iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 **Issue:** VI **Month of publication:** June 2022

DOI: https://doi.org/10.22214/ijraset.2022.45073

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue VI June 2022- Available at www.ijraset.com

Time-Series Forecasting: Predicting Stock Index Using Arima and Facebooks Prophet Model

Sushma Niveni Pindiga[1], Dinesh Motati[2], Nikhil Gurram[3]
[1-3]*Computer Science and Engineering, Jawaharlal Nehru Technological University, Hyderabad*
SRM Institute of Science and Technology, Chennai
Guru Nanak Institutions Technical Campus (GNITC), Hyderabad

Abstract: ***The DJIA is a New York Stock Exchange volatility index that incorporates the 30 maximum widespread shares inside the U.S stock market. Since the stock market is based totally on threats and speculations, forecasting the DJIA index helps us know the trends of 30 companies indexed. As a result, it helps investors of these 30 companies to be cautious. But forecasting these stock indexes could be challenging to assess as they were affected by various causes, making the prediction inaccurate. Throughout the paper, specific modifications had been accomplished at the version to increase the optimum variables to result in a minimal range of errors. This Project calls for thorough studies of the volatility of the economic marketplace and the various factors that affect it. Hence, this Project will serve economic analysts and investors to observe their analysis or investment selections by lowering the uncertainty.***

Keywords: ARIMA, Facebook's Prophet, Time Series, Stock Market, Dow Jones Industrial Average

I. INTRODUCTION

The process of analysing and managing the time series data is known as Time series analysis. Time series analysis, in contrast to regression analysis, is constructive in finding essential features of time series data. Time series analysis help us understand the major factors that lead to a specific trend in time series data points and help us to predict data points. It is only a hopeful dream to be able to see into the future. Nonetheless, a driving factor for statisticians and theorists is their attempts to develop new models and methods to achieve as accurate forecasts as possible. One way to do this is by studying a company and the market where the company is established by work on fundamental analysis. However, technical analysis is the most crucial element in forecasting and is based on historical data on the price of a stock. These price movements are fundamental drivers for the next day, month or year predicted price. Models can be extended to get more predictable forecasts by adding more dividends, technical improvement, or a crisis. Knowing when to quit is the true problem since failing to do so might result in poor performance, erroneous findings, and a time-consuming process, which brings us to the paper's main question. Which model has the better forecasting ability when predicting the value of the Dow Jones Industrial Average Index? We want to investigate how our models will react to this. We will investigate this when we evaluate a model's performance when predicting the Dow Jones Industrial Average price. It is well known that the stock market is built on the expectation that is influenced by dividends, technology progress, innovations, and other announcements. Stock-price may also rely on other parameters such as vacations, holidays, or even weather. These parameters can be used to test a hypothesis or find a trend, notified as a cyclical pattern in the time-series data.

This paper will use the one-time price Dow Jones Industrial Average to forecast future price movements. We are going to apply two different models. The Autoregressive Integrated Moving Average Model (ARIMA) will be the first model we utilize, and the Facebook Prophet model will be the second model. The autoregressive integrated moving average, also known as ARIMA, is an analytical analysis model. It uses predicted time series data for further analysing the data set or to forecast future trends. Based on the past value, the analytical analysis model predicts the future values. Furthermore, the ARIMA model can predict the stock's future price using past perforation. It can predict the future possibility of the share price. ARIMA model introduces an order of differencing into the time-series data if the data is non-stationary. Dickey-Fuller test is used to verify data stationarity.

- AR (p) Auto-regression: the relationship between a current series and observation over a previous step. (p) Point out the use of preceding values in the regression equalization for foretelling the current one.
- When performing the time series stationary, I (d) Integrated employs the difference of observations, which includes subtracting the current values from their prior values (d) number of times.
- MA (q): A moving average component shows the inaccuracy of the model as a combination of prior mistakes. The number of words that will be added to this model is indicated by the sequence (q).

©IJRASET: All Rights are Reserved

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue VI June 2022- Available at www.ijraset.com

Facebook Prophet is a tool designed to let you easily predict time series at a large scale. The three main components of Facebook Prophet's analysable time series model are Trends, Holidays, and Seasonal. The combination of effect and error are mentioned below:

Before deciding to use Facebook prophet, some data characteristics should be met:

1) Every hour, every day, or weekly research within a few months (at least one month), but one year of old data is much favoured.
2) Holding powerful seasonality's: day of the week and time of the year
3) Significant events or festivals that happen must be seen.
4) A moderate amount of missing or outlier data
5) Past trend trades

We will finally evaluate and compare which models create the most accurate forecasts when predicting Index Values.

II. LITERATURE REVIEW

The authors [N Viswam] and [G Satyanarayana Reddy] [1] tried to implement a model which forecasts the share market trends by taking the company's previous historical time series data. They used the ARIMA model to make predictions to help investors to decide whether they can buy a stock or they can sell it. This implementation was done through R language and the drawback is that they can try to implement in python and compare the results with that of the R language for better accuracy.

Forecasting the stock exchange is one of the significant financial subjects. The authors Mahantesh C. Angadi, Amogh P. Kulkarni developed an Arima model and forecasted the stock market trends for a short period using previous historical data and data mining techniques. The results indicated that the model be applied for short-term forecasting.

In this work, the authors [B. Uma Devi1], [D.Sundar] and [Dr. P. Alli] [2] developed an Arima model which predicted trends of Nifty Midcap-50. They followed the BoxJenkins method to identify the model and AICBIC test principles are applied opposite to the data presented in the previous to decide on the best model.

The authors [Tayman],[Jeff, et al] [7] implemented six different arima models indicating variety of population growth trajectories. They implemented six different models using the data from four different states in United States. Research on other methods to measure uncertainty is also needed

III.RESULTS AND DISCUSSION

In this project, we collected data on Dow Jones Industrial Average from (2009-2019). We forecast the stock price using Time series forecasting with the ARIMA model and Facebook Prophet.

The complete architecture of the system is shown below.

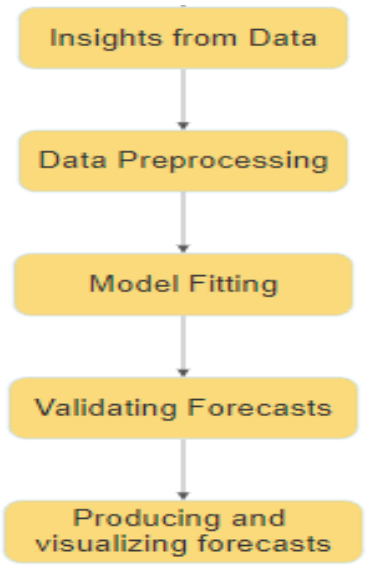


Fig. 1 Steps Followed

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |

A. Data Insights

We cannot comprehend the present or glance of our future if we cannot know our past which links to time-series forecast; we cannot decide which approach, we will use, we cannot predict future results accurately. This process includes getting the dates which has highest and lowest index values at a given time interval. Moreover, grouping the dates and visualizing the index values for each year to get a complete picture.



Fig.2 Visualization of Close Index values of time series data

The different factors affecting the observing values in a graph are the elements of a timeline. The four different types of time series items are trend, seasonal variation, cyclic variation, Random or abnormal movement. By using time-series decomposition we can visualize our data which helps us to divide us into three distinguished components: trend, seasonality, noise.

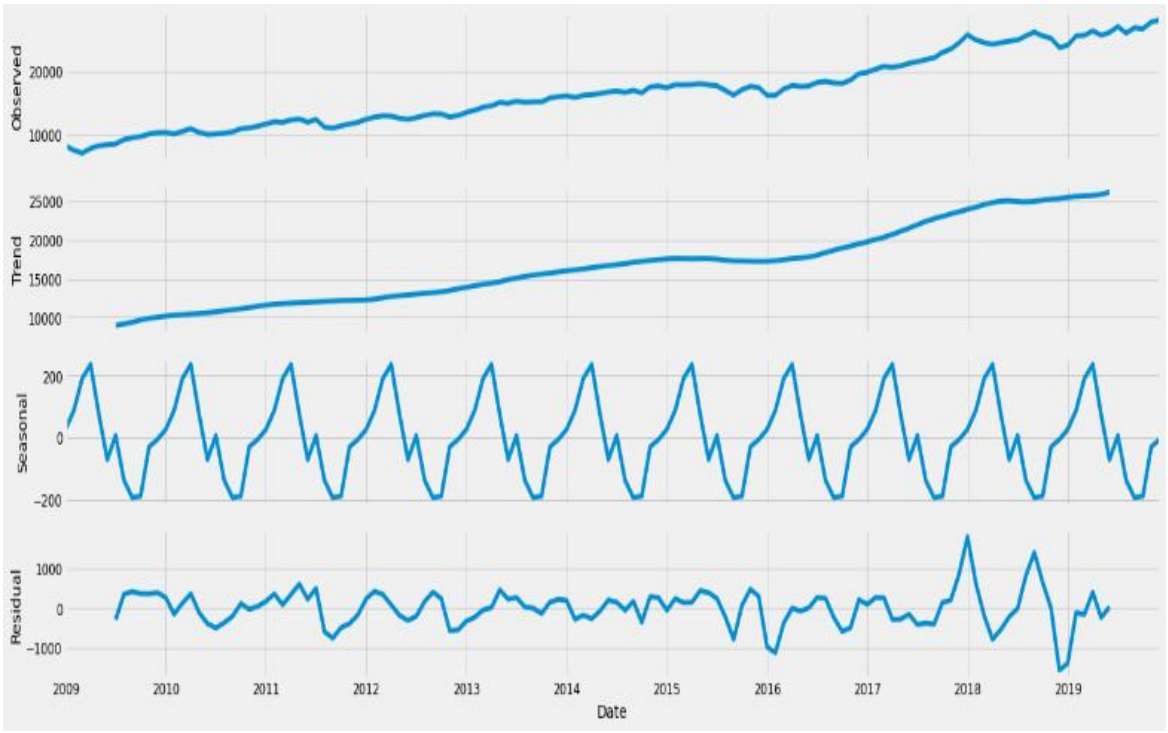


Fig.3 Plotting Components of Time series: Trend, Seasonal, Residual.

B. Data Pre-Processing

The Data Pre-processing involves applying of some data wrangling techniques on raw data to make it ready for model fitting. This includes removing unwanted columns, check missing values, aggregate index value of stocks by date. It includes some data cleaning tasks such as working with missing values and inconsistent data. This method also includes detection of outliers and fixing them.

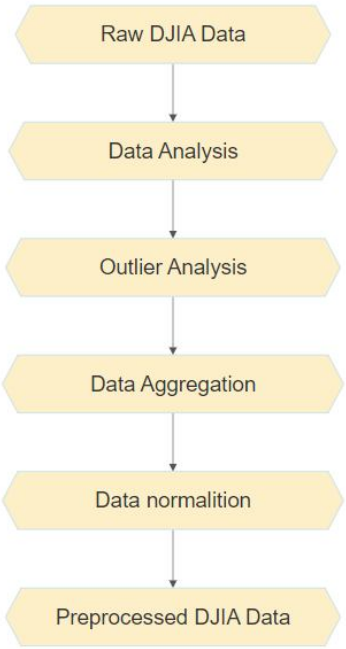


Fig. 4 Steps in Data Pre-proceesing

C. Model Fitting

1) Approach 1: Using Autoregressive integrated moving average model

It uses predicted time series data of DJIA index for further analysing the data set or to forecast future trends which as a result forecasts the closing share value. ARIMA forecasts is more accurate and reliable. ARIMA is running easily with only one variable and cannot exploit leading indicators variables. The index value has been complicated and commonly related to a set of observable variables.

The SARIMAX class is an instance of a full-fledged model built applying the state space backend for evaluation. The output object has many attributes and techniques we could exact from other stats models outputs objects, involving standard errors, prediction/forecasting, and z-statistics.

	coef	std err	z	P>|z|	[0.025	0.975]
ma.L1	0.0665	0.095	0.699	0.484	-0.120	0.253
ma.S.L12	-0.9989	5.790	-0.173	0.863	-12.347	10.349
sigma2	2.463e+05	1.42e+06	0.173	0.863	-2.54e+06	3.03e+06

Fig.5 State Space – SARIMAX

2) Approach 2: Using Facebook's Prophet Model

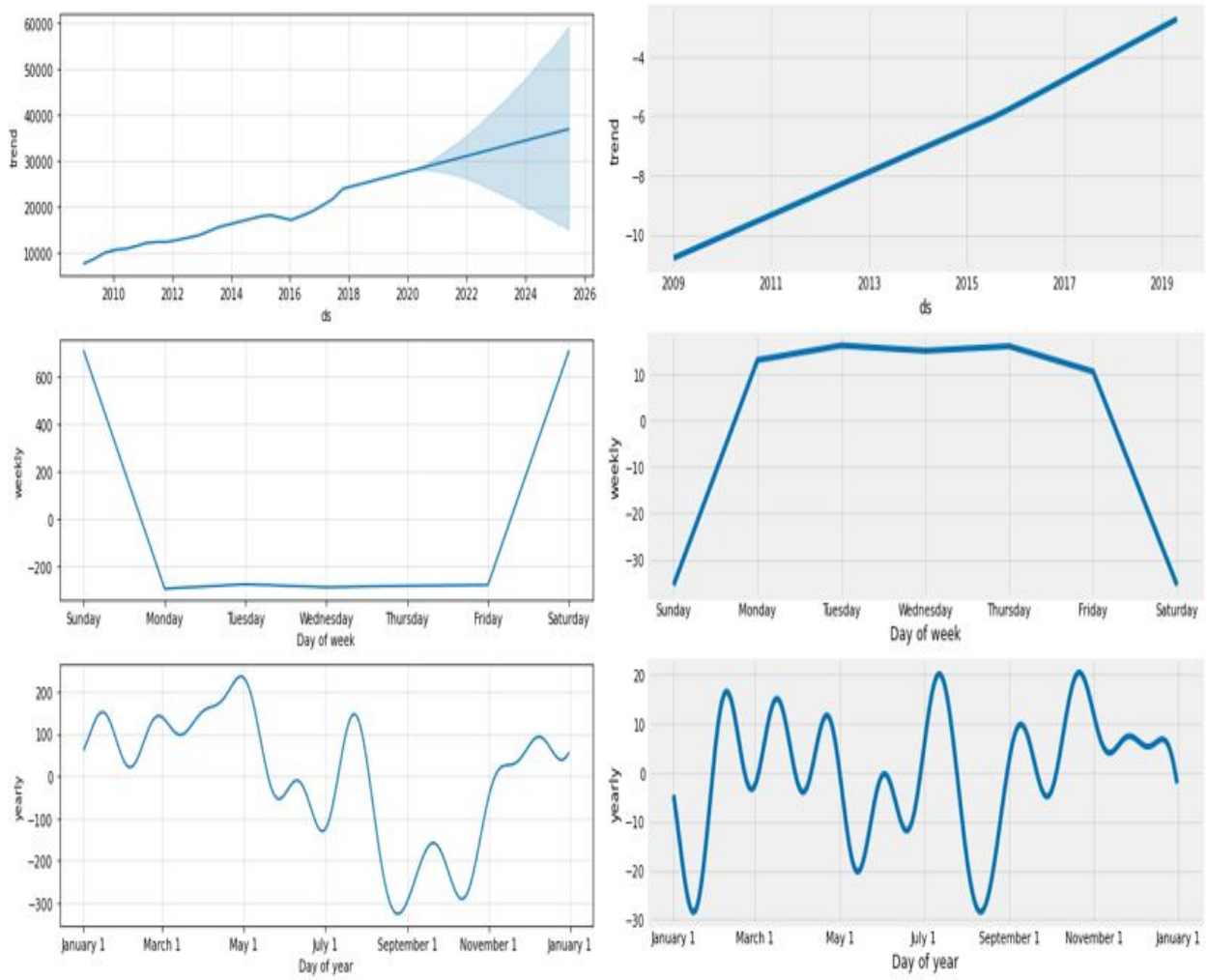
It is an open-source library developed by the Facebook team. The application of Prophet uses single variate model where only one variable of time is used to forecast results.

The equation of forecast is written as:

$$y(t) = g(t) + s(t) + h(t) + \epsilon_t$$

y(t): Target
g(t): Trend
s(t): Season
h(t): Holiday
E_t: Error

The Advantage of Facebook Prophet is it is very simple process to forecast by just using a pandas data frame which contains target variable and the time column. Forecast components can be produced in several view levels, such as how the trend will be on holidays or a weekly or yearly. We have taken the hyper parameter values as default to show the better solutions.

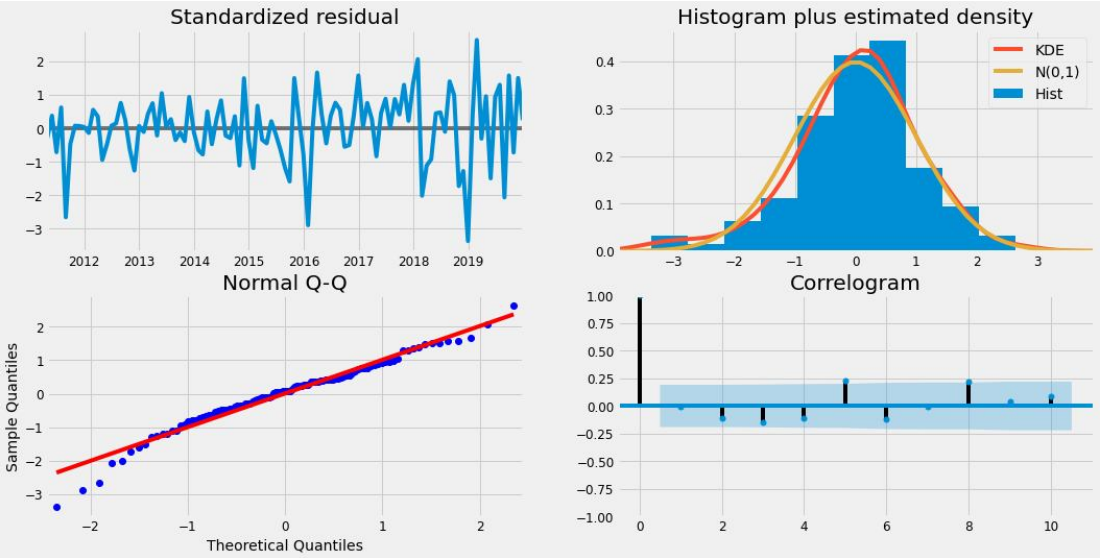


D. Validating Forecasts

To get a better understanding of the exactness of our prediction, we compared the forecast close value of DJIA to the actual close value of our time series model, and our forecast starts from 31-12-2014 to the end date. The line shows the observed value to the rolling value of our projections. Totally, our forecast joins with the original value very well, showing a positive trend from starting of the year. In mathematics, the mean squared error values an average of the squares of errors. That is the difference between the average square and the estimated value. The MSE is a state of estimation. Root Mean Square Error shows that our model could project the median daily close price of DJIA in the test set within the portion of the real close price.

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |

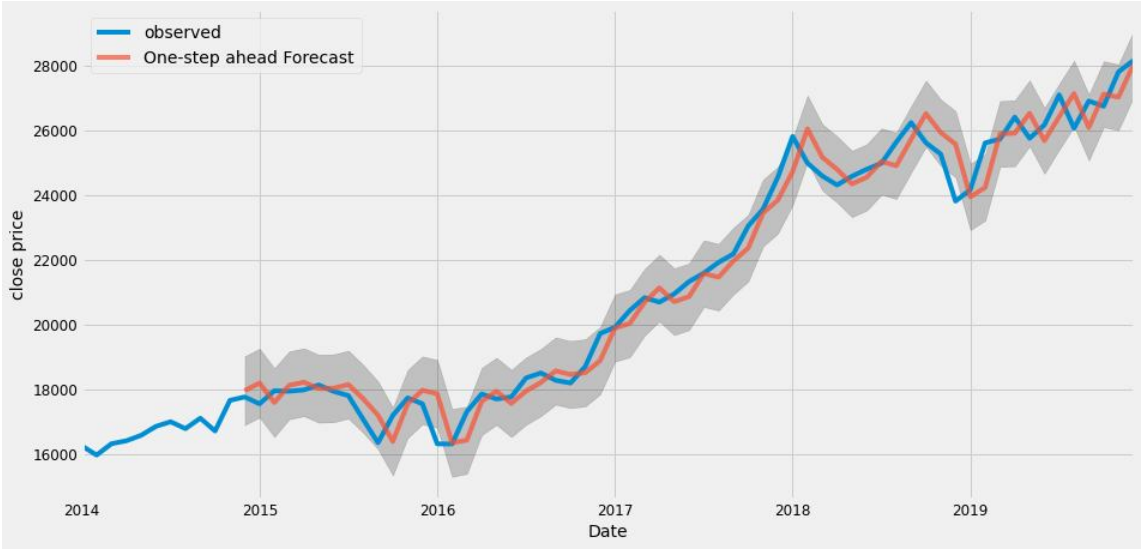
For ARIMA Model, we performed some metrics to check its efficiency.



For Facebook Prophet Model:

horizon	mse	rmse	mae	mape	mdape	coverage
37 days	1.388912e+06	1178.521294	918.572654	0.050857	0.042553	0.202186
38 days	1.398105e+06	1182.414937	925.528763	0.051218	0.042938	0.196296
39 days	1.399938e+06	1183.189693	931.475199	0.051587	0.042940	0.191612
40 days	1.379362e+06	1174.462614	932.579978	0.051807	0.043917	0.187354
41 days	1.349275e+06	1161.583108	928.344534	0.051777	0.043804	0.182084

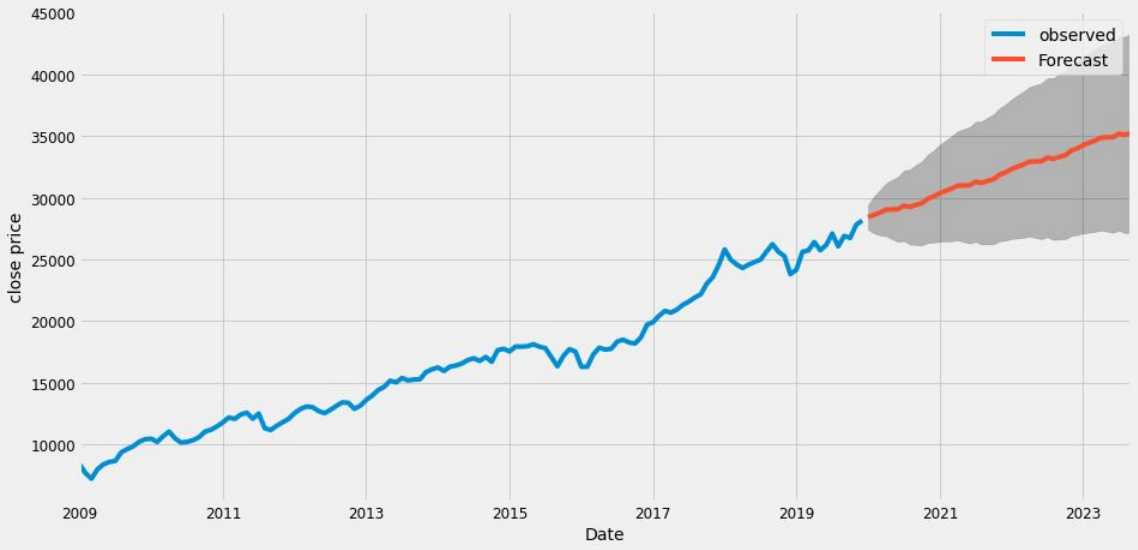
For getting the accuracy of our forecasts, we compared between projected Close value of DJAI index to real close price of the DJAI index.



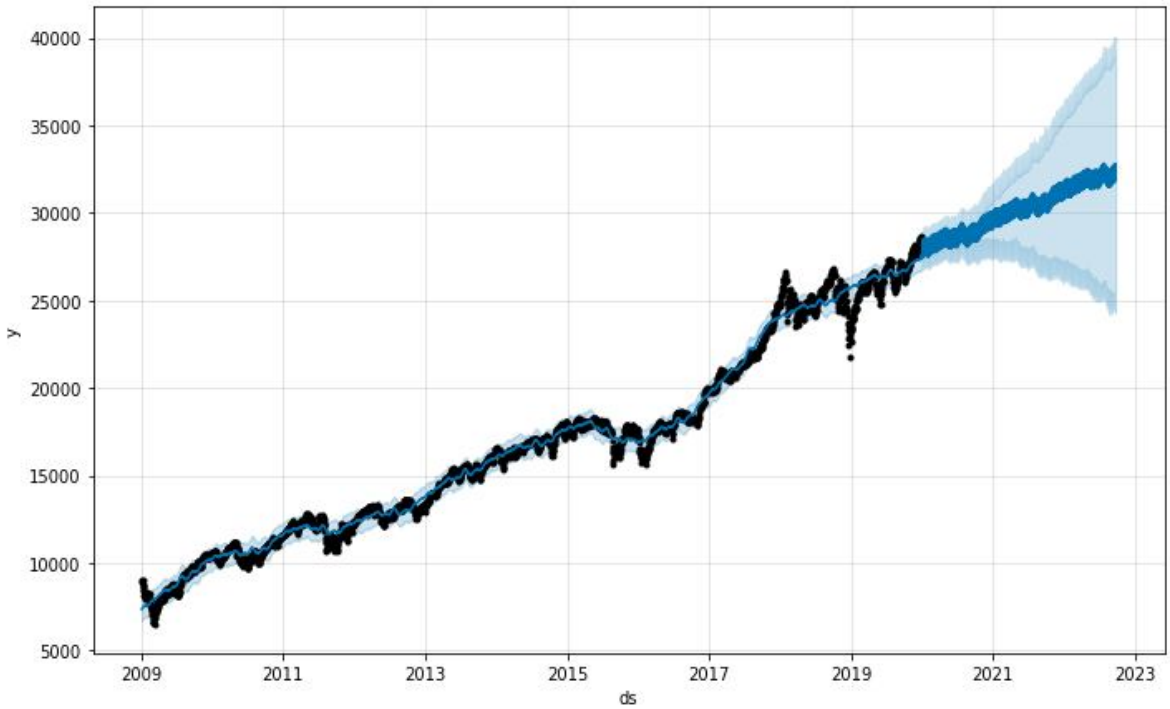
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue VI June 2022- Available at www.ijraset.com

E. Producing and Visualizing Forecasts

By analysing the previous year's index the future years i.e. from 2021-2023 is forecasted and visualized using ARIMA model.



By the previous year's index the future years i.e. from 2021-2023 is Projected and visualized using Facebook's Prophet Model.



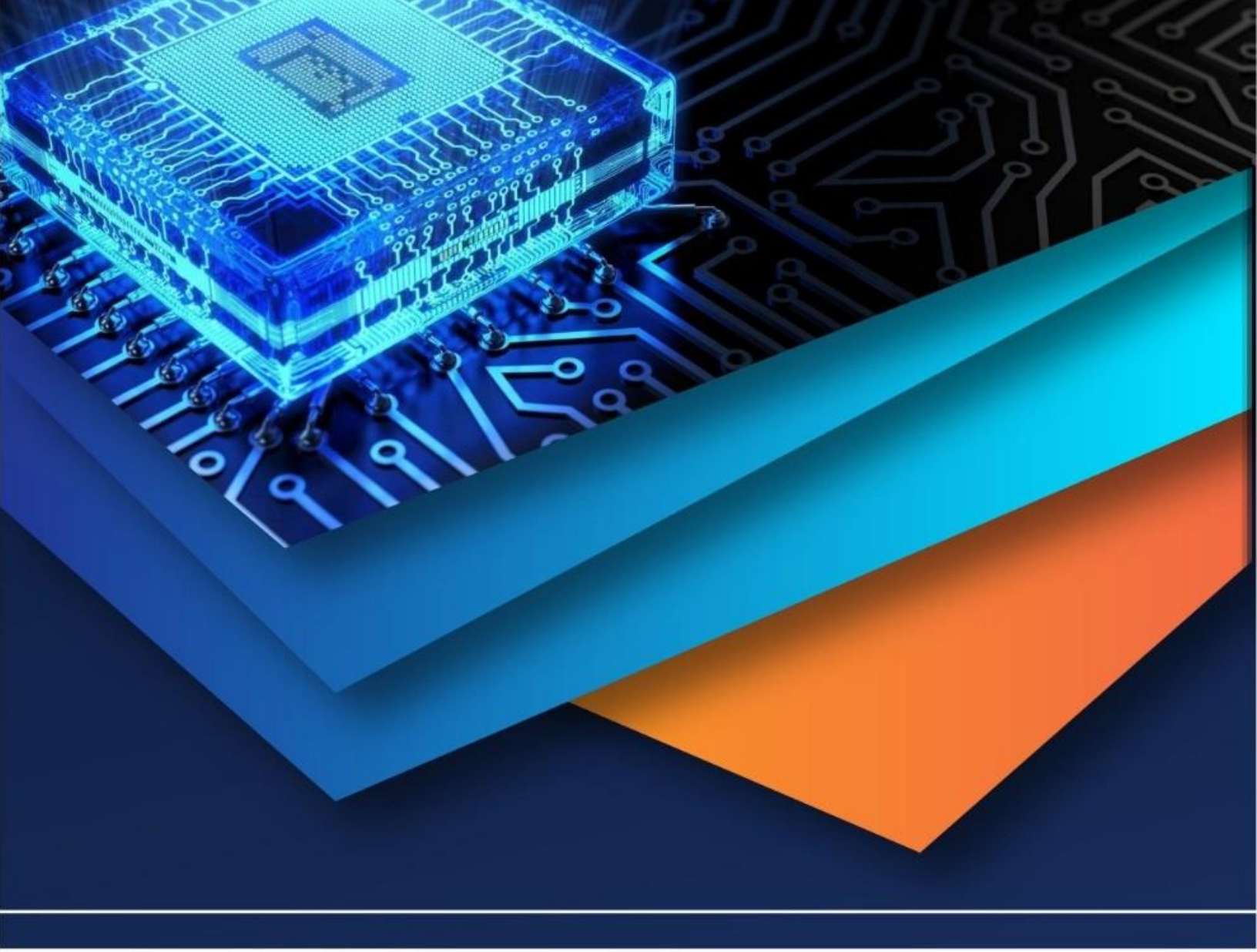
IV. CONCLUSIONS

We tried to find out the best approach between ARIMA and Facebook prophet to forecast the DJIA index. ARIMA models play a very crucial role in predicting short-term momentum in the stock market. We calculated RMSE and MSE values to tell the reader which technique is better to forecast future prices. Our complete research suggests that forecasting using ARIMA gives minor errors than Facebook prophet. So we need to observe these predictions more carefully to get a favourable outcome because the stock market is crucial. We need to compare these time series models to help us identify the further possibilities of the Dow Jones Industrial Average Index.

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |

REFERENCES

[1]. N Viswam. Stock market prediction using time series analysis, International Journal of Statistics and Applied Mathematics 2018; 3(1): 465-469
[2]. B. U. Devi, D. Sundar, and P. Alli, "An Effective time series analysis for stock trend prediction using ARIMA model for Nifty Midcap-50," International Journal of Data Mining & Knowledge Management Process, vol. 3, no. 1, pp. 65–78, 2013.
[3]. P. Fen "An empirical study on the stock price analysis and prediction based on ARMA model," Journal of Mathematics in Practice and Theory, vol. 41, no. 22, pp. 84–90, 2011.
[4]. Jarrett E Jeffrey, ARIMA modeling with intervention to forecast and analyze Chinese stock prices, International Journal of Engineering Business Management, 2011; 3(3)
[5]. Hanias "Prediction with Neural Networks: The Athens Stock Exchange Price Indicator", European Journal of Economics, Finance and Administrative Sciences, Vol 9, pp. 21–27, 2007.
[6]. Perez-Rodriguez, Forecasting Performance on the Spanish IBEX-35 Stock Index', Journal of Empirical Finance, Vol 12, No 3, pp. 490–509, 2005.
[7]. Tayman, Jeff, et al. "Precision, Bias, and Uncertainty for State Population Forecasts: An Exploratory Analysis of Time Series Models." Population Research and Policy Review, vol. 26, no. 3, Springer, 2007, pp. 347-69
[8]. Wanyonyi Maurice, Dominic Makaa Kitavi, David Muchangi Mugo and Edwin Benson Atitwa, "Covid-19 Prediction in Kenya using the Arima Model", International Journal of Electrical Engineering and Technology (DJEET), 12(8), 2021, pp. I05-114.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)