PROJECT REPORT

Time Series Analysis For Bitcoin Price Prediction Using Prophet

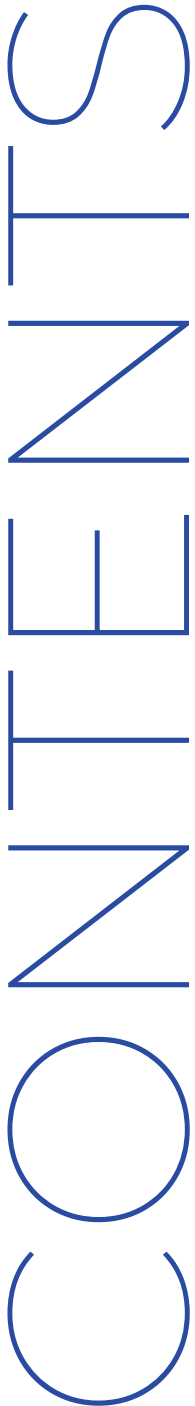**TEAM NUMBER - 500**

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INTRODUCTON

Overview :

In this project, we aim to utilize time series analysis techniques to predict the price of Bitcoin using the Prophet forecasting model. Time series analysis is a powerful approach that considers the sequential nature of data points and captures underlying patterns and trends. Bitcoin, as a highly volatile and widely-traded cryptocurrency.

The main tool we will employ is Prophet, a popular open-source library. Prophet is specifically designed for time series forecasting and is known for its ease of use and ability to handle various types of trends and seasonal patterns. It combines both linear and non-linear modeling techniques.

Purpose :

1. **Forecasting Bitcoin Price:** The primary goal is to predict the future price of Bitcoin accurately.
2. **Trend Identification:** Time series analysis allows for the identification and understanding of underlying trends in Bitcoin price data.
3. **Seasonality and Cyclical Patterns:** Time series analysis can uncover recurring seasonal or cyclical patterns in Bitcoin price data.
4. **Risk Management:** Accurate price predictions obtained through time series analysis can assist in risk management strategies. By understanding the potential price movements and volatility of Bitcoin.
5. **Performance Evaluation:** The project allows for the evaluation of the Prophet forecasting model's performance in predicting Bitcoin prices.
6. **Insight into Cryptocurrency Market:** Analyzing Bitcoin price data using time series analysis techniques provides insights into the dynamics of the cryptocurrency market as a whole.

In summary, the use of time series analysis for Bitcoin price prediction using Prophet aims to provide accurate price forecasts, identify trends and patterns, facilitate risk management, evaluate forecasting model performance, and offer insights into the cryptocurrency market.

LITERATURE SURVEY

Existing Problem: The existing problem is the challenge of accurately predicting the price of Bitcoin using time series analysis. Bitcoin's price is highly volatile and influenced by various factors, making it difficult to capture and predict its future movements accurately.

Proposed Solution: The proposed solution for Time Series Analysis for Bitcoin Price Prediction using Prophet involves the following steps:

- **Data Collection**: Gather historical Bitcoin price data from reliable sources.
- **Data Preprocessing**: Clean and preprocess the collected data to handle missing values, outliers, and inconsistencies. This step ensures the data is suitable for analysis.
- **Time Series Visualization**: Visualize the Bitcoin price data to gain insights into its trends, seasonality, and other patterns. This visualization helps understand the data better.
- **Model Training with Prophe**t: Utilize the Prophet forecasting model, an open-source library specifically designed for time series forecasting. Train the model using the historical Bitcoin price data.
- **Model Evaluation**: Evaluate the trained Prophet model's performance using appropriate metrics.
- **Future Price Prediction**: Utilize the trained Prophet model to forecast the future price of Bitcoin by providing a future time range. The model incorporates historical patterns, trends, and seasonality to generate predictions for the specified time period.
- **Visualization and Interpretation**: Visualize the predicted Bitcoin price and compare it with the actual price to assess the model's effectiveness.
- **Continuous Monitoring and Updating**: Regularly update the model by incorporating new data as it becomes available. This ensures the model stays up to date and maintains its accuracy in predicting Bitcoin prices.

By following these steps, the proposed solution aims to leverage time series analysis techniques and the Prophet model to predict Bitcoin prices accurately.

BLOCK DIAGRAM

HARDWARE/SOFTWARE DESIGN
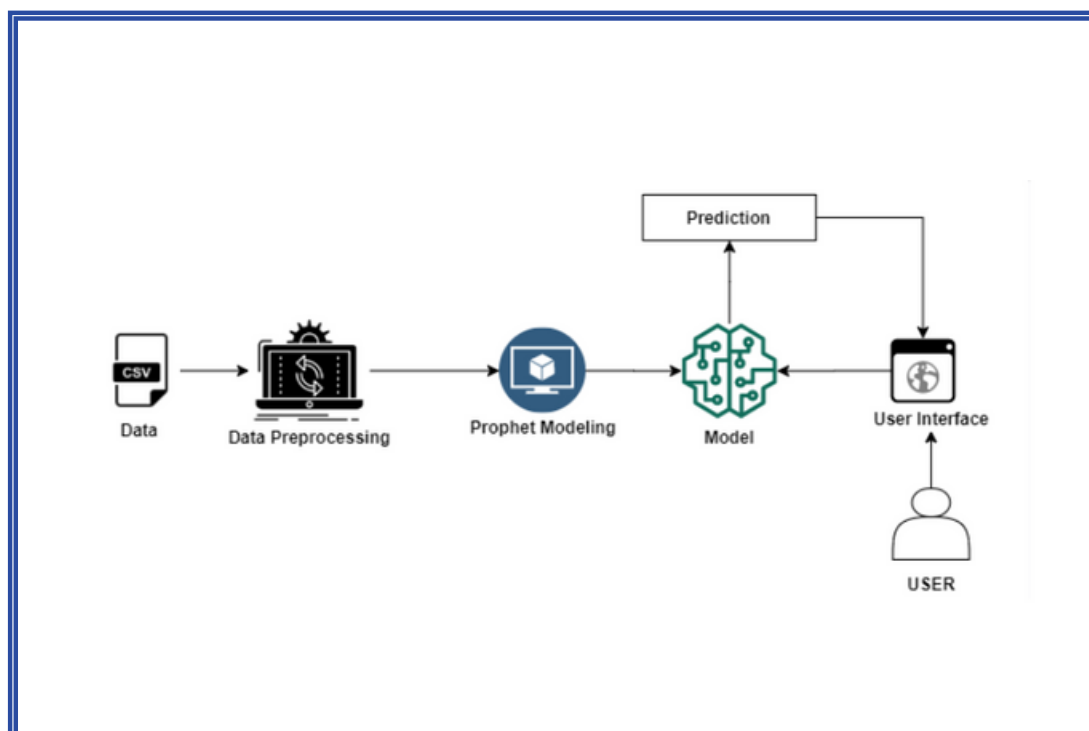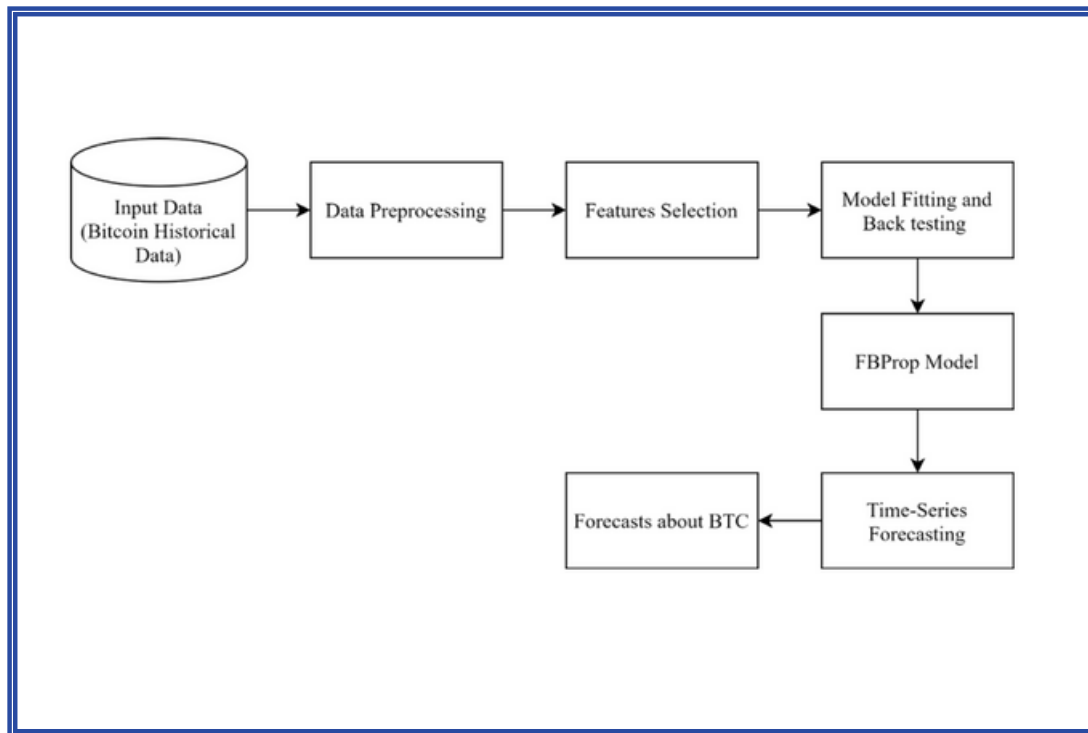
Hardware:
1. Computer: A reliable computer or server with sufficient processing power and memory to handle the data analysis tasks efficiently.

Software:
1. Programming Language: Choose a programming language suitable for time series analysis and data manipulation, such as Python.
2. Data Collection and Cleaning: Use software libraries or tools to collect historical Bitcoin price data from reliable sources, such as cryptocurrency exchanges or APIs.
3. Data Visualization: Utilize software libraries like Matplotlib or Plotly to visualize the historical Bitcoin price data and identify patterns or trends.
4. Time Series Analysis Libraries: Use specialized libraries like pandas, NumPy, or statsmodels in Python, or forecast for time series analysis tasks.
5. Integrated Development Environment (IDE): Choose an IDE like Jupyter Notebook, PyCharm, or RStudio to write, test, and execute code efficiently.

EXPERIMENTAL INVESTIGATIONS

01 Installation of Prerequisites

- To begin with, we need to install the necessary prerequisites for working with Prophet. These prerequisites typically include Python, Jupyter Notebook (optional but recommended), and the Prophet library.

02 Data Collection:

- The next step is to collect the data for Bitcoin price prediction.

03 Data Pre-processing:

- Handling missing values: Check for any missing values in the data and decide on an appropriate strategy to handle them, such as interpolation or filling with the mean or median.
- Data formatting: Ensure that the timestamp is in a consistent format and convert it into the appropriate data type. Prophet typically expects time series data to be in the format of a DataFrame with two columns: 'ds' (timestamp) and 'y' (observed value).
- Outlier detection: Identify and handle any outliers in the data. Outliers can significantly impact the performance of the model and the accuracy of predictions.

04 Model Building:

- Fit the model: Use the pre-processed data to fit the model. This involves calling the **fit** method of the Prophet model instance and passing in the DataFrame containing the 'ds' and 'y' columns.
- Generate forecasts: After fitting the model, you can use it to generate forecasts for future time periods. The predict method of the Prophet model allows you to specify the number of periods to forecast and returns a DataFrame with the forecasted values.
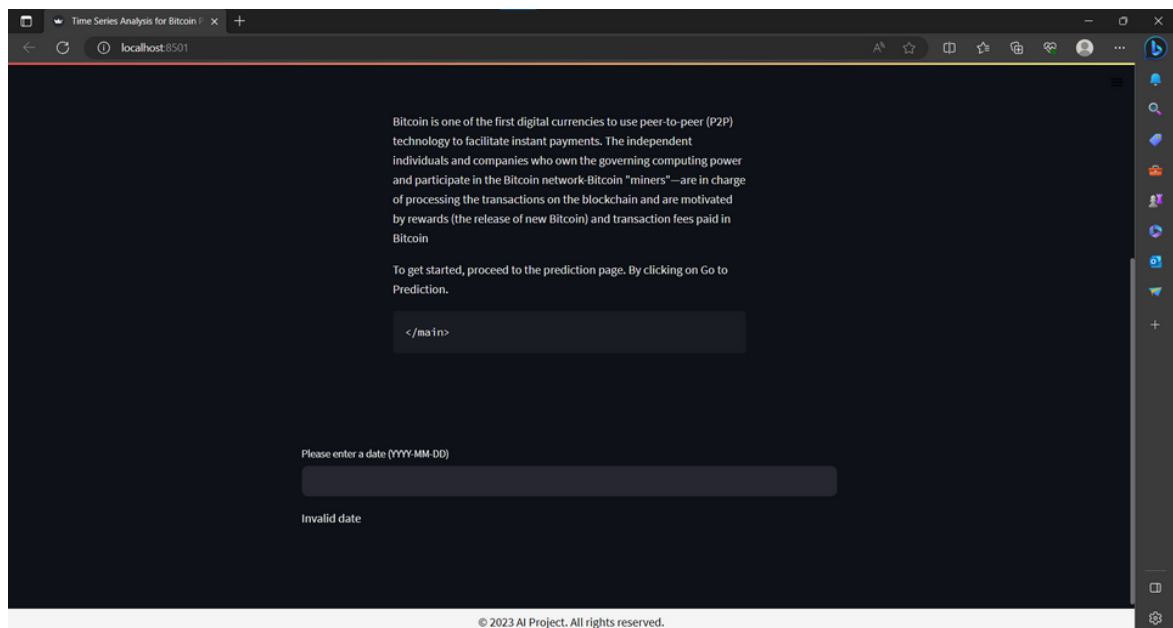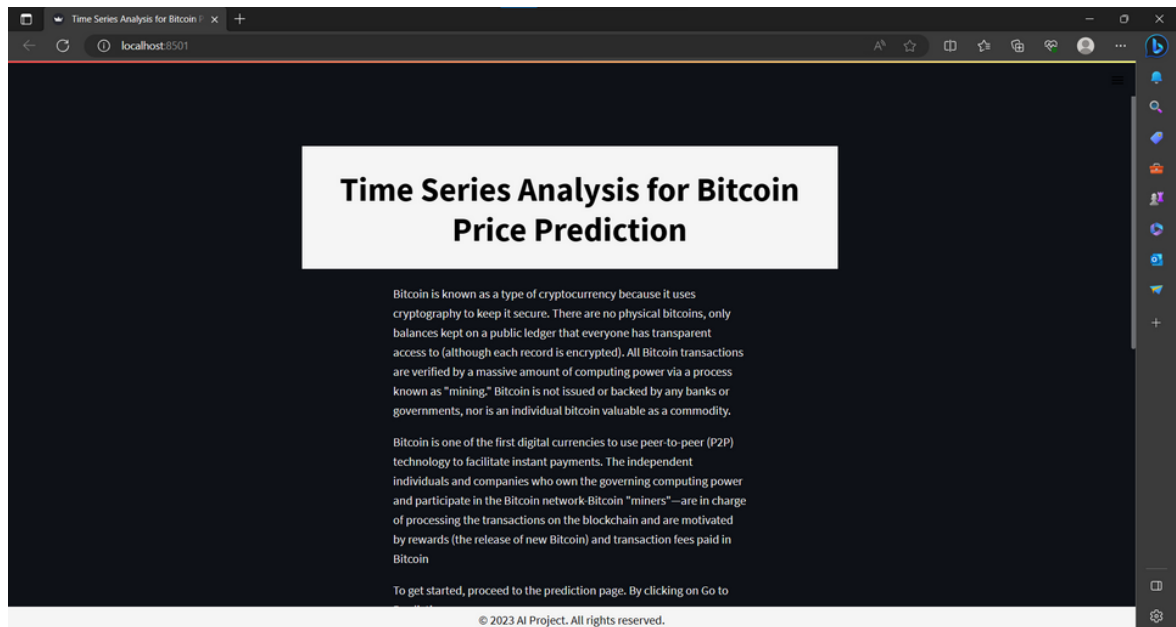
05 Application Building:

- Once training the Prophet model is done and obtained forecasts,we build an application or a visualization to showcase the predictions. This could be a web application, a dashboard, or a simple graphical representation. The application can take user inputs and display the predicted Bitcoin prices.
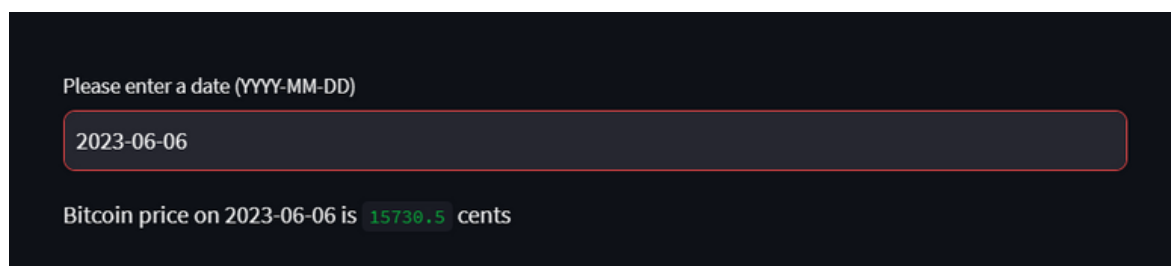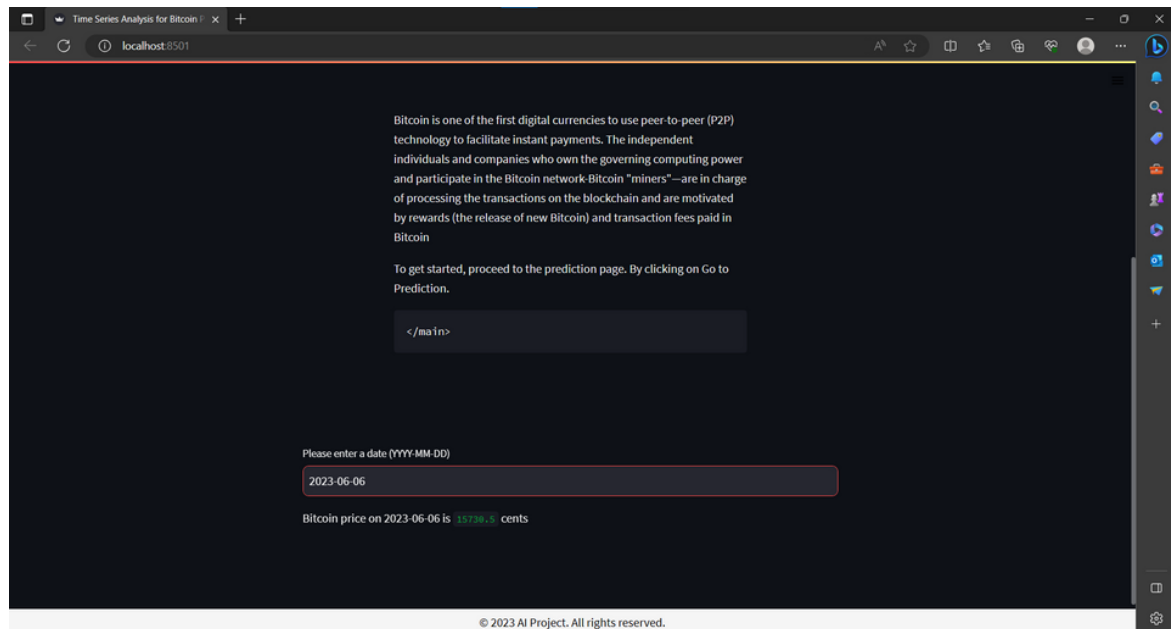
FLOW CHART

FLOW CHART OF
TIME SERIES ANALYSIS FOR BITCOIN PRICE PREDICTION USING PROPHET

BITCOIN
HISTORICAL DATA

DATA
PRE-PROCESSING

MODEL FITTING

TIME SERIES
FORECASTING

FORECAST
ABOUT BTC

RESULT

RESULT

ADVANTAGES & DISADVANTAGES

Advantages

1. Easy Implementation
2. Automatic Seasonality Detection
3. Flexibility in Trend Modeling
4. Handling of Outliers
5. Incorporation of External Factors
6. Interpretable Results

Disadvantages

1. Limited to Time Series Analysis
2. Lack of Customization
3. Sensitivity to Hyperparameters
4. Computational Resource Requirements
5. Dependency on Data Quality
6. Limited Future Forecasting

APPLICATIONS

1. **Financial Markets:** The solution can be used by traders, investors, and financial institutions to make informed decisions related to Bitcoin investments. By accurately predicting the Bitcoin price, it can aid in identifying favorable buying or selling opportunities and managing investment portfolios.
2. **Cryptocurrency Exchanges:** Cryptocurrency exchanges can leverage the solution to provide price prediction tools to their users. This can enhance the trading experience by offering insights into future price trends and assisting traders in making more informed trading decisions.
3. **Risk Management:** Financial institutions, including banks and hedge funds, can utilize the solution to assess the risk associated with Bitcoin-related products and investments. Accurate predictions can help in managing risk exposure and developing risk mitigation strategies.
4. **Market Research and Analysis:** Market research firms and analysts can employ the solution to gain insights into the Bitcoin market and forecast future trends. This information can be used to inform market reports, investment recommendations, and industry insights.
5. **Algorithmic Trading:** Automated trading systems and algorithmic trading strategies can incorporate the solution to make data-driven trading decisions. By integrating the price predictions into trading algorithms, it may improve the performance and profitability of trading strategies.

CONCLUSION

In conclusion, the work on time series analysis for Bitcoin price prediction using Prophet has provided valuable insights and findings. The solution utilizing the Prophet library simplifies the process of forecasting Bitcoin prices by incorporating various components such as trend, seasonality, and outlier handling.

Throughout the analysis, several advantages of the proposed solution have been identified. Prophet offers easy implementation, automatic seasonality detection, flexibility in trend modeling, handling of outliers, and the ability to incorporate external factors. The interpretability of the results further aids in decision-making.

However, it is important to acknowledge the limitations of the solution. Prophet is primarily designed for time series analysis and may not be suitable for complex machine learning tasks. Customization options may be limited, and sensitivity to hyperparameters requires careful tuning. Additionally, the solution is dependent on the quality of the input data and may not capture unforeseen events or external factors that can impact Bitcoin prices.

Despite these limitations, the application of the solution holds great potential in various domains. Financial markets, cryptocurrency exchanges, risk management, market research, algorithmic trading, portfolio optimization, and academic research are among the areas where the solution can be beneficial.

Ultimately, the success of the solution relies on thorough evaluation, validation, and continuous refinement. It is essential to consider the specific requirements, constraints, and market conditions when applying the solution for Bitcoin price prediction. With careful implementation and monitoring, the solution can contribute to better decision-making, improved trading strategies, and enhanced understanding of the Bitcoin market dynamics.

FUTURE SCOPE

1. **Feature Engineering:** Explore additional features that may have an impact on Bitcoin price movements. This could include incorporating sentiment analysis of news articles or social media data, macroeconomic indicators, or blockchain-specific metrics. The inclusion of relevant external regressors can improve the accuracy of predictions.

2. **Advanced Modeling Techniques:** While Prophet provides a robust framework for time series analysis, consider exploring more advanced modeling techniques. This could involve using deep learning models like recurrent neural networks (RNNs) or long short-term memory (LSTM) networks, which can capture complex dependencies and nonlinear patterns in the data.

3. **Real-time Prediction:** Develop methods to enable real-time prediction of Bitcoin prices. This would involve updating the model and generating forecasts as new data becomes available, allowing for timely decision-making and trading strategies.

4. **Uncertainty Estimation:** Incorporate uncertainty estimation techniques to provide confidence intervals or probabilistic forecasts alongside point predictions. This can provide a better understanding of the potential range of Bitcoin price outcomes.

5. **Market Integration:** Explore integration with market data platforms and APIs to gather real-time data on Bitcoin prices, trading volumes, and other relevant variables. This would enable the model to adapt quickly to changing market conditions and provide more accurate predictions.

APPENDIX

Source Code

Python code:

```python
#Installation of Prophet
!pip install prophet

#Data Pre-processing
#Import Libraries

import pandas as pd
import yfinance as yf
from datetime import datetime
from datetime import timedelta
import plotly.graph_objects as go
from prophet import Prophet
from prophet.plot import plot_plotly,
plot_components_plotly
import warnings
warnings.filterwarnings("ignore")
pd.options.display.float_format = "${:,.2f}".format

#Import Dataset

today = datetime.today().strftime('%Y-%m-%d')
start_date = '2016-01-01'
df = yf.download('BTC-USD', start_date, today)
df
df.columns
```

APPENDIX

Source Code

```python
#Analyse The Data

df.head()
df.tail()
df.describe()
df.info()

#Handling Missing Values, Reset The Index & Renaming
The Column

df.isnull().any()
df.isnull().sum()
df.reset_index(inplace = True)
df.columns
df1=df[["Date","Open"]]
df1.head()
df1.columns = ['ds','y']
df1.head()

#Visualize Time Series Plot

x = df1["ds"]
y = df1["y"]
fig=go.Figure()
fig.add_trace(go.Scatter(x=x, y=y))
```

APPENDIX

Source Code

```python
# Set title

fig.update_layout(
 title_text="Time.series.plot.of.Bitcoin.Open.Price",
)
fig.update_layout(
 xaxis=dict(
 rangeselector=dict(
 buttons=list(
 [
 dict (count=1, label="im", step="month",
stepmode="backward"),
 dict(count=6, label="6", step="month",
stepmode="backward"),
 dict(count=1, label="YTD", step="year", stepmode="todate"),
 dict(count=1, label="ly", step="year",
stepmode="backward"),
 dict(step="all"),
 ]
 )
 ),
 rangeslider=dict(visible=True),
 type="date",
 )
)
```

APPENDIX

Source Code

```
#Model Building
#Fitting The Prophet Library

m=Prophet( seasonality_mode="multiplicative")
m.fit(df1)

#Making Future Predictions

future = m.make_future_dataframe (periods = 365)
future.tail()

#Evaluate The Model

forecast = m.predict(future)
forecast
next_day = (datetime.today () + timedelta
(days=1)).strftime('%Y-%m-%d')
forecast[forecast['ds'] ==next_day]['yhat'].item()
plot_plotly(m,forecast)

#Save the model

import pickle
pickle.dump (m, open('fbcrypto.pkl', 'wb'))
```

APPENDIX

Source Code

```
import streamlit as st
import yfinance as yf
from prophet import Prophet

df = yf.download('BTC-USD')
df.reset_index(inplace=True)
df = df[['Date','Adj Close']]
df.columns = ['ds','y']

model = Prophet()
model.fit(df)

future_dates =
model.make_future_dataframe(periods=100,freq='D')
prediction = model.predict(future_dates)

selected_date_str = st.text_input("Please enter a date (YYYY-
MM-DD)")
if selected_date_str in prediction['ds'].astype(str).values:
    price_prediction = prediction.loc[prediction['ds'].astype(str)
== selected_date_str, 'yhat'].values[0]
    st.write("Bitcoin price on", selected_date_str, "is",
round(price_prediction, 2), "cents")
else:
    st.write("Invalid date")
```