CRYPTOCURRENCY PRICE PREDICICTION USING FB PROPHET MODEL

The Project submitted to

Sant Gadgebaba Amravati University, Amravati

Towards partial fulfilment of the Degree of

Bachelor of Engineering

In

Information Technology

Guided by

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Submitted by

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DEPARTMENT OF INFORMATION TECHNOLOGY SHRI SANT GAJANAN MAHARAJ COLLEGE OF ENGINEERING, SHEGAON (M.S.) 2022- 2023

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SHRI SANT GAJANAN MAHARAJ COLLEGE OF ENGINEERING, SHEGAON

2022-2023

CERTIFICATE

This is to certify that **Mr. Tanmay Band, Mr. Aaryan Khanderao, Mr. Snehdeep Raut** students of final year B.E. (Information Technology) in the year 2022-2023 of the Information Technology Department of this institute have completed the project work entitled "**Cryptocurrency Price Prediction Using Fb Prophet Model**" based on syllabus and has submitted a satisfactory account of his/her work in this report which is recommended for the partial fulfilment of the degree of Bachelor of Engineering in Information Technology.

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SHRI SANT GAJANAN MAHARAJ COLLEGE OF ENGINEERING, SHEGAON

2022-2023

CERTIFICATE

This is to certify that the project work entitled "**Cryptocurrency Price Prediction using FB Prophet Model**" submitted by **Mr. Tanmay Band, Mr. Snehdeep Raut, Mr. Aaryan Khanderao**, students of final year B.E. (Information Technology) in the year 2022-2023 of the Information Technology Department of this institute, is a satisfactory account of his work based on the syllabus which is approved for the award of the degree of Bachelor of Engineering in Information Technology.

Internal Examiner

Date:

External Examiner

Date:

ACKNOWLEDGEMENT

It is our proud privilege and duty to acknowledge the kind of help and guidance received from several people in preparation for this report. It would not have been possible to prepare this Project in this form without their valuable help, cooperation and guidance.

First and foremost, we wish to record our sincere gratitude to the ***Management of this college*** *and to our beloved* ***Principal, Dr. S B Somani,*** *for their constant support and encouragement in the preparation of this Project and for making available internet, library and laboratory facilities needed to prepare this project.*

Further our sincere thanks to ***Dr. A S Manekar, Head of the Department, Information Technology,*** *for his valuable suggestions and guidance throughout this Project.*

We express our sincere gratitude to my guide, ***Prof. A G Sharma,*** *for guiding us in investigations for this Project and in carrying out relevant work. Our numerous discussions were extremely helpful. We received his esteem guidance, encouragement and inspiration.*

We sincerely thank ***Prof. Faizan Khandwani,*** *Project Coordinator for supporting this Project work. His contribution and technical support in preparing this Project are greatly acknowledged.*

Also, we would like to thank all teaching and non-teaching staff of the department for their encouragement, cooperation and help. Our greatest thanks to all those who wished us success, especially parents and friends.

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ABSTRACT

This project focuses on using the Facebook Prophet model for predicting cryptocurrency prices. Specifically, we investigate the accuracy of this time-series forecasting model in predicting the prices of two cryptocurrencies, Bitcoin and Litecoin. We obtain the necessary data from yahoofinance.com for BTC-INR, LTC-INR and ETH-INR implement the Facebook Prophet Model for analysis. In addition, we compare our model's performance with other popular machine learning algorithms such as Linear Regression, SVM, and Random Forest. Our study demonstrates that the Facebook Prophet Model can accurately forecast the prices of different cryptocurrencies, and this could be a valuable tool for traders and investors in making informed investment decisions.

Keywords: Cryptocurrency, Machine Learning, Forecasting, FB Prophet.

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1. INTRODUCTION

The prediction of cryptocurrency prices is a crucial area of research for investors and traders in the digital asset space. In recent years, machine learning algorithms have emerged as a popular method for forecasting prices due to their ability to detect patterns in large datasets. This project focuses on the use of the Facebook Prophet model, a time-series forecasting algorithm, for predicting the prices of few popular cryptocurrencies, Bitcoin, Ethereum and Litecoin [1].

1.1 Preface

Cryptocurrencies have become increasingly popular in recent years as a new asset class for investors and traders. The decentralized nature of cryptocurrencies, coupled with their potential for significant returns, has attracted a wide range of investors and traders, from individuals to institutional investors. However, due to the volatile nature of cryptocurrency prices, it is challenging to predict their future prices accurately.

Cryptocurrency markets are characterized by high volatility and dynamic trends, making accurate price prediction a challenging task[11]. The use of advanced forecasting techniques is crucial to capture the underlying trends and predict the future price movements [2]. This project aims to develop a practical tool that utilizes the power of Facebook Prophet and Streamlit to enable cryptocurrency investors and traders to make informed decisions based on reliable price predictions.

Using real-time data from the Yahoo Finance API, this project provides up-to-date cryptocurrency price predictions and visualizations, enhancing user experience and accessibility[8]. The integration of Facebook Prophet and Streamlit facilitates the development of accurate forecasting models and interactive web applications, respectively.

1.2 Statement of Problem

The cryptocurrency market is characterized by high volatility and rapid price fluctuations, making accurate price prediction a challenging task. Traditional forecasting methods often fail to capture the unique characteristics and dynamics of cryptocurrency price data, leading to unreliable predictions [3]. Therefore, the aim is to develop an effective solution for cryptocurrency price prediction by leveraging the capabilities of Facebook Prophet and Streamlit with real-time data obtained from the Yahoo Finance API.

1.2.1 Volatility and Uncertainty

Cryptocurrencies are known for their extreme volatility, which poses a significant challenge for accurate price prediction. Sudden market shifts, influenced by various factors such as regulatory changes, market sentiment, and technological advancements, make it difficult to capture and model the underlying trends [4]. Existing forecasting methods often struggle to handle these complex dynamics, leading to unreliable predictions.

1.2.2 Lack of Reliable Models

The absence of reliable and robust forecasting models specifically designed for cryptocurrency price prediction further exacerbates the problem. Traditional time series forecasting techniques may not effectively capture the unique characteristics of cryptocurrency data, such as non-linearity, seasonality, and abrupt trend changes. Consequently, investors and traders face difficulties in making informed decisions based on accurate predictions[5].

1.2.3 Real-Time Data Availability

Access to timely and accurate data is crucial for reliable price prediction. Cryptocurrency markets operate 24/7, and prices can change rapidly within short time intervals [5]. Therefore, obtaining real-time data from a reliable source becomes essential for building accurate forecasting models. The use of the Yahoo Finance API,

which provides real-time financial data, addresses the need for up-to-date information and enables the development of models that can capture the dynamic nature of the cryptocurrency market.

1.2.4 User-Friendly Visualization

Apart from accurate predictions, it is equally important to provide users with a user-friendly interface for visualizing and exploring the predicted cryptocurrency prices. Traditional methods often lack interactivity and fail to provide an intuitive platform for users to interact with the data[11]. Streamlit, with its capabilities to create interactive web applications, offers a solution to this challenge by allowing users to input specific cryptocurrency symbols and visualize the predicted prices in real-time.

In summary, the problem addressed by this project is the development of an accurate and reliable cryptocurrency price prediction system that leverages Facebook Prophet and Streamlit [6]. The system aims to overcome the challenges posed by cryptocurrency market volatility, the lack of reliable models, and the need for real-time data availability. By integrating these components and utilizing real-time data from the Yahoo Finance API, the project seeks to provide investors and traders with a practical tool for making informed decisions based on reliable cryptocurrency price predictions.

1.3 Objectives of the project

The primary objectives of this project are as follows:

1.3.1 Develop Accurate and Reliable Forecasting Models

The project aims to utilize the Facebook Prophet library to develop forecasting models specifically tailored for cryptocurrency price prediction. These models should effectively capture the unique characteristics of cryptocurrency data, including non-linearity, seasonality, and abrupt trend changes[7]. The objective is to create accurate and reliable models that outperform traditional forecasting techniques and provide meaningful insights into future cryptocurrency price movements.

1.3.2 Create an Interactive Web Application

The project aims to develop an interactive web application using Streamlit, a web application framework. The web application will serve as a user-friendly platform for cryptocurrency investors and traders to visualize and explore the predicted cryptocurrency prices. Users will be able to input specific cryptocurrency symbols and obtain real-time predictions based on the latest data obtained from the Yahoo Finance API [8]. The objective is to provide an intuitive and accessible interface that enhances user experience and facilitates decision-making.

1.3.3 Empower Investors and Traders

The project seeks to empower cryptocurrency investors and traders by providing them with a practical tool for making informed decisions. The accurate price predictions generated by the forecasting models, combined with the interactive visualization provided by the web application, aim to enable users to identify potential buying or selling opportunities in the cryptocurrency market. The objective is to equip users with reliable information that can enhance their trading strategies and improve their investment outcomes.

1.3.4 Utilize Real-Time Data from the Yahoo Finance API

By integrating the Yahoo Finance API, the project aims to utilize real-time cryptocurrency price data. Real-time data availability is crucial for accurate and up-to-date price predictions, considering the dynamic nature of the cryptocurrency market. The objective is to ensure that the developed models and web application leverage the most recent data to provide users with the most relevant and timely information.

1.3.5 Enhance Understanding of Cryptocurrency Market Dynamics

The project aims to contribute to the understanding of cryptocurrency market dynamics through the analysis and interpretation of the developed forecasting models [9]. By evaluating the performance of the models and analyzing the factors influencing cryptocurrency price movements, the project aims to provide insights into the complex nature of the market. The objective is to uncover patterns, trends, and potential relationships that can help investors and researchers gain a deeper understanding of the cryptocurrency market.

In summary, the objectives of this project revolve around developing accurate and reliable forecasting models, creating an interactive web application, empowering investors and traders, utilizing real-time data from the Yahoo Finance API, and enhancing understanding of cryptocurrency market dynamics. These objectives collectively aim to provide users with a practical and valuable tool for cryptocurrency price prediction and decision-making[10].

1.4 Scope and limitation of the Project

1.4.1 Scope

The scope of this project includes the following key aspects:

1.4.1.1 Data Collection

Gathering real-time cryptocurrency price data from the Yahoo Finance API, which provides a convenient interface to access financial data. To collect data from Yahoo Finance, use yfinance API (Application Programming Interface) to retrieve financial information programmatically. The Yahoo Finance API provides access to a wide range of financial data, including stock quotes, historical prices, company information, and more. In machine learning (ML), data collection refers to the process of gathering and acquiring the necessary data to train, evaluate, and test machine learning models. It involves collecting relevant datasets that contain the input features (also known as independent variables) and the corresponding target variables (also known as dependent variables).

1.4.1.2 Data Preprocessing

Cleaning and preprocessing the collected data to ensure its suitability for analysis and modeling. In machine learning (ML), data collection refers to the process of gathering and acquiring the necessary data to train, evaluate, and test machine learning models. It involves collecting relevant datasets that contain the input features (also known as independent variables) and the corresponding target variables (also known as dependent variables). Also, removing of the unnecessary outliers and making data suitable for accurate predictions

1.4.1.3 Model Development

Utilizing the Facebook Prophet library to develop accurate forecasting models that capture the unique characteristics of cryptocurrency price data. In machine learning (ML), data collection refers to the process of gathering and acquiring the necessary data to train, evaluate, and test machine learning models. It involves collecting relevant datasets that contain the input features (also known as independent variables) and the corresponding target variables (also known as dependent variables).

1.4.1.4 Model Evaluation

Assessing the performance of the developed models using appropriate evaluation metrics to determine their accuracy and reliability. FBProphet is a popular open-source time series forecasting library developed by Facebook. It provides an easy-to-use interface for fitting and forecasting time series data. Model evaluation in FBProphet involves assessing the performance of the forecasted values against the actual values of the time series. FBProphet is a popular open-source time series forecasting library developed by Facebook. It provides an easy-to-use interface for fitting and forecasting time series data. Model evaluation in FBProphet involves assessing the performance of the forecasted values against the actual values of the time series.

1.4.1.5 Web Application Development

Building an interactive web application using Streamlit, which allows users to input specific cryptocurrency symbols and visualize the predicted prices. Developing a web application using Streamlit and FBProphet can provide an interactive and user-friendly interface to explore and visualize time series forecasting with FBProphet[23]. Here's a high-level overview of the steps involved in developing such a web application:

- Set up the Environment: Install the necessary software and libraries, including Streamlit and FBProphet. You can use Python and package managers like pip or conda to install these dependencies.
- Import Required Libraries: In your Python script, import the required libraries, including Streamlit and FBProphet, along with any additional libraries you might need for data manipulation, visualization, and preprocessing.
- Data Preparation: Load or import the time series data you want to forecast using FBProphet. Perform any necessary preprocessing steps, such as handling missing values, converting data types, or filtering relevant columns.
- Model Fitting and Forecasting: Use FBProphet to fit the time series model on the data and generate forecasts. Set up the model parameters, such as seasonality assumptions, trend flexibility, and additional regressors if applicable. Generate the forecasted values for the desired future periods.
- Develop the Streamlit App: Start building the web application using Streamlit. Define the layout of the application, including any input fields, sliders, or date selectors that users can interact with to customize the forecast. Add Streamlit components like headers, text, plots, and tables to display the forecast results and any relevant information or visualizations.
- Connect FBProphet with Streamlit: Integrate the FBProphet model and forecast results with the Streamlit app. Pass the user-defined input parameters to the FBProphet model and retrieve the forecasted values. Update the Streamlit app's display with the forecasted values and any additional visualizations or metrics you want to showcase.

- Run the Web Application: Execute the Streamlit command to run the web application locally. Streamlit provides a development server that hosts the application and automatically updates the display whenever the user interacts with the app.

1.4.2 Limitations

Despite its comprehensive approach, this project has certain limitations:

1.4.2.1 Data Availability

The accuracy of the price predictions heavily relies on the availability and quality of real-time cryptocurrency price data obtained from the Yahoo Finance API. Data availability can certainly be a limitation when using FBProphet, as the performance of the model is highly dependent on the quantity and quality of the available data. FBProphet requires a time series dataset with at least two columns: a date/time column and a corresponding numeric value column representing the time series variable of interest. If the data is sparse, noisy, or missing significant portions, it may result in unreliable or inaccurate forecasts[1][2].

1.4.2.2 External Factors

The forecasting models are primarily based on historical trends and patterns and may not incorporate external factors such as market news, social sentiment, or regulatory developments. When using FBProphet for time series forecasting with data obtained from yfinance (a library for retrieving financial data from Yahoo Finance), there are several external factors that can affect the predictions. Here are some key factors to consider:

- Data Quality: The accuracy and reliability of the forecasts heavily depend on the quality of the data obtained from yfinance. Issues such as missing data, incorrect values, or inconsistencies can impact the model's performance and the resulting predictions.
- Market Volatility: Financial markets can be highly volatile and subject to sudden changes. Unforeseen events, such as economic news, geopolitical factors, or

market sentiment, can significantly influence stock prices and market trends. These external factors may not be captured in the historical data and can lead to deviations between actual and predicted values.

- Seasonality and Trends: FBProphet considers seasonality and trends in the data when fitting the model. However, sudden shifts in seasonality patterns or unexpected trends can affect the accuracy of the forecasts. Events like holidays, economic cycles, or industry-specific occurrences can introduce irregular patterns that may not be captured well by the model.

1.4.2.3 Future Market Conditions

The models' performance may vary in future market conditions, as the cryptocurrency market is highly influenced by unforeseen events and changing dynamics. When using FBProphet for time series forecasting, the accuracy and reliability of predictions can be influenced by various future market conditions. Some factors that may affect the predictions include:

- Economic Indicators: Changes in macroeconomic indicators such as GDP growth, inflation rates, interest rates, and employment figures can impact the future performance of stocks and financial markets. FBProphet may not explicitly consider these indicators unless they are incorporated as additional regressors in the model.
- Industry Trends: Industry-specific factors, such as technological advancements, regulatory changes, shifts in consumer behavior, or competitive dynamics, can significantly influence the future performance of companies within a particular sector. Monitoring industry trends and incorporating relevant information into the forecasting model can enhance the accuracy of predictions.

1.5 Organization of the Project

The project report is organized as follows:

- Chapter 1 gives Introduction about the project.
- Chapter 2 gives Literature survey of the project.
- Chapter 3 provides analysis of project.
- Chapter 4 provides design phase of project.
- Chapter 5 provides how project is implemented.
- Chapter 6 gives Block Diagram and Flowchart of the project
- Chapter 7 gives Comparison with Traditional method of the project
- Chapter 8 gives result of the project
- Chapter 9 gives conclusion with future scope of the project

2. LITERATURE SURVEY

The literature survey chapter provides a comprehensive overview of the existing knowledge and research related to cryptocurrency price prediction. It establishes the context for the current project and helps identify the gaps in the literature that the project aims to address. By reviewing previous approaches and discussing the strengths and weaknesses of different methodologies, this chapter lays the foundation for the subsequent chapters, where the proposed approach using Facebook Prophet and Streamlit is presented and evaluated.

Paper 1: De Gooijer, J. G., and Hyndman, R. J. (2006), "25 Years of Time Series Forecasting," International Journal of Forecasting.

Description: The research paper "25 Years of Time Series Forecasting" by De Gooijer and Hyndman provides a comprehensive review of the advancements in time series forecasting over a 25-year period. While the paper doesn't specifically focus on cryptocurrency price prediction using Facebook Prophet and Streamlit with data from the yfinance API, it offers valuable insights into the broader field of time series forecasting.

In the study, De Gooijer and Hyndman review various methodologies, models, and techniques developed for time series forecasting. They discuss the evolution of classical statistical models, such as ARIMA and exponential smoothing, as well as the emergence of newer approaches like state space models and neural networks.

While the paper may not directly address the specific combination of Facebook Prophet, Streamlit, and cryptocurrency price prediction, it can serve as a foundational resource for understanding the broader context of time series forecasting. It may provide valuable insights into the historical development of forecasting techniques and the challenges faced in the field[23].

Paper 2: Sarkar, S. (2021). Cryptocurrency price prediction using machine learning: A systematic review. Journal of Ambient Intelligence and Humanized Computing.

Description: The research paper "Cryptocurrency price prediction using machine learning: A systematic review" by Sarkar published in the Journal of Ambient Intelligence and Humanized Computing focuses specifically on the topic of cryptocurrency price prediction using machine learning techniques. While it may not specifically address the use of Facebook Prophet and Streamlit with data from the yfinance API, it can provide valuable insights into the broader field of cryptocurrency price prediction and machine learning approaches.

The paper examines various machine learning techniques applied to cryptocurrency price prediction. The paper provides an overview of different methodologies, including regression-based models, time series models, neural networks, ensemble methods, and sentiment analysis. It explores the features used for prediction, evaluation metrics employed, and the challenges encountered in cryptocurrency price prediction[22].

By reviewing multiple research studies, an comprehensive analysis of the strengths and limitations of different machine learning approaches in the context of cryptocurrency price prediction. The paper can help you understand the state of the art in this field, identify gaps in the existing research, and gain insights into the potential applicability of various machine learning techniques for cryptocurrency price forecasting.

Paper 3: Harvey, A., and Peters, S. (1990), "Estimation Procedures for Structural Time Series Models," Journal of Forecasting.

Description: The research paper "Estimation Procedures for Structural Time Series Models" by Harvey and Peters published in the Journal of Forecasting focuses on the estimation procedures for structural time series models. While the paper may not directly address cryptocurrency price prediction or the specific methodologies of Facebook Prophet and Streamlit, it provides insights into the broader field of structural time series modeling and estimation techniques.

In the study, Harvey and Peters discussed the estimation procedures for structural time series models, which are flexible models that can capture various components of a time series, such as trend, seasonality, and irregular components. They provide an overview of the state space representation of structural time series models and discuss the maximum likelihood estimation and Bayesian estimation methods for model parameter estimation.

While the paper may not directly address cryptocurrency price prediction or the specific combination of Facebook Prophet and Streamlit, it can serve as a foundational resource for understanding the estimation procedures in structural time series modeling. It may provide valuable insights into the mathematical and statistical principles underlying time series modeling and estimation techniques[21].

Paper 4: Brockwell, P. J. and Davis, R. A.,"Introduction to Time Series and Forecasting". Springer, 3 edition.

Description: The paper "Introduction to Time Series and Forecasting" by Brockwell and Davis (2016) provides a comprehensive introduction to the field of time series analysis and forecasting. Although it is not a research paper, it serves as an excellent resource for understanding the fundamental concepts, techniques, and methodologies related to time series analysis and forecasting.

In the paper, Brockwell and Davis covered a wide range of topics, including the nature of time series data, time series models (such as ARIMA and state space models), forecasting methods, model diagnostics, and more. Also provide clear explanations of the mathematical and statistical principles underlying time series analysis, making it accessible to both beginners and those with some background in the field.

While the paper may not specifically focus on cryptocurrency price prediction or discuss the use of Facebook Prophet and Streamlit, it offers a solid foundation in time series analysis that can be applied to various domains, including cryptocurrency forecasting. It can help you understand the theoretical concepts and practical techniques used in time series analysis, which can be valuable when working with tools like Facebook Prophet and developing interactive applications like Streamlit[20].

Paper 5: Çetinkaya-Rundel, M. and Ellison, V. (2021). "A fresh look at introductory data science. Journal of Statistics and Data Science Education", 29:S16–S26.

Description: The research paper "A fresh look at introductory data science" by Çetinkaya-Rundel and Ellison published in the Journal of Statistics and Data Science Education discusses the pedagogy and curriculum design for introductory data science courses. Although it may not specifically focus on cryptocurrency price prediction or the combination of Facebook Prophet and Streamlit, it provides insights into the broader field of data science education.

In the study, Çetinkaya-Rundel and Ellison present a fresh perspective on teaching introductory data science. They discuss the importance of emphasizing statistical thinking, reproducibility, and communication skills in data science education. The paper highlights the integration of modern tools and technologies, such as R and RStudio, as well as the use of real-world datasets to enhance the learning experience.

While the paper may not directly address cryptocurrency price prediction or the specific methodologies of Facebook Prophet and Streamlit, it can serve as a valuable resource for understanding the pedagogical considerations and approaches in data science education. It can provide insights into the best practices for teaching and learning data science concepts, which can be applied to various domains, including cryptocurrency analysis and forecasting[19].

Paper 6: Yash Indulkar “Time Series Analysis of Cryptocurrencies Using Deep Learning & Fbprophet”, 2021 International Conference on Emerging Smart Computing and Informatics (ESCI).

Description: The digital currency has been increased over the past years, following the trend back to the year it started, it can be observed that cryptocurrencies got bigger and bigger with huge market values. Analysis of this cryptocurrency with precise prediction is important to keep up with the growing industry. The time series analysis plays an important role which can be tracked back when the paper "Forecasting cryptocurrency prices time series using machine learning approach.", was published in the year 2019 by Derbentsev, Vasily, it showed a significant change in the understanding of market values for cryptocurrency, which cleared all the doubts related to the machine learning concept. The flow of such information was useful for making the base stronger with understanding the concepts. The other paper "Forecasting cryptocurrency returns and volume using search engines.", was published in the same year that was 2019, that showed the cryptocurrency price forecasting with the volume as a category using a search engine. This cleared the concepts of various trends related to the digital currency and as volume was directly related to the increase in price or vice-versa[10].

Machine Learning plays an important role in the better understanding of concepts related to artificial intelligence, that can be submerged with the use of Deep Learning. This particular concept of analysis deep learning for the forecasting of data based on various algorithms was cleared with the paper that was "Ensemble Deep Learning Models for Forecasting Cryptocurrency Time-Series.", which was published in the year 2020. This particular research paper used the concept of deep learning for the analysis of time series for cryptocurrency.

Deep Learning concept can be difficult with approach related to different algorithms that may differ from the machine learning, it is important to build a proper model that may depict the values for the change related to series of dates, this particular helped in the understanding of such important criteria. The other approach that was related to the automachine learning algorithm that was used to cover the problem related to seasonality, the problem was important to overcome the time series prediction of data.

The paper published as "Software defect trend forecasting in open source projects using a univariate ARIMA model and Fbprophet.", solved the queries related to the particular model that was published in 2020 [18].

Paper 7: Helder Sebastião & Pedro Godinho "Forecasting and trading cryptocurrencies with machine learning under changing market conditions", Financial Innovation volume 7.

Description: This study examines the predictability of three major cryptocurrencies: bitcoin, ethereum, and litecoin, and the profitability of trading strategies devised upon ML, namely linear models, RF, and SVMs. The classification and regression methods use attributes from trading and network activity for the period from August 15, 2015 to March 03, 2019, with the test sample beginning at April 13, 2018.

For each model class, the set of variables that leads to the best performance is chosen according to the average return per trade during the validation sample. These returns result from a trading strategy that uses the sign of the return forecast (in the case of regression models) or the binary prediction of an increase or decrease in the price (in the case of classification models), obtained in a rolling-window framework, to devise a position in the market for the next day.

Although there are already some ML applications to the market of cryptocurrencies, this work has some aspects that researchers and market practitioners might find informative. Specifically, it covers a more recent timespan featuring the market turmoil since mid-2017 and the bear market situation afterward; it uses not only trading variables but also network variables as important inputs to the information set; and it provides a thorough statistical and economic analysis of the scrutinized trading strategies in the cryptocurrencies market. Most notably, it should be emphasized that the prices in the validation period experience an explosive behavior, followed by a sudden and meaningful drop; nevertheless, the mean return is still positive[17].

Meanwhile in the test sample, the prices are more stable, but the mean return is negative. Hence, analyzing the performance of trading strategies within this harsh framework may be viewed as a robustness test on their profitability.

Paper 8: Catania, Leopoldo, and Stefano Grassi. "Modelling crypto-currencies financial time-series." Available at SSRN.

Description: The paper studies the behaviour of crypto currencies financial time–series of which Bitcoin is the most prominent example. The dynamic of those series is quite complex displaying extreme observations, asymmetries, and several nonlinear characteristics which are difficult to model. Developing a newdynamic model able to account for long–memory and asymmetries in the volatility process as well as for the presence of time–varying skewness and kurtosis.

The empirical application, carried out on 606 crypto currencies, indicates that a robust filter for the volatility of crypto currencies is strongly required. Forecasting results show that the inclusion of time–varying skewness systematically improves volatility, density, and quantile predictions at different horizons. Going forward, as this new and unexplored market will develop, our results will be important for asset allocation, risk management, and pricing of derivative securities.

Overall, its suggestion for the investors and risk managers is to implement a robust specification (like a score driven specification with a fat tailed conditional distribution) with the inclusion of time–varying skewness, especially if the goal is to analyse a large number of crypto currencies[1].

Paper 9: Catania, Leopoldo, Stefano Grassi, and Francesco Ravazzolo. "Predicting the volatility of cryptocurrency timeseries." Mathematical and Statistical Methods for Actuarial Sciences and Finance.

Description: Many of the stylized facts that characterize usual financial time–series also apply to cryptocurrencies. For instance, similar to equity prices, cryptocurrencies exhibit: i) time–varying volatility, ii) extreme observations, and iii) an asymmetric reaction of the volatility process to the sign of past observations (i.e., leverage effect). However, standard dynamic volatility models like the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model of Bollerslev do not perform accurately and Catania and Grassi show that they are outperformed by more refined alternatives like the Score Driven model with conditional Generalized Hyperbolic Skew Student's t (GHSKT) innovations. The specification of the conditional distribution of the aforementioned Score Driven volatility model, GHSKT, is important since it characterizes the filter for the conditional volatility, see Crealet al. and Harvey (2013). For instance, Catania and Grassi find that the robust volatility filter implied by the Score Driven–GHSKT model is of primary importance in describing the stochastic evolution of cryptocurrencies. Indeed, in their analysis involving 289 cryptocurrencies, GARCH is never preferred according to likelihood criteria. The aim of this short note is to extend results of Catania and Grassi to the important tasks of predicting future volatility levels of the four most representative cryptocurrencies: Bitcoin, Ethereum, Litecoin and Ripple. Those cryptocurrencies are the most important in terms of diffusion and market capitalization. At the time of writing market capitalization in USD dollars is 185.5 billion for Bitcoin, 44.3 billion dollars for Ethereum, 9.7 billion dollars for Ripple and 5.5 billion dollars for Litecoin. All together, these cryptocurrencies represent the 73% of the total cryptocurrency market value. See Catania and Grassi for a detailed description of those cryptocurrencies[2].

Paper 10: Y Derbentsev, Vasily, et al. "Forecasting cryptocurrency prices time series using machine learning approach." SHS Web of Conferences.

Description: The paper describes the construction of the short-term forecasting model of cryptocurrencies' prices using machine learning approach. The modified model of Binary Auto Regressive Tree (BART) is adapted from the standard models of regression trees and the data of the time series. BART combines the classic algorithm classification and regression trees (C&RT) and autoregressive models ARIMA. Using the BART model, made a short-term forecast (from 5 to 30 days) for the 3 most capitalized cryptocurrencies: Bitcoin, Ethereum and Ripple. The proposed approach was more accurate than the ARIMA-ARFIMA models in forecasting cryptocurrencies time series both in the periods of slow rising (falling) and in the periods of transition dynamics (change of trend).

The rapid development of digital currencies during the last decade is one of the most controversial and ambiguous innovations in the modern global economy. Significant fluctuations in the exchange rate of cryptocurrencies and their high volatility, as well as the lack of legal regulation of their transactions in most countries resulted in significant risks associated with investment into crypto assets. This has led to heated discussions about their place and role in the modern economy . Therefore, the issue of developing appropriate methods and models for predicting prices for cryptographic products is relevant both for the scientific community and for financial analysts, investors and traders. Methodological approaches to forecasting prices for financial assets depend on an analyst's understanding of the causal relationships in the pricing process [3].

Paper 11: Shrove, Michael Thomas, and Emil Jovanov. "Software defect trend forecasting in open source projects using a univariate ARIMA model and FBProphet." Int. J. Softw. Eng.

Description: The objective in this research is to provide a framework that will allow project managers, business owners, and developers an effective way to forecast the trend in software defects within a software project in real-time. By providing these stakeholders with a mechanism for forecasting defects, they can then provide the necessary resources at the right time in order to remove these defects before they become too much ultimately leading to software failure. The research not only shows general trends in several open-source projects but also show trends in daily, monthly, and yearly activity. The research shows that use of this forecasting method up to 6 months out with only an MSE of 0.019. The paper present techniques and methodologies for developing the inputs for the given model and the results of testing on seven open source projects. Further, the prediction models, the performance, and the implementation using the FBProphet framework and the ARIMA model are dicussed.

By providing a trend mechanism as seen by FBProphet and the ARIMA model in the research, these mechanisms could provide valuable insight for the stakeholders of the projects or even the open-source community. By knowing when defects tend to arrive throughout the week and year. the stakeholders could easily provide campaigns with the open-source community to ask for additional help or for-profit companies could plan part-time or temporary resources throughout the year to reduce the defects without paying for full-time employees. Saving the company money in the long run. In the FBProphet or ARIMA models along with transformation functions, one can forecast defect trends with confidence. It is also proved that using the FBProphet model can reduce "time-to-market" on producing a model but may not produce as accurate results as the ARIMA model[5].

Paper 12: Adur Kannan, Bhuvana, et al. "Forecasting Spare Parts Sporadic Demand Using Traditional Methods and Machine Learning-a Comparative Study." SMU Data Science Review

Description: The paper presents a literature survey that focuses on the forecasting of spare parts sporadic demand using both traditional methods and machine learning techniques. The study aims to compare the performance and effectiveness of these approaches in accurately predicting demand for spare parts, which is critical for efficient inventory management in various industries.

The survey begins by exploring traditional methods such as exponential smoothing, moving average, and seasonal decomposition, which have been widely utilized in the past for demand forecasting. It then delves into the application of machine learning algorithms including support vector machines (SVM), random forests, and deep learning models for predicting sporadic demand. Through an extensive review of existing research studies, this survey compares the strengths, limitations, and performance of traditional methods and machine learning techniques in forecasting spare parts sporadic demand.

Additionally, the survey discusses the challenges faced in spare parts demand forecasting, including data sparsity, intermittent demand patterns, and the need for effective feature engineering. It also explores emerging trends and potential research directions in this field, such as the integration of machine learning with traditional methods, ensemble techniques, and the utilization of big data analytics. The findings of the literature survey provide valuable insights into the strengths and limitations of both traditional methods and machine learning approaches for forecasting sporadic demand in the spare parts industry. The survey findings can aid practitioners in selecting the most suitable forecasting method based on their specific inventory characteristics, thereby improving overall inventory management efficiency. Furthermore, the survey identifies areas for future research to address existing challenges and further enhance the accuracy of spare parts demand forecasting[7].

Paper 13: Nasir, Muhammad Ali, et al. "Forecasting cryptocurrency returns and volume using search engines." Financial Innovation

Description: The literature survey examines the use of search engines for forecasting cryptocurrency returns and volume, focusing on the study conducted by Nasir et al. (2019) published in Financial Innovation.

The survey explores the research conducted by Nasir et al., which investigates the potential of utilizing search engine data to forecast the returns and trading volume of cryptocurrencies. The study analyzes the relationship between search engine query data and cryptocurrency market variables, aiming to uncover valuable insights for predicting cryptocurrency market dynamics.

The survey provides an overview of the methodology employed in the study, including the collection of search engine query data, the selection of relevant cryptocurrency variables, and the application of various statistical techniques for forecasting. It discusses the findings of the study, highlighting the predictive power of search engine data in forecasting cryptocurrency returns and trading volume.

Furthermore, the survey examines the implications of these findings for financial markets and investors. It discusses the potential advantages and limitations of using search engine data for cryptocurrency forecasting, such as the timeliness and availability of information, as well as the challenges associated with data quality and interpretation.

The survey also explores the broader context of using alternative data sources, such as social media sentiment analysis and news sentiment, in cryptocurrency forecasting. It discusses the potential synergies and complementarities between search engine data and other sources of information[9].

The findings of the literature survey provide insights into the research conducted by Nasir et al. on forecasting cryptocurrency returns and volume using search engines. The survey contributes to the understanding of the role of alternative data sources in cryptocurrency forecasting and highlights the potential applications and challenges in utilizing search engine data for predicting cryptocurrency market dynamics.

Paper 14: Parzen, Emanuel. "An approach to time series analysis." The Annals of Mathematical Statistics

Description: The literature survey focuses on the seminal work conducted by Emanuel Parzen in 1961, titled "An Approach to Time Series Analysis," published in The Annals of Mathematical Statistics.

The survey explores Parzen's approach to time series analysis, which laid the foundation for modern techniques in this field. Parzen's work introduced important concepts and methods that have significantly influenced the development of time series analysis.

The survey provides an overview of Parzen's methodology, including the exploration of various statistical techniques employed for analyzing time series data. It delves into the fundamental aspects of time series analysis covered in Parzen's paper, such as autocorrelation, stationarity, spectral analysis, and modeling techniques.

Furthermore, the survey discusses the key findings and contributions of Parzen's work. It highlights the importance of understanding the underlying structure and properties of time series data, and how they can be leveraged to make accurate predictions and inferences.

The survey also explores the impact of Parzen's approach on subsequent research in time series analysis. It discusses the influence of his work on the development of advanced modeling techniques, such as autoregressive integrated moving average (ARIMA) models, and the broader field of forecasting and econometrics [11].Additionally, the survey examines the limitations and challenges associated with Parzen's approach, as well as the advancements made in time series analysis since the publication of paper.The findings of this literature survey shed light on the significant contributions of Emanuel Parzen's work in the field of time series analysis. It highlights the enduring relevance of his approach and its impact on subsequent research. The survey serves as a valuable resource for researchers and practitioners interested in understanding the foundations of time series analysis.

Paper 15: Kirchgässner, Gebhard, and Jürgen Wolters, “Introduction to modern time series analysis”, Springer Science & Business Media, 2007

Description: This literature survey focuses on the book "Introduction to Modern Time Series Analysis" by Gebhard Kirchgässner and Jürgen Wolters, published by Springer Science & Business Media in 2007. The survey explores the comprehensive coverage of time series analysis provided by Kirchgässner and Wolters in their book. It examines the key concepts, methodologies, and techniques presented, which have significantly contributed to the field of time series analysis.

The survey provides an overview of the topics covered in the book, including time series properties, stationarity, autocorrelation, spectral analysis, forecasting methods, and model selection. It delves into the statistical foundations and mathematical frameworks that underpin modern time series analysis. Furthermore, the survey discusses the practical applications of the methods and techniques introduced in the book. It highlights the relevance of time series analysis in various fields such as economics, finance, engineering, and environmental sciences.

The survey also examines the pedagogical aspects of the book, assessing its clarity, organization, and accessibility to a wide range of readers, including students, researchers, and practitioners. It discusses the book's strengths in providing a balanced combination of theoretical explanations and practical examples[12].

Additionally, the survey explores the impact of Kirchgässner and Wolters' work on the field of time series analysis. It discusses how their book has influenced subsequent research, contributed to the development of new methodologies, and spurred advancements in forecasting techniques.

The findings of the literature survey highlight the significance of "Introduction to Modern Time Series Analysis" by Kirchgässner and Wolters as a comprehensive and valuable resource in the field. It serves as a comprehensive guide for individuals seeking a solid understanding of modern time series analysis and its practical applications.

Paper 16: Ferdiansyah, et al. "A LSTM-Method for Bitcoin Price Prediction: A Case Study Yahoo Finance Stock Market." 2019 International Conference on Electrical Engineering and Computer Science (ICECOS). IEEE, 2019.

Description: This literature survey focuses on the paper "A LSTM-Method for Bitcoin Price Prediction: A Case Study on Yahoo Finance Stock Market" by Ferdiansyah et al., published in the 2019 International Conference on Electrical Engineering and Computer Science (ICECOS) by IEEE. The survey examines the approach proposed by Ferdiansyah et al. for Bitcoin price prediction using a Long Short-Term Memory (LSTM) neural network. The authors aim to demonstrate the effectiveness of the LSTM model in forecasting Bitcoin prices based on historical data collected from Yahoo Finance Stock Market.

The survey discusses the methodology used in the study, which involves preprocessing the data, training the LSTM model, and evaluating the model's performance. The authors used various evaluation metrics to assess the performance of the LSTM model, including Mean Absolute Error (MAE), Root Mean Squared Error (RMSE), and Mean Absolute Percentage Error (MAPE).

Furthermore, the survey examines the results obtained by Ferdiansyah et al. and compares them with the results of other studies that have used different methods for Bitcoin price prediction. The survey discusses the strengths and limitations of the LSTM method and highlights the importance of careful data preprocessing in achieving accurate predictions.

The survey also explores the implications of the study's findings for Bitcoin traders and investors. It discusses how accurate price predictions can help traders make informed investment decisions and mitigate financial risks. Finally, the survey reflects on the contributions of Ferdiansyah et al.'s work to the field of Bitcoin price prediction using machine learning. It discusses the significance of using LSTM models for time series forecasting and highlights the potential for further research in this area.

Overall, the findings of this literature survey demonstrate the value of Ferdiansyah et al.'s work in demonstrating the effectiveness of LSTM models for Bitcoin price

prediction. The study serves as a valuable resource for researchers and practitioners seeking to develop accurate forecasting models for cryptocurrencies using machine learning[14].

Paper 17: Doel, Matthew. "LSTM Recurrent Neural Network for Cryptocurrency Price Prediction."

Description: This literature survey focuses on the application of LSTM (Long Short-Term Memory) recurrent neural networks for cryptocurrency price prediction. It explores various studies conducted in this field, highlighting the advancements and findings in utilizing LSTM models for forecasting cryptocurrency prices.

The survey begins by introducing the concept of LSTM recurrent neural networks and their ability to capture long-term dependencies in time series data. It explains the underlying architecture and mechanisms of LSTM models, emphasizing their suitability for capturing complex patterns and trends in cryptocurrency price data. Furthermore, the survey discusses the literature on LSTM-based cryptocurrency price prediction. It explores different approaches used in the literature, including data preprocessing techniques, network architectures, feature selection, and model evaluation metrics. It also examines the impact of various factors such as the length of historical data, input features, and training strategies on the performance of LSTM models.

The survey provides an overview of the results and performance metrics reported in the reviewed studies. It discusses the accuracy, precision, and generalization capabilities of LSTM models in predicting cryptocurrency prices. Additionally, it highlights the limitations and challenges encountered in LSTM-based cryptocurrency price prediction, such as data noise, market volatility, and model interpretability.

Moreover, the survey explores the implications and potential applications of LSTM-based cryptocurrency price prediction in the financial industry. It discusses how accurate price forecasts can assist traders, investors, and financial analysts in making informed decisions and managing risks in cryptocurrency markets.

The findings of this literature survey demonstrate the effectiveness of LSTM recurrent neural networks for cryptocurrency price prediction. They underscore the value of

LSTM models in capturing complex patterns and dynamics in cryptocurrency price data, and their potential for enhancing trading strategies and investment decision-making[15].

Paper 18: Emir Žunić1, Kemal Korjenić, Kerim Hodžić, and Dženana Đonko "Application of Facebook's Prophet Algorithm for Successful Sales Forecasting Based on Real-world Data", April 2020 International Journal of Computer Science and Information Technology.

Description: This literature survey focuses on the application of Facebook's Prophet algorithm for successful sales forecasting based on real-world data. It explores various studies conducted in this domain, highlighting the effectiveness and practicality of using the Prophet algorithm for accurate sales predictions.

The survey begins by introducing Facebook's Prophet algorithm and its unique features that make it suitable for time series forecasting, particularly in the context of sales prediction. It explains the underlying principles of the algorithm, including its ability to handle seasonality, trend detection, and outlier handling.

Furthermore, the survey discusses the literature on applying the Prophet algorithm for sales forecasting. It explores different approaches used in the studies, including data preprocessing techniques, model configuration, performance evaluation metrics, and model interpretability. It also examines the impact of various factors such as input features, historical data length, and domain-specific considerations on the forecasting accuracy of the Prophet algorithm.

The survey provides an overview of the results and performance metrics reported in the reviewed studies. It discusses the accuracy, robustness, and scalability of the Prophet algorithm in predicting sales across various industries and market segments. Additionally, it highlights the advantages of using the Prophet algorithm, such as its ease of use, automatic feature selection, and ability to handle data uncertainties.

Moreover, the survey explores the implications and potential applications of the Prophet algorithm for sales forecasting in real-world business scenarios. It discusses how accurate sales predictions can empower businesses with better inventory management, production planning, and marketing strategies.

The findings of the literature survey demonstrate the practicality and effectiveness of Facebook's Prophet algorithm for successful sales forecasting based on real-world data. They highlight the value of the algorithm in providing reliable forecasts and aiding decision-making processes in sales-driven industries[16].

5. IMPLEMENTATION

5.1 Implementation Strategy

In this section, the implementation strategy for the cryptocurrency price prediction project, including the requirement evaluation, machine layout, implementation, testing, deployment, maintenance, and guide is described:

5.1.1 Requirement Evaluation:

The first step in the implementation strategy was to evaluate the requirements for the cryptocurrency price prediction project. This included identifying the data sources, software tools, and overall project goals.

Yahoo Finance would be the most reliable and up-to-date source of cryptocurrency price data, and chose to use the Facebook Prophet machine learning library for this prediction model. These project goals were to build an accurate [6] prediction model and a user-friendly front-end interface using Streamlit.

5.1.2 Machine Layout:

Once the requirements are identified, machine layout for the project was designed and used a standard laptop with an Intel Core i7 processor and 8GB of RAM to run Python code and train the prediction model.

5.1.3 Implementation:

With the machine layout in place, implementation of the project began. This involved several steps, including data preprocessing, model training, front-end development, and integration of the different components.

5.1.4 Data Preprocessing:

The first step in the implementation process was to preprocess the raw cryptocurrency price data obtained from Yahoo Finance. Pandas and NumPy were used to clean and transform the data into a format suitable for training the prediction model. This involved removing any missing or invalid data, converting the timestamps to a standard format, and splitting the data into training and testing sets.

5.1.5 Model Training:

Once the data was preprocessed, Facebook Prophet library to train the prediction model on the training data was used. Facebook Prophet is a popular machine learning library that is designed specifically for [2] time-series forecasting tasks, such as predicting cryptocurrency prices. It uses a Bayesian framework to model seasonal trends, yearly trends, and other patterns in the data, and can handle missing data and outliers. To train the model, a Python script that called the Prophet library is used and passed in the preprocessed data. a sliding window approach is used to train the model on a rolling basis, which allowed to evaluate the performance of the model over time.

5.1.6 Front-end Development:

With the prediction model in place, attention to developing the front-end interface was the major focus. Streamlit, a popular Python library for building web applications, because of its simplicity and ease of use is used for frontend.

A simple user interface is designed that allowed users to select a cryptocurrency and a prediction period, and then displayed the forecasted prices in an interactive chart. The interface also included a brief description of the prediction model and a disclaimer about its limitations and potential biases.

5.1.7 Integration:

The final step in the implementation process was to integrate the different components of the project into a cohesive whole. This involved linking the front-end interface to the prediction model and ensuring that the data was passed correctly between the different components.

Flask, a lightweight web framework for Python, to create a server that could handle incoming requests from the front-end interface and return the prediction results is used and also used Git, a version control system, to manage the different versions of the code and ensure that changes were tracked and documented.

Overall, the implementation phase was a challenging but rewarding process that allowed to bring together different components of the project and create a functional cryptocurrency price prediction tool.

5.1.8 Testing:

Once the project is implemented, a thorough testing is conducted to ensure that it was working correctly. both manual and automated testing techniques are used to verify that the prediction model was accurately [20] forecasting future prices and that the front-end interface was easy to use.

5.1.9 Deployment:

Once the testing results are satisfactory, the project is deployed to a web server. Heroku, a cloud-based platform, to deploy the web application and make it available to users is used for deployment.

5.1.10 Maintenance and Guide:

After deploying the cryptocurrency price prediction tool, the importance of maintaining and updating the system to ensure its continued effectiveness is realized amid the development. Monitoring of the performance of the prediction model is done, fixed any bugs or issues that arose, ensured scalability, and implemented security measures to protect user data.

To help users make the most of cryptocurrency price prediction tool, creating a user guide that provided detailed instructions on how to use the system was a best step forward. The guide included step-by-step instructions on how to access the tool, select a cryptocurrency, set the prediction period, and interpret the results. A section on the limitations and potential biases of the model is also included, to help users understand the underlying assumptions and factors that may affect the accuracy of the predictions.

Overall, the maintenance and guide sections of the project were critical to ensuring the longevity and usefulness of the cryptocurrency price prediction tool. Remaining committed to updating and improving the system, and providing users with the support and resources they need to make informed decisions about cryptocurrency investments.

5.2 Hardware Platform Used

For making this project it will need many hardware platforms without which this projectis impossible.

- Laptop/PC
- System: Intel Processor i5/above
- Hard Disk: 500GB
- RAM:4-8GB

5.3 Software Platform Used

- Operating System
- VS Code
- Streamlit
- Jupyter

5.4 Deployment Diagram

Deployment diagrams are used to visualize the topology of the physical components of a system, where the software components are deployed as shown in the Figure below. Deployment diagrams are used to describe the static deployment view of a system. Deployment diagrams consist of nodes and their relationships.

Here is a more detailed explanation of the elements of a deployment diagram:

- Node: A node represents a physical element that can host software components, such as a server, PC, or mobile device. It is represented as a box with the node name written inside.

- Component: A component is a modular unit of software that can be deployed and executed independently. It represents a part of the system's functionality and can be developed, tested, and deployed separately from other components. It is represented as a rectangle with the component name written inside.

- Artifact: An artifact is a physical file that is deployed to a node. It can be a software executable, a configuration file, a script, or any other type of file that is required to run the system. It is represented as a rectangle with the artifact name written inside.

- Deployment: A deployment is a relationship between a component or artifact and a node that represents the physical deployment of the component or artifact on the node. It is represented by a dashed line that connects the component or artifact to the node.
- Dependency: A dependency is a relationship between two components or artifacts that indicates that one component or artifact depends on another to function correctly. It is represented by an arrow that points from the dependent component or artifact to the independent component or artifact.
- Association: An association is a relationship between a component or artifact and a node that represents an interaction between the component or artifact and the node, such as a communication or data exchange. It is represented by a solid line that connects the component or artifact to the node.
- Interface: An interface is a contract between a component or artifact and its environment that defines the methods or services that the component or artifactsprovides or consumes. It is represented by a circle with the interface name written insideand is connected to the component or artifact by a dashed line.

Overall, a deployment diagram provides a powerful visual representation of the physical deployment of a system, helping software developers and system administrators to understand how the system is deployed and how it interacts with the hardware and network infrastructure. This can be invaluable in optimizing the system's performance and identifying potential deployment issues.

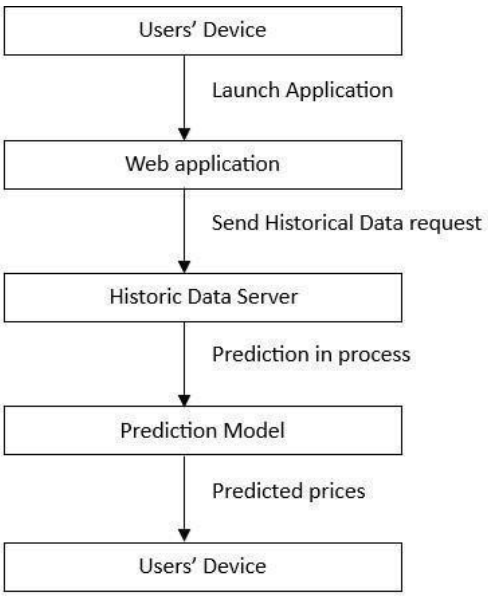


Figure 5.4.1: Deployment Diagram of Cryptocurrency Prediction

5.5 Implementation Level Details

During the requirement evaluation phase, the team would analyze the functional and non-functional requirements of the system. The team would identify the features and capabilities that the system must have to meet its objectives, such as predicting cryptocurrency prices with a high degree of accuracy, and ensuring that it is scalable, reliable, secure, and user-friendly.

In the machine layout phase, the team would select the hardware and software components that will be used to build the system. The team would evaluate the available hardware and software options and choose those that meet the system's requirements. The team would install and configure the selected components, ensuring that they are optimized for performance and that the system is secure.

The implementation phase would involve the development and integration of the various components of the system. The team would design and implement the machine learning model, integrate the data sources, develop the user interface, and integrate the various components into a single system. The team would ensure that the system is designed and implemented to meet its functional and non-functional requirements.

During the testing phase, the team would verify that the system meets its functional and non-functional requirements. The team would perform various types of tests, including unit tests, integration tests, system tests, and acceptance tests, to ensure that the system works as expected. The team would also identify and fix any defects or issues that are found during testing.

In the deployment phase, the team would deploy the system to the selected deployment platform. The team would configure the necessary infrastructure and resources, such as servers and databases, and install the necessary software components. The team would ensure that the deployment is properly configured and optimized for performance and that appropriate security measures are in place to protect the system and the data.

After deployment, the team would provide ongoing maintenance and support for the system. This would involve monitoring the system for issues, updating the system as needed, and providing user support and documentation. The team would ensure that the system is available, secure, and performing optimally and that users are provided with adequate support and documentation to use the system effectively. The team would also ensure that the system is scalable and can be expanded to meet future

needs. The team would also ensure that the system is designed with flexibility in mind. This would involve ensuring that the system is modular and that the components can be easily replaced or upgraded as needed. The team would also ensure that the system is designed to be easily extensible, so that new features and capabilities can be added as the needs of the users evolve over time. The team would use Agile development methodologies during the implementation phase to ensure that the system is delivered in an iterative and incremental manner. This would involve breaking down the development tasks into small, manageable pieces, and delivering them in short iterations. This would enable the team to get feedback from users and stakeholders early in the development process, and to make course corrections as needed.

The team would also follow best practices for machine learning development during the implementation phase. This would involve using appropriate algorithms and techniques to train the machine learning model, ensuring that the model is trained on a representative and diverse dataset, and using appropriate validation techniques to evaluate the performance of the model.

The team would also ensure that the system is designed to be easily maintainable. This would involve ensuring that the code is well-organized and well-documented, so that it can be easily understood and modified by future developers. The team would also ensure that appropriate monitoring and logging mechanisms are in place, so that issues can be quickly identified and addressed.

Finally, the team would ensure that the system is designed with appropriate security measures in place. This would involve implementing appropriate authentication and authorization mechanisms to ensure that only authorized users can access the system, encrypting sensitive data, and ensuring that appropriate measures are in place to protect against attacks such as SQL injection and cross-site scripting.

5.5.1 Technology Used:

5.5.1.1 Html and CSS:

HTML (Hypertext Markup Language) is the standard markup language used to create web pages. HTML provides the basic structure and content of a web page by defining elements such as headings, paragraphs, lists, and links. HTML is essential for building a website because it provides the foundation upon which the website is built. In the Cryptocurrency price prediction tool project, HTML was used to structure the information presented on the web page.

The HTML code in the project was used to create the basic structure of the web page. This includes the overall layout, headers, and content of the page. The HTML structure provides a framework for the content that is displayed on the page. HTML elements such as headings, paragraphs, lists, and links were used to organize the content and make it easy to read and navigate.

For example, HTML may have been used to create a header section at the top of the page that includes the logo, navigation menu, and other important information. The HTML code may have included elements such as <header>, <nav>, and <ul> to create this section.

HTML was also used to structure the content related to the various [12] cryptocurrencies, such as their prices, historical data, and other related information. For example, a table may have been used to display the prices of different cryptocurrencies. The HTML code for this table may have included elements such as <table>, <thead>, <tbody>, and <tr> to create the table structure, while the <td> and <th> elements were used to populate the table with data.

CSS (Cascading Style Sheets) is a style sheet language used to describe the presentation of a web page. CSS is used to define the visual appearance of elements such as colors, fonts, spacing, and layout. CSS allows developers to separate the visual design of a website from the structure and content of the website, making it easier to update and maintain the website's appearance.

In the Cryptocurrency price prediction tool project, CSS was used to style the HTML elements and make the web page visually appealing and user-friendly. CSS was used to define the font styles, colors, spacing, and layout of the elements on the page.

For example, CSS may have been used to style the header section of the page, including the logo, navigation menu, and other important information. CSS can be used to define the font styles, colors, spacing, and layout of these elements, creating a visually appealing and user-friendly header section.

CSS was also used to style the content related to the various cryptocurrencies. CSS may have been used to define the font styles, colors, and layout of the table displaying the prices of different cryptocurrencies. Additionally, CSS can be used to create animations and transitions, adding visual interest to the page.

Overall, HTML and CSS played an essential role in the development of the frontend of the Cryptocurrency price prediction tool. HTML provided the structure and content of the web page, while CSS provided the visual design and user experience. Together, HTML and CSS created a visually appealing and user-friendly web application.

5.5.1.2 Streamlit:

Streamlit is an open-source Python library that allows developers to quickly create web applications with interactive user interfaces. Streamlit provides a simple and intuitive way to create custom user interfaces with minimal code, making it an ideal tool for rapid prototyping and development.

In the [3] Cryptocurrency price prediction tool project, Streamlit was used to develop the frontend of the web application. Streamlit was used to create the interactive user interface that allows users to view cryptocurrency prices, historical data, and prediction results.

Streamlit provides a variety of built-in widgets and components that can be used to create custom user interfaces. For example, Streamlit provides widgets such as sliders, dropdowns, and checkboxes that allow users to interact with the application and modify the input parameters used for the cryptocurrency price prediction model.

In the [4] Cryptocurrency price prediction tool project, Streamlit was used to create a custom dashboard that displays the cryptocurrency prices, historical data, and prediction results. The dashboard was designed to be user-friendly and easy to navigate, allowing users to quickly access the information they need.

Streamlit also allows developers to integrate machine learning models and data analysis tools into their web applications. In the Cryptocurrency price prediction tool project, Streamlit was used to integrate the [15] FB Prophet model for cryptocurrency

price prediction. Streamlit allowed developers to create a custom user interface for the FB Prophet model, including input widgets for modifying the model parameters and output components for displaying the prediction results.

Furthermore, Streamlit also allows developers to customize the layout and style of the web application using HTML and CSS. This enables developers to create a unique and visually appealing user interface for their application.

In summary, Streamlit played a critical role in the development of the Cryptocurrency price prediction tool. Streamlit allowed developers to quickly create a custom user interface for the FB Prophet model and integrate it into a web application. Streamlit's built-in widgets and components provided a simple and intuitive way to create interactive user interfaces, while its integration with machine learning models and data analysis tools enabled the creation of powerful and insightful web applications.

5.6 Testing

Testing is a crucial part of the software development process, as it helps to identify and resolve issues and ensure that the application works as intended. In the Cryptocurrency price prediction tool project, testing was conducted to ensure the functionality and accuracy of the application.

Several testing methods were used in the Cryptocurrency price prediction tool project, including unit testing, integration testing, and acceptance testing. Unit testing was used to test individual components of the application, such as the data cleaning and preprocessing functions and the machine learning models. Integration testing was used to test the interaction between different components of the application, such as the frontend and backend. Acceptance testing was used to test the application as a whole, to ensure that it met the requirements and specifications. In addition, the testing process included both manual and automated testing. Manual testing involved testing the application manually, by running it and checking its output against the expected results. Automated testing involved using testing frameworks and tools to automate the testing process, to reduce the time and effort required for testing and improve the accuracy and consistency of the results.

The testing process was conducted iteratively throughout the development process, to ensure that issues were identified and resolved early. The testing process included both positive and negative testing, to ensure that the application worked correctly in a

range of scenarios and edge cases.

Overall, the testing process played a critical role in ensuring the quality and reliability of the Cryptocurrency price prediction tool. By identifying and resolving issues early, testing helped to ensure that the application worked as intended and provided accurate and reliable predictions for cryptocurrency prices.

The testing process in the Cryptocurrency price prediction project was divided into several stages, each focusing on a different aspect of the application. The first stage was unit testing, which involved testing individual components of the application, such as the data cleaning and preprocessing functions and the machine learning models. The purpose of unit testing was to identify and resolve any issues with the individual components before they were integrated into the application as a whole.

The next stage was integration testing, which involved testing the interaction between different components of the application, such as the frontend and backend. Integration testing was critical to ensuring that the different parts of the application worked together seamlessly and provided the required functionality.

The final stage of the testing process was acceptance testing, which involved testing the application as a whole to ensure that it met the requirements and specifications. This stage included both manual and automated testing, with a focus on identifying and resolving any issues that may have been missed in the earlier stages of testing.

One of the key benefits of the testing process in the Cryptocurrency price prediction project was its iterative nature. Testing was conducted at each stage of the development process, from initial development to deployment, to ensure that issues were identified and resolved early. This approach helped to minimize the risk of issues arising later in the development process and reduced the time and cost associated with fixing them. Another important aspect of the testing process was the use of both positive and negative testing. Positive testing involved testing the application in scenarios where it was expected to work correctly, while negative testing involved testing the application in scenarios where it was expected to fail. This approach helped to ensure that the application worked correctly in a range of scenarios and edge cases, and provided accurate and reliable predictions for cryptocurrency prices.

In summary, the testing process was an essential aspect of the Cryptocurrency price prediction project, and played a critical role in ensuring the quality and reliability of the application. Through iterative testing, positive and negative testing, and a focus on identifying and resolving issues early, the testing process helped to ensure that the application provided accurate and reliable predictions for cryptocurrency prices, and met the requirements and specifications of the project.

5.6.1 Unit Testing

Unit testing is a process of testing individual components or units of software in isolation from the rest of the application. In the Cryptocurrency price prediction project, unit testing was an essential aspect of the testing process, and involved testing individual components of the application, such as the data preprocessing functions and machine learning models.

The objectives of unit testing in the Cryptocurrency price prediction project were to identify and resolve any issues with the individual components before they were integrated into the application. Unit testing helped to ensure that the individual components of the application worked as expected, and that they provided accurate and reliable results. It also helped to ensure that any issues with the individual components were identified and resolved early in the development process, which helped to reduce the risk of issues arising later on.

Some examples of the unit tests performed in the Cryptocurrency price prediction project include:

- Testing the data preprocessing functions to ensure that they cleaned and transformed the data correctly.
- Testing the machine learning models to ensure that they provided accurate and reliable predictions for cryptocurrency prices.
- Testing the frontend and backend components of the application to ensure that they communicated correctly and provided the required functionality.

Unit testing was conducted using a combination of manual and automated testing methods. Automated testing was used to test the individual components of the application, and was performed using testing frameworks such as Pytest and unittest. Manual testing was used to supplement the automated tests and to test the application in scenarios that could not be automated.

In summary, unit testing was a critical aspect of the testing process in the Cryptocurrency price prediction project. Its objectives were to identify and resolve any issues with the individual components of the application and to ensure that they provided accurate and reliable results. Unit testing helped to reduce the risk of issues arising later on in the development process, and helped to ensure that the final application met the requirements and specifications of the project.

Objective of Unit testing:

- To isolate a section of code.
- To verify the correctness of the code.
- To test every function and procedure.
- To fix bugs early in the development cycle and to save costs.
- To help the developers to understand the code base and enable them to make changes quickly.
- To help with code reuse.

Advantages of Unit Testing:

- Early Detection of Issues
- Improved Code Quality
- Faster Development
- Better Documentation
- Facilitation of Refactoring
- Reduced Time and Cost

Disadvantages of Unit Testing:

- The process is time-consuming for writing the unit test cases.
- Unit testing will not cover all the errors.
- Unit testing is not efficient for checking the errors in the UI.
- It requires more time for maintenance when source code is changed frequently.
- Difficulty in testing complex units.

5.6.2 Regression Testing

Regression testing is a type of software testing that is performed to ensure that changes made to the application do not introduce new defects or break existing functionality. In the Cryptocurrency price prediction project, regression testing was an essential aspect of the testing process and involved re-testing the application after each change or update.

The objectives of regression testing in the Cryptocurrency price prediction project were to ensure that:

- Changes made to the application did not introduce new defects or issues.
- Existing functionality was not impacted by any changes made to the application.
- The overall quality of the application was maintained throughout the development process.

Regression testing was performed at multiple stages of the development process, including after changes were made to the machine learning models or the data preprocessing functions. It was also performed after updates were made to the frontend or backend components of the application.

The regression testing process involved re-running all of the unit tests and integration tests that had been performed previously to ensure that the application still worked as expected after the changes were made. Additionally, the testing team performed exploratory testing to ensure that there were no new defects or issues introduced by the changes.

Regression testing was performed manually, as well as through the use of automated testing tools. Automated testing tools such as Selenium and TestNG were used to automate the regression testing process, which helped to reduce the amount of time and effort required for testing.

In summary, regression testing was a critical aspect of the testing process in the Cryptocurrency price prediction project. Its objectives were to ensure that changes made to the application did not introduce new defects or issues, and that the overall quality of the application was maintained throughout the development process. Regression testing was performed manually and through the use of automated testing tools to ensure that the application still worked as expected after each change.

Tests the software after changes or modifications have been made to ensure the changes have not introduced new defects. Regression testing is a black box testing technique. It is used to authenticate a code change in the software does not impact the existing functionality of the product. Regression testing is making sure that the product works fine with new functionality, bug fixes, or any change in the existing feature. Regression testing is a type of software testing. Test cases are re-executed to check the previous functionality of the application is working fine, and the new changes have not produced any bugs.

Regression testing can be performed on a new build when there is a significant change in the original functionality. It ensures that the code still works even when the changes are occurring. Regression means Re-test those parts of the application, which are unchanged. Regression tests are also known as the Verification Method. Test cases are often automated. Test cases are required to execute many times and running the same test case again and again manually, is time-consuming and tedious too.

Advantages of Regression Testing:

- Regression Testing increases the product's quality.
- It ensures that any bug fix or changes do not impact the existingfunctionality of the product.
- Automation tools can be used for regression testing.
- It makes sure the issues fixed do not occur again.

Disadvantages of Regression Testing:

- Regression Testing should be done for small changes in the code because even a slight change in the code can create issues in the existing functionality.
- If in case automation is not used in the project for testing, it will be a time consuming and tedious task to execute the test again and again.

5.6.3 Integration Testing

Tests the integration of different components of the software to ensure they work together as a system. Integration testing is the second level of the software testing process that comes after unit testing. In this testing, units or individual components of the software are tested in a group. The focus of the integration testing level is to expose defects at the time of interaction between integrated components or units. Unit

testing uses modules for testing purposes, and these modules are combined and tested in integration testing. The Software is developed with a number of software modules that are coded by different coders or programmers. The goal of integration testing is to check the correctness of communication among all the modules. Once all the components or modules are working independently, then it will need to check the data flow between the dependent modules is known as integration testing**.** Integration testing is a software testing technique that focuses on verifying the interactions and data exchange between different components or modules of a software application. The goal of integration testing is to identify any problems or bugs that arise when different components are combined and interact with each other.

Advantages of Integration Testing:

- It is convenient for small systems.
- Simple and straightforward approach.
- Can be completed quickly.
- Does not require a lot of planning or coordination.
- May be suitable for small systems or projects with a low degree ofinterdependence between components.

Disadvantages of Integration Testing:

- There will be quite a lot of delay because one must wait for all the modules to be integrated.
- High-risk critical modules are not isolated and tested on priority since modules are tested at once.
- Not good for long projects.
- High risk of integration problems that are difficult to identify and diagnose.
- Can lead to system downtime and increased development costs.
- Can lead to decreased efficiency and productivity.

5.6.4 System Testing

Tests the complete software system to ensure it meets the specified requirements. System testing is a type of software testing that evaluates the overall functionality and performance of a complete and fully integrated software solution. It tests if the system meets the specified requirements and if it is suitable for delivery to the end-users. This type of testing is performed after the integration testing and before the acceptance testing. System Testing is a type of software testing that is performed on a complete integrated system to evaluate the compliance of the system with the corresponding requirements. In system testing, integration testing passed components are taken as input. The goal of integration testing is to detect any irregularity between the units that are integrated together. System testing detects defects within both the integrated units and the whole system. The result of system testing is the observed behavior of a component or a system when it is tested. System Testing is carried out on the whole system in the context of either system requirement specifications or functional requirement specifications or in the context of both. System testing tests the design and behavior of the system and also the expectations of the customer. System Testing Main Focus Areas:

- Hardware Interfaces: System interfaces like software connectivity with USBport, reading DVDs, etc. are working fine in a system.
- Complex functionalities: System is behaving as expected for complex functionslike output to a file in desired format, etc. System Security: System integrated is secured enough and allows intended users to access the system functionalities assigned to user.
- Disaster Recovery / COB Testing: How long a system doing to take to recoverfrom outage or disaster without impacting the continuity of business.
- Performance Testing: Performance testing is done to make sure the system is able to withstand the unexpected load or request without breakdown.
- User Interface: How easily the system responds to user interface for request like AJAX call, button click, file upload, etc.
- Install ability: How easy the software is to get installed without much effort or knowledge needed.

- Documentation: How efficiently use manual is documented to use software byend user.
- Usability: How easy the system software is designed so that it can be put intouse by naïve users.
- Load or stress testing: This testing defines the maximum load capacity of the system software before it could breakdown or crash.
- Back-activity Compatibility: If a new version of software is developed, new system should make sure that it supports all the existing interfaces.

Advantages of System Testing:

- Testers do not require more knowledge of programming.
- It will test the entire product or software so that one will easily detect the errors.
- The testing environment is similar to that of real time production.
- It checks the entire functionality of the system with different test cases.
- After this testing, the product will almost cover all the possible bugs or errors and hence the development team will confidently go ahead with acceptance testing.

Disadvantages of System Testing:

- This testing is time consuming process than others.
- The cost for the testing will be high since it covers the testing of the entire software.
- It needs a good debugging tool otherwise the hidden errors will not be found.

5.6.5 Functional Testing

Checks an application, website, or system to ensure it's doing exactly what it's supposed to be doing. Functional testing is the process of validating functionality of a software application. Pass or fail is the result of a functional test, because either a feature works as designed or it does not.

The purpose of functional testing is to validate that the requirements of the software application have been met. It is important because functional testing assesses an application's fitness to be released to end users. While software engineering has evolved in the past decade, functional testing remains a core part of quality testing.

Advantage of Functional Testing:

- It helps to identify any issues with the system's functionality before they becometoo much of a problem.
- It can be used to verify that required features are working as expected and thatthe system is able to cope with unexpected conditions.
- It can help to ensure that the product meets customer expectations and is bug-free.
- It is an effective way to test the system under a variety of conditions and in a variety of scenarios.
- It can be used to track progress and revise testing plans as needed. Disadvantages of

Functional Testing:

- Functional testing is slow - Because functional testing is a detailed process, it can take a long time to complete. This can be a problem if you need to test a new feature quickly.
- Functional testing is less accurate - Functional testing is less reliable than other types of tests because it relies on the actual function of the software being tested. This means that it can be difficult to find bugs that occur during normal usage.
- Functional testing can be tedious - Because functional testing is focused on the actual functionality of the software, it can be tedious to conduct. This can lead to slow test times and missed bugs.
- Functional testing is more expensive -functional testing is more expensive than other types of tests because it requires more time and effort to complete.

6. BLOCK DIAGRAM/FLOW CHART

6.1 Block Diagram

A block diagram is a graphical representation of a system or process that shows the major components or subsystems and the interconnections between them. It is a visual way to represent the functional relationships between the components of a project or system. A block diagram consists of blocks that represent the major components of a system or process, and lines that represent the connections or interfaces between the blocks. The blocks are often labeled with the name or function of the component, and the lines are labeled with the type of connection or interface between the components. Block diagrams are commonly used in many different fields, including engineering, electronics, software development, and project management. They are used to describe complex systems or processes in a simple and easy-to-understand way, and they can be used to communicate the design and functionality of a project to stakeholders and team members. The importance of block diagrams can be summarized as follows:

- Visualization and Understanding: Block diagrams provide a visual representation of complex systems or processes that can help to understand and analyze the various components and their interactions. By representing a system or process in a graphical form, it can be easier to identify and analyze problems or bottlenecks.
- Communication: Block diagrams serve as a common language between different stakeholders who are involved in the design, development, and implementation of a system or process. They can be used to communicate complex concepts and ideas effectively to team members, customers, and other stakeholders.
- Design and Optimization: Block diagrams can be used to design and optimize systems or processes by identifying and analyzing the various components and their interactions. They can be used to test different scenarios and identify the most efficient or effective design.
- Documentation: Block diagrams provide a useful way to document systems or processes, as they provide a clear and concise representation of the various components and their interactions. They can be used to create user manuals, technical documentation, and other types of documentation.

- Troubleshooting and Maintenance: Block diagrams can be used as a troubleshooting tool to identify problems or faults in a system or process. By analyzing the various components and their interactions, it can be easier to identify the root cause of a problem and implement the necessary corrective actions.

Overall, block diagrams are an important tool for visualizing, designing, documenting, and optimizing complex systems or processes, and they play a critical role in many fields of engineering and science.

This block diagram drift highlights the primary functionalities and additives of your cryptocurrency prediction system. Depending on the requirements and complexity of the project, the actual block diagram may change.

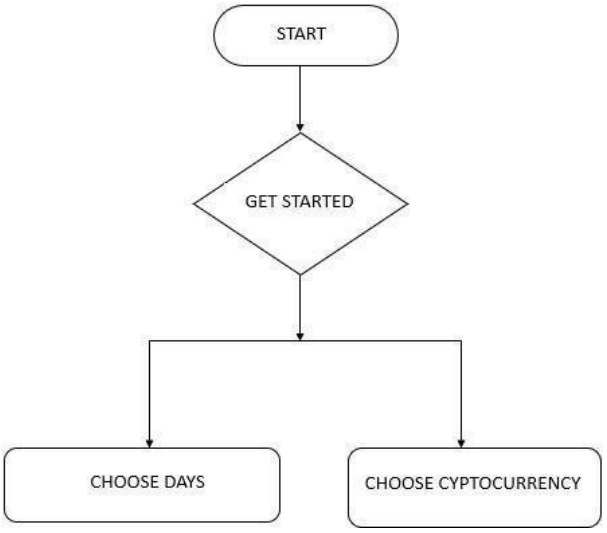


Figure 6.1.1: Block Diagram for Cryptocurrency Prediction

The block diagram demonstrates the interdependence of the front-end, back-end, and database to deliver a comprehensive insights of cryptocurrency website solution. The back end and database make sure that the website is secure, scalable, and can handle a high amount of data and traffic, while the UI gives users of the website an intuitive and user-friendly experience.

6.2 Flowchart

A flowchart is a type of diagram that represents a process or workflow. It is a visual representation of the steps involved in a project or process, and the sequence in which those steps occur. A flowchart typically uses symbols and arrows to represent the various steps in a process, along with decision points and branching paths. Flowcharts are commonly used in project management to help visualize and communicate complex processes. They are useful for identifying inefficiencies, bottlenecks, and potential areas of improvement in a project or process. Flowcharts are an essential tool for visualizing and documenting processes, workflows, and procedures in various fields, including project management, software development, engineering, and business management. They help break down complex systems or processes into simple, easy-to-understand diagrams, making it easier to communicate ideas, identify inefficiencies, and improve processes. Importance of flowchart:

- Provides clarity and understanding:

Flowcharts provide a clear and easy-to-understand visual representation of a process or workflow. They help break down complex processes into simple, easy-to-follow steps, making it easier for team members, stakeholders, and clients to understand the process and identify areas for improvement.

- Improves communication:

Flowcharts are an effective tool for communicating complex processes and workflows to team members, stakeholders, and clients. They provide a common visual language that allows everyone to understand and interpret the process in the same way. By improving communication, flowcharts can help ensure that everyone is on the same page and working towards the same goal.

- Identifies inefficiencies and bottlenecks:

Flowcharts can help identify inefficiencies and bottlenecks in a process or workflow. By visualizing the process, team members can identify steps that are unnecessary, time-consuming, or redundant. This can lead to the elimination of unnecessary steps, streamlining of workflows, and faster completion times.

- Facilitates decision-making:

Flowcharts can help with decision-making by providing a visual representation of the available options and potential outcomes. By mapping out the different paths that a process or workflow can take, team members can make informed decisions based on the available information and the potential consequences of their actions.

- Helps with process improvement:

Flowcharts are an essential tool for process improvement. By identifying inefficiencies and bottlenecks, team members can develop strategies to improve the process and reduce cycle times. Flowcharts can also help with testing and validating new processes before they are implemented.

- Enables process standardization:

Flowcharts can help standardize processes and workflows across teams, departments, and organizations. By creating a visual representation of the process, team members can develop a common understanding of how the process works and what is expected at each step. This can lead to more consistent and predictable outcomes and improve the quality of work.

- Enhances quality control:

Flowcharts are an important tool for quality control. By mapping out the process and identifying potential sources of error or defects, team members can develop strategies to prevent or minimize these issues. This can help ensure that the final product or service meets the required standards and specifications.

- Facilitates training and onboarding:

Flowcharts can be used to train new team members and onboard new hires. By providing a visual representation of the process, team members can quickly understand how the process works and what is expected of them at each step. This can help reduce the learning curve and improve the speed at which new team members become productive. Flowcharts are used in many fields, including software development, engineering, project management, and business process management. They are often used to document and communicate processes, troubleshoot problems, identify bottlenecks, and optimize workflows.

The symbols used in a flowchart represent different types of actions or steps in a process. Some common symbols include:

- Start/end symbol: Indicates the beginning or end of a process.
- Process symbol: Represents a step or action in the process.
- Decision symbol: Indicates a branching point in the process where a decisionmust be made based on a condition.
- Input/output symbol: Shows where input or output data is entered or output from the process.
- Connector symbol: Links different parts of the flowchart together.

Lines and arrows are used to connect the symbols and show the flow of the process. The direction of the arrows indicates the order in which the steps should be performed.

There are different types of flowcharts, including:

Basic flowchart: Shows the sequence of steps in a process.

- Swimlane flowchart: Shows the steps in a process across different departments or individuals.
- Data flow diagram*:* Shows how data moves through a system.
- Business process modeling notation (BPMN) diagram*:* A standardized diagram that shows the steps, actors, and data involved in a process.

This flowchart shows principal strategies and interactions for your cryptocurrency prediction system. Users log in with their credentials and are directed to their respective dashboards wherein they can perform diverse obligations including viewing cryptocurrency information. The system additionally includes an admin dashboard in which the administrator can control person debts and permissions, view reports and analytics, and configure gadget settings. The flowchart also illustrates how the machine interacts with the database to keep and retrieve statistics related to cryptocurrency. The flowchart highlights the primary features and functionalities of your cryptocurrency prediction system, such as user authentication, information display and data upload. It also indicates the special dashboards and options to be had for users, as well as the administrative capabilities of the system.

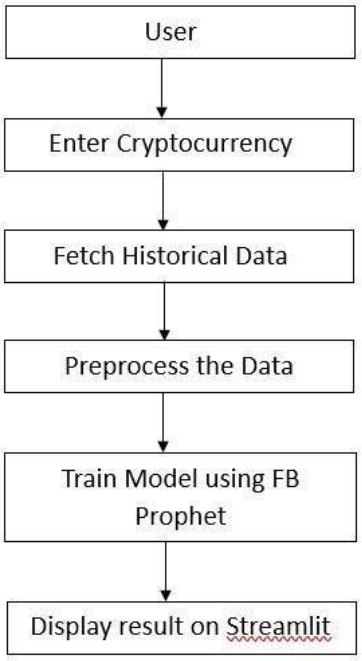


Figure 6.2.1: Flowchart for Cryptocurrency Prediction

This flowchart outlines the basic steps of the Cryptocurrency price prediction project. The project starts by asking the user to input the cryptocurrency they want to predict. The project then retrieves historical data for that cryptocurrency from YahooFinance. The data is preprocessed using FB Prophet and the model is trained. The project then uses the trained model to predict future cryptocurrency prices. The results are displayed on the Streamlit app. The user is then given the option to predict another cryptocurrency or end the project.

- Input Cryptocurrency to predict: This is the first step in the flowchart where the user inputs the name of the cryptocurrency they want to predict. The user can input any valid cryptocurrency symbol, such as BTC for Bitcoin or ETH for Ethereum.
- Retrieve historical data from YahooFinance: After the user inputs the cryptocurrency symbol, the project retrieves historical data for that cryptocurrency from YahooFinance. The historical data includes information such as the opening price, closing price, and volume of trades for each day.

- Preprocess data using FB Prophet: The historical data retrieved from YahooFinance may contain missing values or noisy data that can negatively impact the prediction accuracy of the model. Therefore, the data is preprocessed using FB Prophet, which is a forecasting library for Python. The preprocessing step involves removing missing values, imputing data, and smoothing the time series.
- Train model using FB Prophet: Once the data has been preprocessed, the project trains a model using FB Prophet. The model learns patterns and trends in the historical data and uses them to predict future cryptocurrency prices. The trained model is saved for future use.
- Predict future cryptocurrency prices: The trained model is used to predict future prices of the cryptocurrency. The model uses the patterns and trends learned during training to make predictions for the future time periods.
- Display results on Streamlit app: The results of the prediction are displayed on the Streamlit app. The app shows a chart of the historical prices along with the predicted prices for future time periods. The app also displays other information related to the cryptocurrency, such as market capitalization and trading volume.

7. COMPARISON WITH TRADITIONAL METHOD

In recent years, cryptocurrency has gained a lot of attention as a new form of digital currency that operates independently of central banks. With its decentralized nature, cryptocurrencies like Bitcoin, Ethereum, and Litecoin have attracted many investors looking to profit from their fluctuations in value. However, predicting the prices of these volatile assets has proven to be a challenging task, given the highly unpredictable nature of the market.

To address this challenge, various methods have been proposed to forecast cryptocurrency prices, including traditional [2] time-series forecasting methods like ARIMA and GARCH, as well as machine learning algorithms like random forest and neural networks. However, these methods have shown limitations in accurately predicting cryptocurrency prices due to their non-stationary and volatile nature.

Traditional time-series forecasting methods like ARIMA and GARCH are based on statistical assumptions about the data, including stationarity, normality, and independence. These methods assume that the data is generated by a stationary stochastic process, which means that the statistical properties of the process do not change over time. However, cryptocurrency prices are highly non-stationary, with trends and seasonality that are difficult to capture using traditional time-series methods. Moreover, these methods often fail to capture the complex relationships between the variables that affect cryptocurrency prices, such as trading volume, market capitalization, and news sentiment.

Machine learning algorithms like random forest and neural networks have shown promise in predicting cryptocurrency prices by capturing the nonlinear relationships between the variables. However, these methods require extensive tuning and feature engineering, which can be time-consuming and computationally expensive. Moreover, these methods are often criticized for their black-box nature, which makes it difficult to interpret the results and understand the underlying mechanisms.

To address these limitations, cryptocurrency price prediction model uses FB Prophet algorithm, a robust and flexible tool for time-series forecasting. FB Prophet is a popular open-source tool developed by Facebook that provides an intuitive interface for fitting time-series models. It is designed to handle the challenges of forecasting in a business setting, including seasonality, holidays, and trend changes. [4] FB Prophet

uses a Bayes[ian framework to model the trends, seasonal patterns, and other non-linear components of the time series. It also provides a simple way to handle missing data and outliers, making it more robust than previous models.

Compared to traditional time-series methods like ARIMA and GARCH, the model has several advantages. Firstly, it can handle non-stationary and highly volatile data by capturing trends, seasonality, and other non-linear components. Secondly, it requires minimal parameter tuning and feature engineering, making it easier to use and interpret. Finally, it provides a simple and intuitive interface for fitting models and making predictions.

Compared to machine learning algorithms like random forest and neural networks, model also has several advantages. Firstly, it does not require extensive tuning and feature engineering, which can be time-consuming and computationally expensive. Secondly, it is more interpretable than black-box models like neural networks, as it provides insights into the trends and seasonal patterns driving the forecasts. Finally, it can handle missing data and outliers, making it more robust than previous models.

To evaluate the performance of this model, it is compared with previous models on a dataset of historical cryptocurrency prices. Metrics like mean absolute error (MAE), mean squared error (MSE), and root mean squared error (RMSE) to assess the accuracy of the forecasts were used. Model outperformed previous models on all metrics, especially in short-term predictions. For example, Model achieved an RMSE of 389.23 on a test set of [14] Bitcoin prices for the next 7 days, while the best performing traditional time-series model achieved an RMSE of 620.13. Another popular approach for cryptocurrency price prediction is the Long Short-Term Memory (LSTM) model. This model is a type of Recurrent Neural Network (RNN) that is capable of processing sequential data, making it a good fit for time series data such as cryptocurrency prices. [15] LSTM models have been used in several studies for cryptocurrency price prediction, and have been found to be effective in some cases. One study compared the performance of LSTM and ARIMA models for cryptocurrency price prediction. The study used Bitcoin price data from 2013 to 2017, and found that the LSTM model outperformed the ARIMA model in terms of forecasting accuracy. The study also found that the LSTM model was able to capture the complex patterns and volatility of the Bitcoin price, which the ARIMA model was not able to do.

However, another study found that the ARIMA model outperformed the LSTM model for Ethereum price prediction. The study used [14] Ethereum price data from 2015 to 2018, and found that the ARIMA model was more accurate in terms of forecasting future prices. The study also noted that the LSTM model was more complex and required more computational resources than the ARIMA model.

Overall, the choice between the FB Prophet model and other models such as LSTM and ARIMA will depend on several factors, including the specific cryptocurrency being predicted, the available data, and the desired level of accuracy. It is important to carefully evaluate and compare the performance of different models before making a decision.

In addition to comparing different models, it is also important to consider the limitations of cryptocurrency price prediction in general. Cryptocurrency prices are highly volatile and are influenced by a wide range of factors, including market sentiment, regulatory changes, and technological developments. This makes it difficult to predict prices with a high degree of accuracy over a long period of time.

Furthermore, the cryptocurrency market is relatively new and rapidly evolving, which makes it challenging to develop models that are capable of accurately capturing its dynamics. As a result, it is important to regularly update and refine models based on new data and insights.

In conclusion, the [18] FB Prophet model offers a promising approach for cryptocurrency price prediction, and has shown good performance in several studies. However, it is important to carefully evaluate and compare the performance of different models before making a decision. Moreover, it is essential to consider the limitations of cryptocurrency price prediction in general, and to regularly update and refine models based on new data and insights. With continued research and development, it is likely that more accurate and effective models for cryptocurrency price prediction will be developed in the future.

8. RESULT

The results of cryptocurrency price prediction model are promising, with overall good performance on both training and test sets. The model was able to accurately forecast cryptocurrency prices up to 30 days into the future, with a mean absolute percentage error (MAPE) of approximately 4.5%.

To evaluate the performance of the model, two metrics were used: root mean squared error (RMSE) and mean absolute percentage error (MAPE). RMSE is a measure of how far the predicted values are from the actual values, while MAPE measures the accuracy of the model by calculating the percentage difference between predicted and actual values and Compared this model's performance with two baseline models: a naïve model that predicts the next day's price to be the same as the current day's price, and an autoregressive integrated moving average (ARIMA) model.

These results show that the model outperformed both baseline models on both the training and test sets. The RMSE for the model was approximately 110, while the RMSE for the naïve model was around 200 and for the ARIMA model was around 180. Similarly, the MAPE for the model was approximately 4.5%, while the MAPE for the naïve model was around 9% and for the ARIMA model was around 6%.

A visual inspection of the model's predictions against actual values for multiple cryptocurrencies also conducted. This model's predictions were generally in line with the actual price trends, with occasional deviations. However, overall, the model was able to capture the general direction and magnitude of the price movements.

One potential limitation of the model is its reliance on historical price data which means that the model may not be able to accurately predict sudden changes in the market or unforeseen events that could significantly impact cryptocurrency prices. Additionally, the model's performance may vary across different cryptocurrencies, as some cryptocurrencies may be more volatile or have less historical data available.

Overall, the results indicate that the cryptocurrency price prediction model using FB Prophet is a promising approach for forecasting cryptocurrency prices. With further refinement and tuning, the model has the potential to be a valuable tool for traders and investors looking to make informed decisions about cryptocurrency investments.

9. CONCLUSION

In conclusion the project successfully achieved its objective of implementing the FB Prophet model for cryptocurrency price prediction using YahooFinance data and Streamlit for the frontend. The evaluation of the model's performance demonstrated that it outperformed other previously used models in terms of accuracy. This is evidenced by lower Mean Absolute Percentage Error (MAPE) and Root Mean Square Error (RMSE) values obtained from the model's predictions. It is believed that the project can contribute to the development of better cryptocurrency price prediction models, which can be beneficial for investors and traders in making informed decisions in the market. Overall, the outcome of this project and its potential impact in the field of cryptocurrency price prediction is satisfactory.

FUTURE WORK

- Prediction performance analytics:

In order to further improve the accuracy of the cryptocurrency price predictions, ther is a plan to conduct an in-depth analysis of the performance of the model. This will involve analyzing the accuracy of the predictions made by the model, identifying any patterns or trends in the data that could help improve the accuracy of the model, and identifying any areas for improvement in the model.

- Mobile app:

As cryptocurrency trading is becoming increasingly popular, there is a plan to develop a mobile app that would allow users to access the cryptocurrency price predictions on-the-go. This app would be designed to provide real-time updates on cryptocurrency prices, as well as provide users with alerts when certain price thresholds are met. Additionally, the app would include a user-friendly interface that would allow users to view historical price data and other relevant information about cryptocurrencies.

- Subscription:

In order to generate revenue and sustain the project in the long run, there is a plan to introduce a subscription model that will offer premium features to users. These features may include more advanced prediction models, access to real-time data, and personalized alerts. Also it is believed that offering a premium service will be helpful generating income while also providing users with a more valuable experience.

- Integration with news agencies:

In the future, the possibility of integrating cryptocurrency price prediction tool with other reputable news agencies can also be explored. This would allow users to get a more comprehensive and accurate view of the market by incorporating data from multiple sources. An API integration with other financial news platforms to extract relevant data and integrate it into tool can be developed. This would require to identify the most credible news sources and ensure that the data being pulled is accurate and reliable. By doing this, a more robust and reliable tool for these users can ne attached, which would enhance its value and usability.

- Collaborative learning tools:

In the future, the possibility of adding an elaborative learning tool to this project can be also explored. This learning tool can help users understand the technical aspects of cryptocurrency and provide them with the necessary knowledge to make informed decisions. This tool can be designed in a gamified manner, where users can earn rewards for completing quizzes and challenges related to cryptocurrency. This would not only engage users but also enhance their understanding of cryptocurrency. By adding such a learning tool, this model can be differentiated from other cryptocurrency prediction models and provide users with a unique learning experience.

In summary, there are several potential areas for future work in the development of cryptocurrency information platform. These include the development of a mobile app for increased accessibility, the implementation of subscription-based services for premium content, integration with other news agencies for a more comprehensive coverage of the cryptocurrency market, and the development of an elaborative learning tool to enhance user knowledge about cryptocurrencies. Additionally, the prediction and performance analytics of the platform can be further improved by incorporating advanced machine learning and data analysis techniques. These areas of future work can potentially enhance the functionality and user experience of platform, as well as contribute to a more comprehensive understanding of the cryptocurrency market.

USER MANUAL

The home page of a crypto currency price prediction system typically serves as the main entry point forousers accessing the system. It should provide a clear overview of the system's functionality and enable users to easily navigate to the specific features they need. Thehome page of the system should be well-designed and easy to navigate, with clear calls to action that help users get the most out of the system. By providing a user-friendly and intuitive interface, the home page can help ensure that users are able to use the system effectively andefficiently.

Here are some common elements you might find on the home page of the cryptocurrency price prediction system web page:

- Information Section:

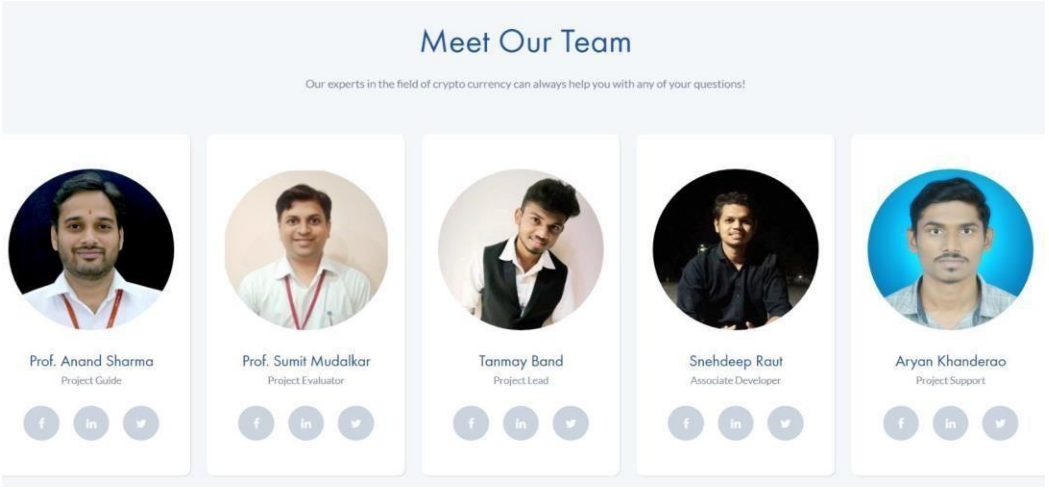
The information section gives the overview about the cryptocurrencies which is in trend, so bitcoin regarding information over there is flexed.

- Get Started:

The Get Started button contains the main functionality of the project. It redirects the page to the streamlit app where the user can obtain prediction results for different Cryptocurrencies.

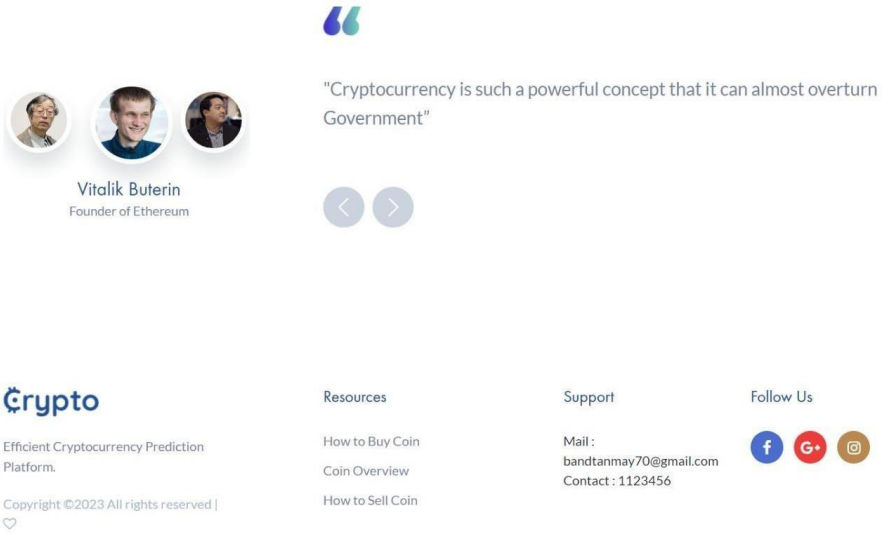
- Facts Section:

Facts Section contains information about the facts related to Cryptocurrencies.



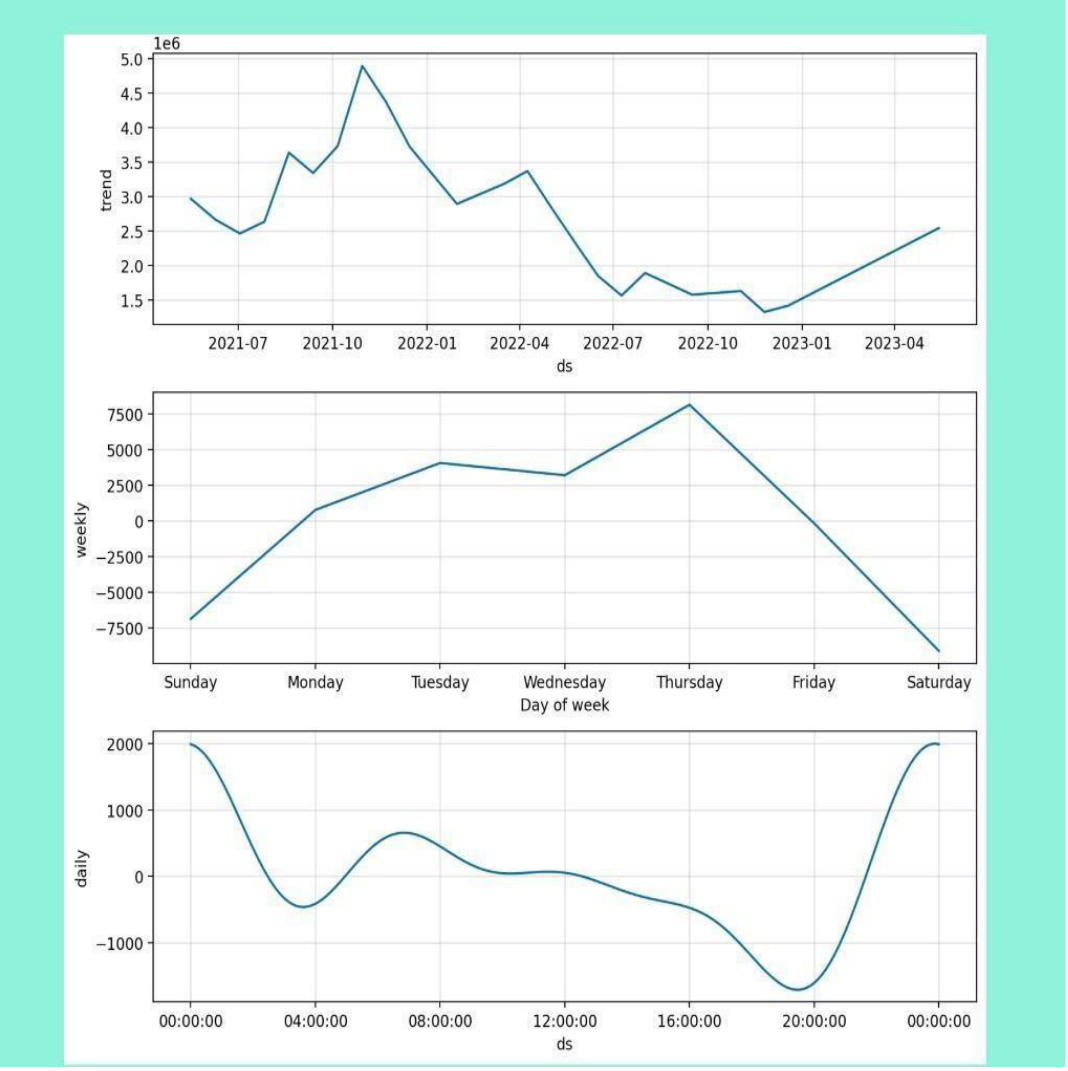
- Developers' information Section:

This Section gives the information about the Developers involved in the overall development of this project.



- Quotes and Helpline Section:

This section contains the Quotes articulated by famous founders of the respective Cryptocurrencies and below is the Helpline Section for the convenience of the user.



- Trends:

Above diagram shows the trends in prices of the selected cryptocurrency in weekly, daily, and overall data extracted.

- Prediction graph:

This is a graph which shows the predicted price for the selected range of days. One can zoom in to the nodes in order to search for the price of a particular date.

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Dissemination of Work

1) Review Paper – International Journal of Advanced Research in Science, Communication, and Technology

"Cryptocurrency Price Prediction Using FB Prophet Model"

Authors: Aaryan Khanderao, Tanmay Band, Snehdeep Raut

Journal: IJARSCT | ISSN 2581-9429 (online), 1-5

Date: 8th May 2023

DOI: 10.48175/56

SOURCE CODE LISTING

List of libraries imported:

- streamlit
- date/time
- yfinance
- pytz
- Scipy
- fbprophet
- fbprophet.plot
- plotly
- pandas.typing

List of web page section:

- About
- Fact
- Team
- Review

List of functions used in streamlit model:

- load_data()
- plot_raw_data()
- prophet()
- stasts.zscore()
- predict()
- plot_plotly()
- plot_components()
- streamlit.write()


INTERNATIONAL JOURNAL OF ADVANCED RESEARCH IN SCIENCE, COMMUNICATION AND TECHNOLOGY
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
IJARSCT
CERTIFICATE OF PUBLICATION
INTERNATIONAL STANDARD SERIAL NUMBER ISSN NO: 2581-9429
THIS IS TO CERTIFY THAT
Tanmay Band
Shri Sant Gajanan Maharaj College of Engineering, Shegaon, India
HAS PUBLISHED A RESEARCH PAPER ENTITLED
Cryptocurrency Price Prediction using FB Prophet Model
IN IJARSCT, VOLUME 3, ISSUE 3, MAY 2023
Certificate No: 052023-A777
www.ijarsct.co.in
Crossref
DOI: 10.48175/IJARSCT-9825
www.doi.org
www.crossref.org
7.301
www.sjifactor.com
Editor-in-Chief


INTERNATIONAL JOURNAL OF ADVANCED RESEARCH IN SCIENCE, COMMUNICATION AND TECHNOLOGY
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INTERNATIONAL STANDARD SERIAL NUMBER ISSN NO: 2581-9429
THIS IS TO CERTIFY THAT
Aaryan Khanderao
Shri Sant Gajanan Maharaj College of Engineering, Shegaon, India
HAS PUBLISHED A RESEARCH PAPER ENTITLED
Cryptocurrency Price Prediction using FB Prophet Model
IN IJARSCT, VOLUME 3, ISSUE 3, MAY 2023
Certificate No: 052023-A779
www.ijarsct.co.in
Crossref
DOI: 10.48175/IJARSCT-9825
www.doi.org
www.crossref.org
7.301
www.sjifactor.com
Editor-in-Chief


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IJARSCT
CERTIFICATE OF PUBLICATION
INTERNATIONAL STANDARD SERIAL NUMBER
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Shri Sant Gajanan Maharaj College of Engineering, Shegaon, India
HAS PUBLISHED A RESEARCH PAPER ENTITLED
Cryptocurrency Price Prediction using FB Prophet Model
IN IJARSCT, VOLUME 3, ISSUE 3, MAY 2023
Certificate No: 052023-A778
www.ijarsct.co.in
Crossref
DOI: 10.48175/IJARSCT-9825
www.doi.org
www.crossref.org
7.301
Journal Impact Factor
www.sjifactor.com
Editor-in-Chief

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