	391.78
25-11-2022	396.3	402.8	406.0
28-11-2022	405.0	405.65	402.0
30-11-2022	402.95	407.6	405.0
01-12-2022	412.2	413.7	412
02-12-2022	409.55	412.4	409

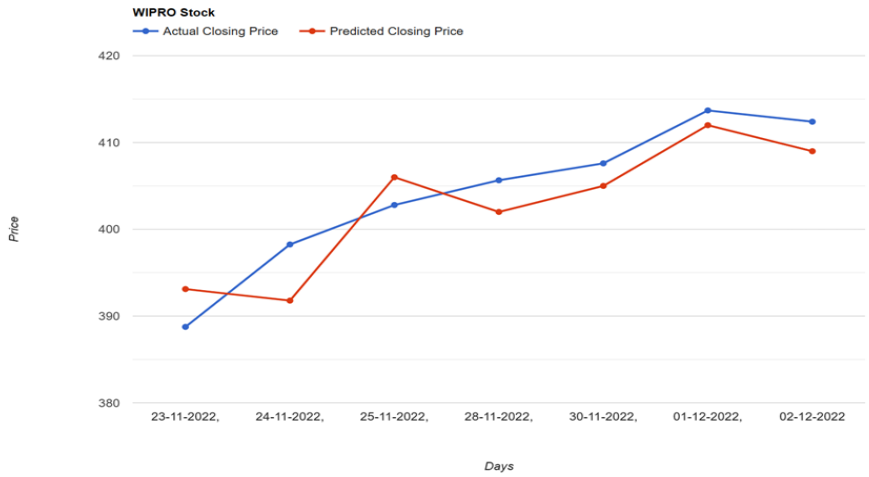

Fig3: Visual representation of WIPRO Stock

TCS stock data

Table III: 7 day values of TCS stock

Date	10 Am(₹)	3.30 Pm(₹)	Predicted Closing(₹)
23-11-2022	3309.0	3306.0	3368.23
24-11-2022	3322.35	3380.15	3311.58
25-11-2022	3362.0	3389.65	3384.7
28-11-2022	3394.45	3393.85	3381.0
30-11-2022	3384.05	3402.95	3430.0
01-12-2022	3464.0	3475.0	3463.0
02-12-2022	3417.3	3439.15	3417.0

Fig4: Visual representation of TCS Stock

Tech Mahindra stock data

Table IV: 7 day values of TECH MAHINDRA stock

Date	10 Am(₹)	3.30 Pm(₹)	Predicted Closing(₹)
23-11-2022	1049.3	1042.5	1065.22
24-11-2022	1049.5	1069.3	1057.27
25-11-2022	1061.5	1080.15	1088.0
28-11-2022	1085.35	1077.2	1080.0
30-11-2022	1064.9	1079.95	1063.95
01-12-2022	1098.7	1101.5	1098.0
02-12-2022	1107.0	1114.75	1106.0

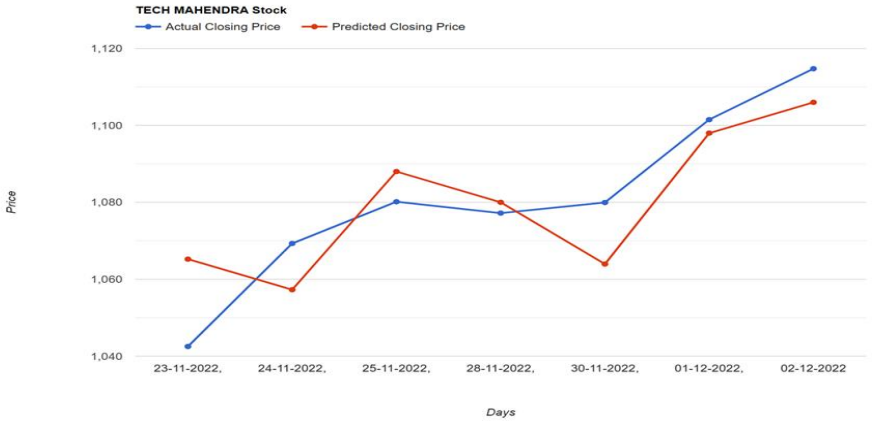

Fig5: Visual representation of TECH MAHINDRA Stock

Table V: Comparing Predicted vs Actual price for 10 companies

Stocks	Predicted Closing Price (₹)	Actual Closing Pricing(₹)
ONGC	146.66	144.9
HCL TECH	1141.21	1122.2
IRCTC	640.03	636.6
ITC	352.0	352.35
DABUR	557.54	557.75
ZEE ENTERTAINMENT	226.0	226.8
BHEL	78.04	78.4
BPCL	343.26	344.0
COAL INDIA	228.05	224.85
GODREJ	915.71	914.3

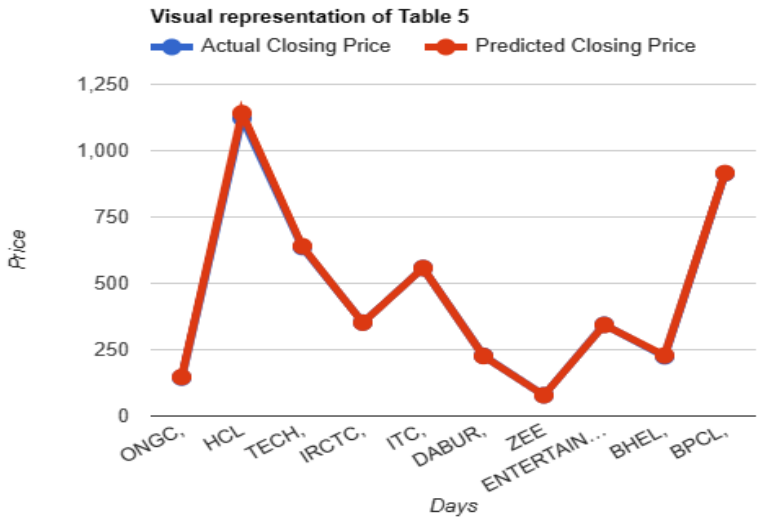

Fig6: Visual representation of Table V

Figure 7 & 8, displays the predicted closing price of the stock, along with key values. These figures also shows the result of our analysis, which can be used to inform investment decisions.

Fig7: SBI STOCK Candlestick chart part

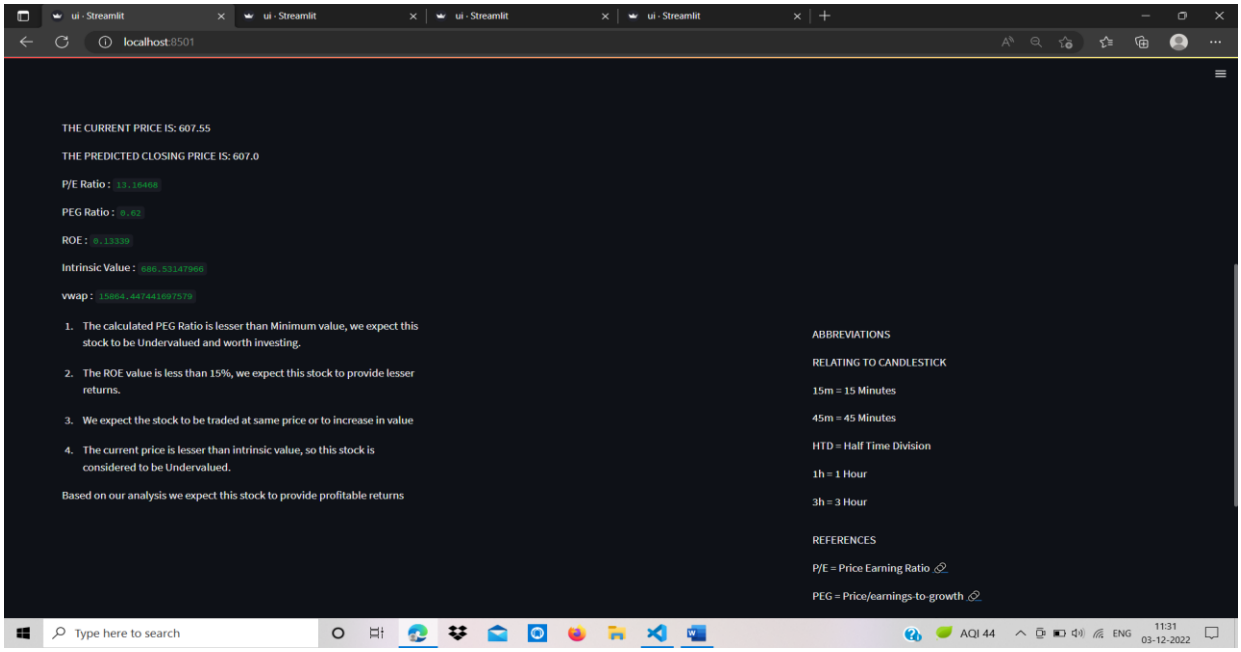

Fig8: SBI STOCK Recommendation logic part

VIII. Conclusion

Thus, this project's Stock Recommendation system consists of two parts: prediction of the future closing price of the stock and recommendation of the stock. The purpose of this prediction part is to predict the future closing price of the stock by using a bagging classifier which consists of classifiers such as Random Forest Classifier, Decision Tree Classifier, and Gradient Boost Regressor with the help of historical data of the stock. The recommendation part of the system uses a set of logical statements to suggest stocks and based on the results, the output is displayed to the user in a simple user interface. The main goal of this project is to provide beginner investors with recommendations on whether or not it is a good time to invest in a particular stock. The output of our stock recommendation system offers valuable insights into the performance of the stock and can be used to make informed investment decisions.

IX. Future Scope

The stock recommendation platform has plans to increase its scalability, allowing for the storage of larger amounts of data through the use of cloud services. The recommendation system's effectiveness can be boosted by incorporating additional logical statements and by offering personalized recommendations based on the user's investment history. Furthermore, the platform aims to expand its data sources to provide more accurate predictions and explore international markets with local stock market data and recommendations. With the integration of AI/ML algorithms, the platform will be able to provide even more accurate predictions and portfolio management for users.

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