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Technical Paper on Stock Prediction using Machine Learning Algorithms

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Abstract: In today's financial world, a stock market is quite important. The stock market's worth is an important part of today's global economic system. The stock market attracts a large number of people from all areas of life, whether corporate or academic. Because of the non-linear structure of the stock market, research is one of the world's hottest and most important topics. People invest in the stock market based on previous theory outcomes or assumptions. When it comes to forecasting, people typically look for ways or procedures to help them reduce risk and improve performance. As a result, in today's competitive stock market, stock value forecast is crucial. Critical and technical studies' approach cannot guarantee the consistency and accuracy of estimations. As a result, machine learning technology has risen in popularity in stock forecasting over the last 5-6 years, with estimates based on current stock values that have been educated in terms of prior values. This research focuses on using LSTM (Long Short Time Memory) technology to forecast future market trends.

I. INTRODUCTION

The stock market has a significant influence on a country's economic performance. Forecasting stock prices, on the other hand, has always been challenging due to the market's volatility character, which does not follow to defined norms. The unpredictability of the market frequently results in losses for investors who gamble by arbitrarily forecasting prices rather than making informed trades. According to studies, up to 90% of investors lose money on a single investment. The stock market operates on supply and demand principles, with a high demand for a given company's stock and a limited supply driving up the stock price. Low demand, on the other hand, can cause a drop in the stock price. Based on historical data and periodic chart patterns, market analysis can be used to forecast stock values, resulting in profitable trading and substantial profits for investors. As a result, it is necessary to assess market conditions and construct a stock price prediction system that allows investors to optimise their outcomes and portfolios.

II. LITRATURE SURVEY

M. Sreemalli, P. Chaitanya, and K. Srinivas [1] claim that support vector machines and artificial neural networks are often employed techniques for stock price forecasting. Input vectors can be mapped onto high-dimensional feature spaces using ANNs, which can then be used to build nonlinear class partitions using linear models. ANNs are especially promising for machine learning tasks including classification and prediction. The ARIMA approach can be used to model time series data. The 2015 Bank Nifty dataset was used in this study to forecast Nifty bank data using machine learning techniques such support vector machines, artificial neural networks, and autoregressive integrated moving average. In comparison to previous approaches, the neural network implementation required more time to finish calculations, while the support vector machine implementation had a greater error rate.

To overcome the difficulties in predicting stock values, Indu Kumar, Kiran Dogra, Chetna Utreja, and Premlata Yadav [2] created a machine learning technique. Five models were developed for the study, and their abilities to forecast market trends were compared. As supervised learning methods, these models use Support Vector Machine (SVM), Random Forest, K-Nearest Neighbour (KNN), Naive Bayes, and SoftMax. The study found that the Random Forest method performs better than other models for larger databases, whereas the Naive Bayesian Classifier is better suited for small databases. Feature extraction from a given database, supervised classification from a training database to a test database, and result evaluation make up the proposed architecture for real-world applications.

For precise stock price estimation, Ishita Parmar, Navan Shu Agarwal, and Shirish Saxena [3] suggested employing LSTM-based regression and machine learning. The study took into account volume, open, low, high, and close data from a Yahoo Finance dataset. For simulation and overview purposes to improve prediction accuracy, they concentrated on data from a single organisation. The LSTM model is more effective in properly forecasting stock values, according to the results.

In order to generate strong demand and successful business, Mariam Moukalled, Wassim ElHaj, and Mohamad Jaber [4] presented an automated industry that incorporates various external tools like mathematics, machine learning, and innovation. They construct unique machine learning methods to accomplish this, taking into account the significance of master data, while developing and training a large number of deep learning models. The stock of Apple Inc. (AAPL) that had the highest accuracy was SVM (82.91%).The direction of today's closing price in relation to yesterday's closing price is predicted using recurrent neural networks (RNN), feed forward neural networks (FFNN), support vector machines (SVM), and vector regression (SVR). Two samples yielded data for four different 10-year periods: historical information obtained from Reuters and stock news

Roondiwala et al.'s [5] developed an LSTM RNN model using features like low, high, off, and on values to estimate the model of the Nifty index. Testing was conducted using the NIFTY 50's five-year history. After 500 training cycles, this yields a root mean square error of 0.0086. This piece, however, steers clear of consistency. The percentage increase in daily sales was used by the authors of this study to determine the RMSE. However, even though the number is zero, it is equal to RMSE divided by 100, or around 1% of the Nifty index.

Also, role of ML and ESPs [11-68] are becoming important in recent applications, recognition and control.

III. RECURRENT NEURAL NETWORK (RNN) AND LONG SHORT-TERM MEMORY (LSTM)

Long Short-Term Memory (LSTM) is a type of Recurrent Neural Network RNN that may capture input from earlier stages and use it to create future predictions [7]. An Artificial Neural Network (ANN) has three levels: the input layer, the hidden layers, and the output layer.

The number of nodes in the input layer in a NN with only one hidden layer is always dictated by the dimension of the data; nodes in the input layer connect to the hidden layer via ‘synapses'. The weight coefficient is the signal decision maker in every two-node relationship from (input to the hidden layer). features a parameter called weight that serves as the signal's decision maker. The learning process is inherently a continuous adjustment of weights; after learning is complete, the Artificial NN will have optimal weights for individual synapses.

The hidden layer nodes use the SoftMax function to apply a sigmoid or tangent hyperbolic (tanh) function to the sum of weights from the input layer, which is called the activation function. This transformation generates values with a minimised error rate between the train and test data. The values obtained after this transformation comprise our NN's output layer; however, they may not be the best output; in this case, a back propagation process will be used to target the optimal value of error; the back propagation process will connect the output layer to the hidden layer, sending a signal conforming to the best weight with the optimal error for the number of epochs determined. This method will be used again and again in an attempt to improve our forecasts and reduce prediction error.

Once this stage is completed, the model will be trained. A recurrent neural network (RNN) is a type of neural network (NN) that predicts future value based on a prior sequence of observations. This sort of NN learns data from earlier stages and forecasts future patterns.

The earlier stages of data need be remembered in order to anticipate and guess future values; in this case, the hidden layer works as a stock for prior information from the sequential data. The practise of forecasting future data by using elements from prior sequences is referred to as recurrent.

Because RNNs cannot hold long-term memory, the usage of Long Short-Term Memory (LSTM) based on "memory line" proved to be particularly beneficial in forecasting scenarios involving long-term data. In an LSTM, previous phases 1170 Adil Moghar et al. / Procedia Computer Science 170 (2020) 1168-1173 Adil MOGHAR and Mhamed HAMICHE/ Procedia Computer Science 00 (2020) 000-000 3 can be remembered using gates with a memory line integrated. The composition of LSTM nodes is depicted in diagram-1.

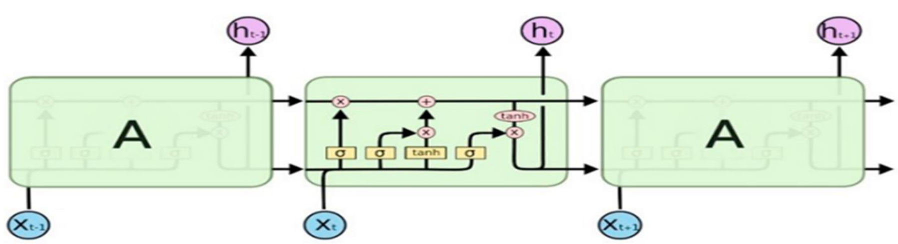

Fig-1 Internal Structure of LSTM

The capacity to memorise data sequences distinguishes LSTMs from other types of RNNs. Every LSTM node must have a set of cells responsible for storing passed data streams; the upper line in each cell connects the models as a transport line handing over data from the past to the present; and cell independence aids the model in disposing of a filter of add values from one cell to another. Finally, the sigmoidal neural network layer, which comprises the gates, drives the cell to an ideal value by discarding or allowing data to pass through. Each sigmoid layer contains a binary value (0 or 1), with 0 representing "let nothing pass through" and 1 representing "let everything pass through." The goal here is to gain control of the the state of each cell, the gates are controlled as follow.

Forget Gate returns a value between 0 and 1, with 1 indicating "completely keep this" and 0 indicating "do not keep this."
"Completely ignore this."

Memory Gate determines which fresh data is saved in the cell. First, a sigmoid layer called the "input door layer" determines which values will be altered. Following that, a tan layer generates a vector of fresh candidate values that could be used.

The Output Gate determines what each cell's output will be. The output value will be dependent on the cell status as well as the filtered and most recently added data.

Result And Conclusion

IV. TECHNICAL APPROACH

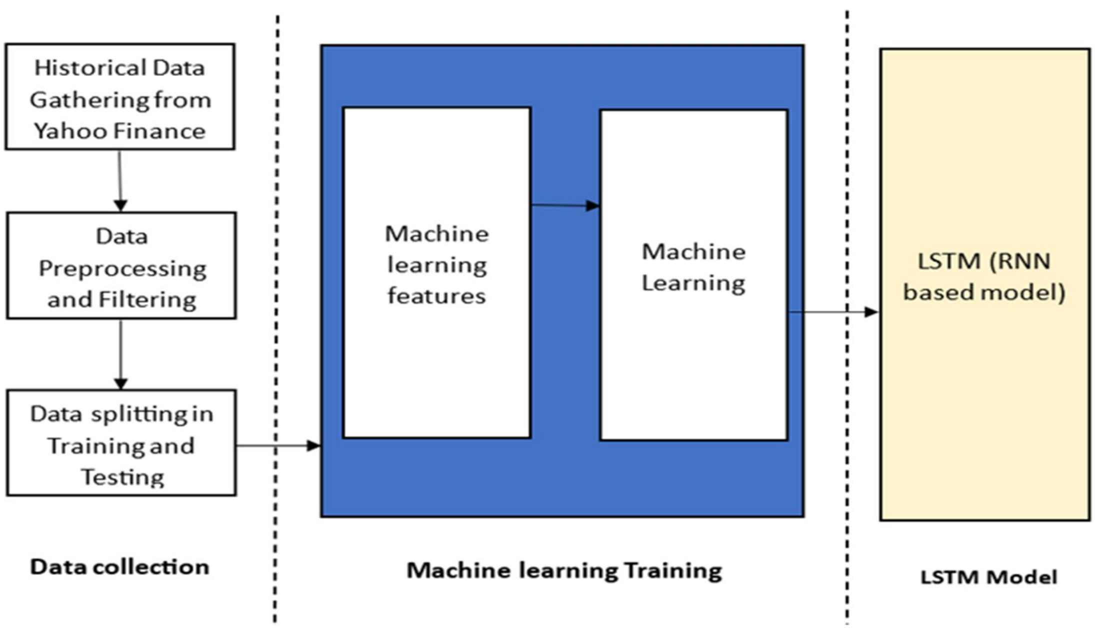

Fig-1 Block Diagram for Training

To retrieve historical stock price data from Yahoo Finance, you can use the yfinance library to specify the stock symbol and time period. The data is obtained as a pandas Data Frame containing OHLC prices and volume. Pre-processing involves handling missing values, detecting and handling outliers, normalizing the data, and performing feature engineering. Unnecessary columns or features can be removed. The pre-processed data is split into training and testing datasets, with time-based splitting ensuring the integrity of time series data. The data is then divided into input features and the target variable.

For machine learning training, the LSTM model is built using libraries like Keras and TensorFlow. The LSTM architecture consists of multiple layers, allowing for the capture of long-term dependencies in sequential data. Activation functions like ReLU introduce non-linearity, and the LSTM layers are connected to output or prediction layers. The model is compiled with a specified loss function and optimizer. Training involves fitting the model to the training data using the fit() function.

LSTM models are effective for stock price prediction due to their ability to learn patterns and relationships over time. They utilize memory cells to store and update information, enabling them to capture long-term dependencies. By stacking multiple LSTM layers, the model can learn hierarchical representations and complex patterns. The output layers map the learned features to the target variable, such as stock price.

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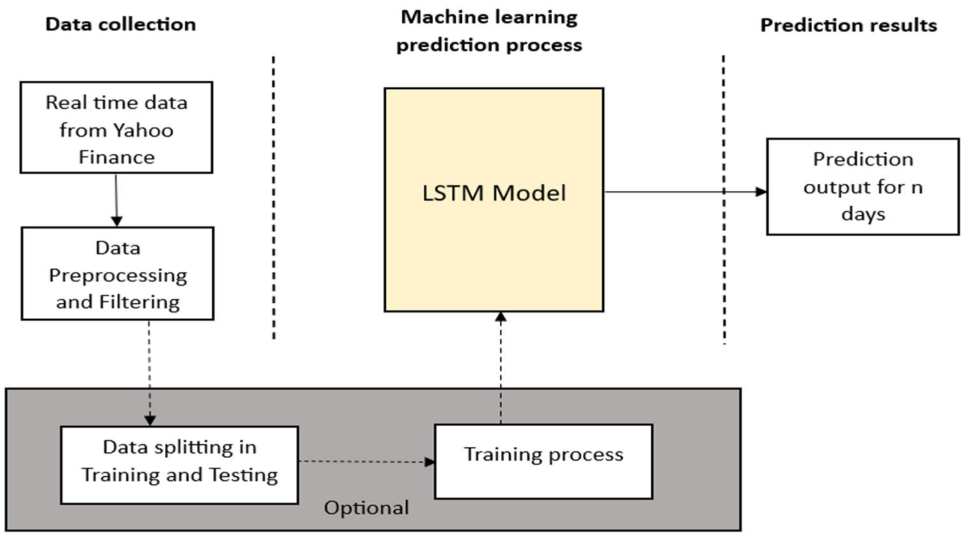

Fig-2 Block Diagram for testing

To retrieve real-time stock price data from Yahoo Finance, the finance library can be used. The LSTM model, comprising stacked LSTM layers, captures patterns from historical stock price data. It utilizes memory cells to understand long-term dependencies. Fully connected dense layers map the learned features to the target variable. Predictions for future days are generated by initializing the model with real-time data and iterating over the specified time frame. The input data is updated, and the predicted values are reversed to obtain actual stock price predictions. These predictions can be visualized or presented for analysis and decision-making.

V. RESULT AND DISCUSSION

Our project encompassed a comprehensive analysis of machine learning algorithms for forecasting the performance of five distinct stocks: Reliance, TCS, NIFTY 50 BANK, Axis Bank, and Adani Power. We delved into the evaluation of several prominent algorithms, including SARIMA, ARIMA, LSTM, Moving Average, and SVM, to determine their efficacy in predicting stock market trends. The primary objective was to discern the reliability and predictive capabilities of these algorithms in capturing the intricacies of stock price movements.

Through rigorous assessment and meticulous evaluation, we obtained accuracy metrics for each algorithm, measured in percentages. These metrics served as a quantifiable indicator of the algorithms' performance in forecasting stock market trends. Our analysis encompassed an extensive range of data, enabling us to gain a comprehensive understanding of the algorithms' strengths and limitations. By examining the accuracy results, we were able to gauge the algorithms' proficiency in capturing and modelling the complex patterns inherent in stock price movements.

This study contributes valuable insights to the field of stock market prediction, aiding investors and market participants in making informed decisions. The findings from our analysis provide a basis for comparing and selecting the most suitable algorithm for forecasting stock performance, depending on the specific requirements and characteristics of the target stocks.

Algorithm	Reliance (%)	TCS (%)	NIFTY 50 BANK (%)	Axis Bank (%)	Adani Power (%)
ARIMA	74-76	70-75	65-70	62-65	68-72
SARIMA	75-80	73-78	68-74	65-70	70-75
LSTM	82-88	80-85	80-84	78-80	80-82
Moving Average	60-64	55-60	52-56	50-54	55-58
SVM	78-80	75-80	70-75	70-73	75-78

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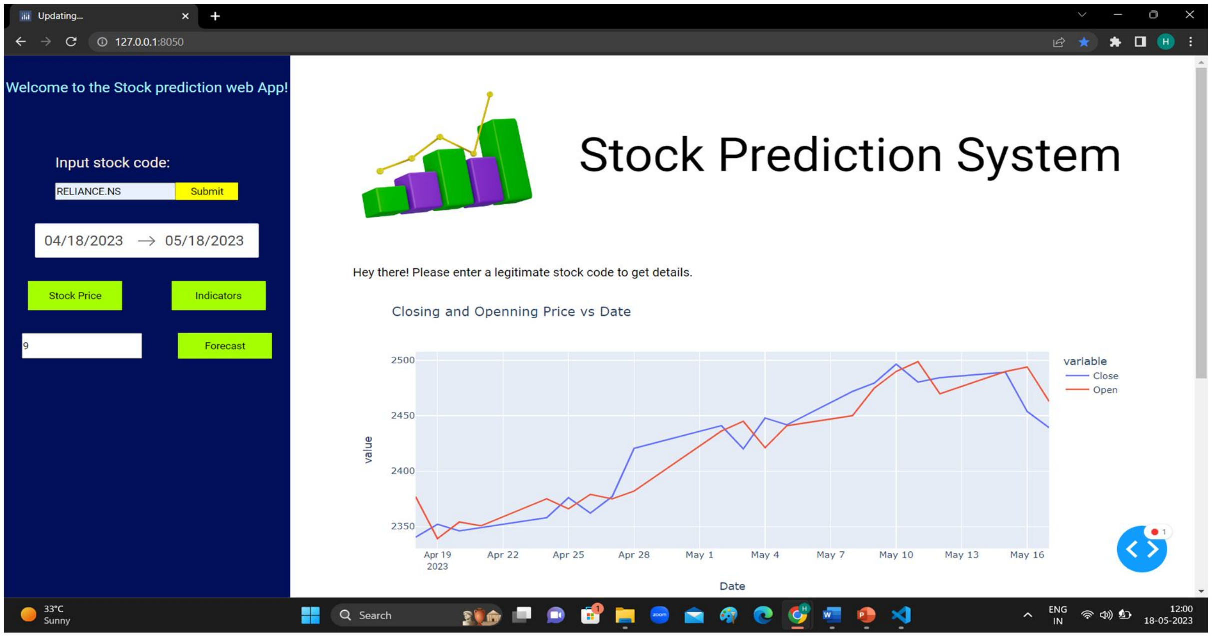

Fig – Closing and opening price Vs Date

The graph displays the historical stock prices of Reliance from 18/4/2023 to 18/5/2023, focusing on the opening and closing prices. The blue line represents the opening prices, while the orange line represents the closing prices for each day. The data from this period is utilized to predict the stock prices for the next nine days.

The visualization provides insights into the trends and fluctuations in Reliance's stock prices during the specified timeframe. By observing the patterns in the opening and closing prices, investors and analysts can gain valuable information to make informed decisions regarding their investments. The predicted nine-day stock prices, represented by the blue and orange lines extending beyond the current timeframe, offer a glimpse into the anticipated future performance of Reliance's stock.

This analysis aids in understanding the potential trajectory of Reliance's stock price based on historical trends, facilitating strategic planning and risk assessment. It enables stakeholders to anticipate and react to market dynamics, supporting effective decision-making and maximizing investment opportunities.

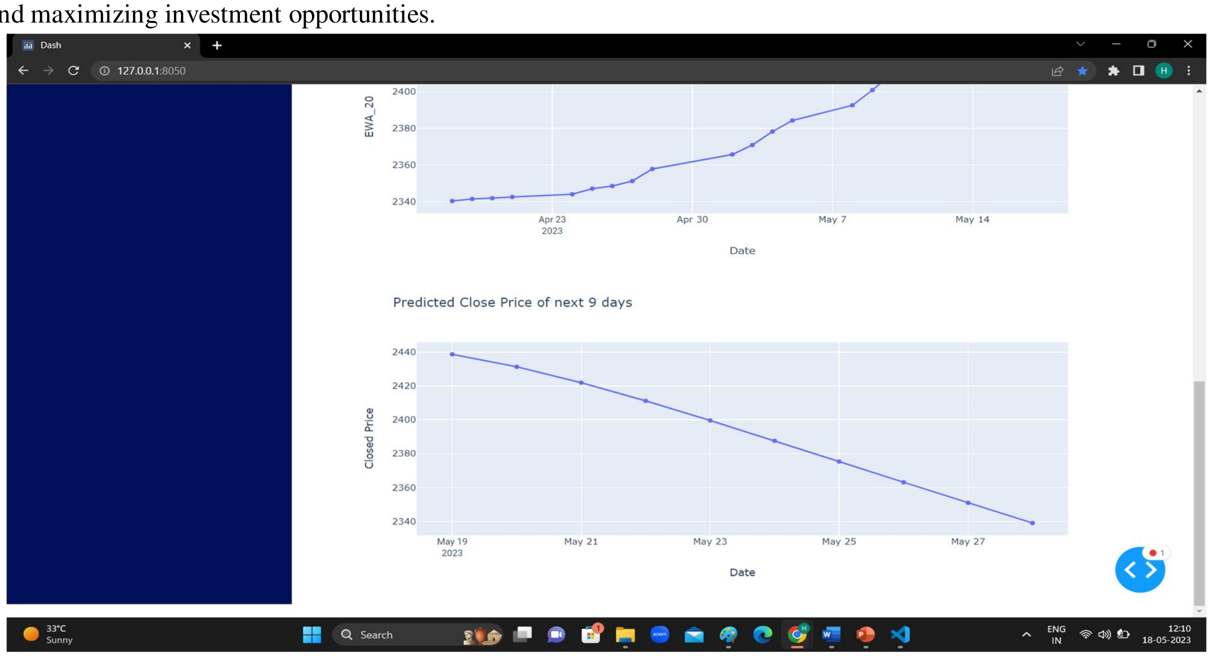

Fig-Prediction for next n days

The LSTM model is utilized to predict the stock prices for the next nine days using the price data of Reliance from April 18, 2023, to May 18, 2023. It is observed that as the amount of available data increases, the accuracy of the predictions improves. To enhance the accuracy and reliability of the predictions, a larger volume of data becomes essential.

By incorporating a larger dataset, the LSTM model can capture a more comprehensive range of market dynamics and patterns. This enables the model to identify and utilize relevant information effectively, resulting in more precise predictions. The inclusion of additional data facilitates a deeper understanding of historical trends, volatility patterns, and market behavior, contributing to enhanced forecasting accuracy.

Therefore, for improved prediction outcomes, it is advisable to incorporate a larger dataset encompassing a more extensive time period. This increased data volume enables the LSTM model to leverage a more robust foundation of information, leading to more reliable and accurate predictions of stock prices.

VI. CONCLUSION

Low demand, on the other side, may result in a reduction in stock price. Market analysis can be used to forecast stock values based on historical data and periodic chart patterns, resulting in profitable trading and considerable gains for investors. As a result, it's critical to examine market conditions and build a stock price prediction system that helps investors to maximise their outcomes and portfolios. This research offers an RNN built on LSTM to anticipate future values for both axis bank and dependence assets; the results of our model have been promising. The test results show that our model can track the evolution of opening prices for both assets. We will aim to find the optimal settings for bout data length and number of training epochs that better suit our assets and maximise our prediction accuracy in the future.

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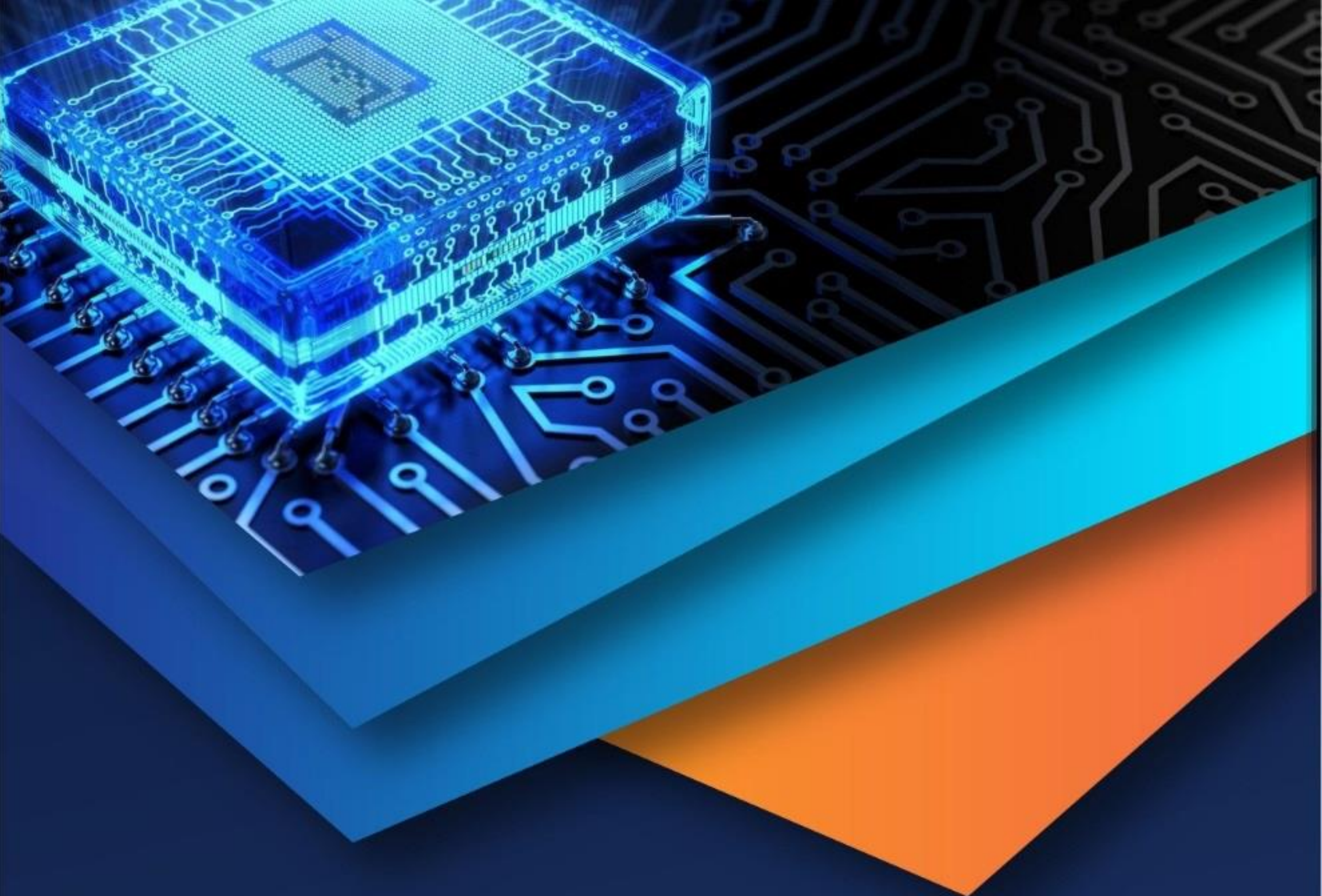

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