CRYPTOCURRENCY PRICE ANALYSIS USING ARTIFICIAL INTELLIGENCE

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ABSTRACT
Cryptocurrency is playing an increasingly important role in reshaping the financial system due to its growing popular appeal and merchant acceptance. While many people are making investments in Cryptocurrency, the dynamical features, uncertainty, the predictability of Cryptocurrency are still mostly unknown, which dramatically risk the investments. It is a matter to try to understand the factors that influence the value formation. In this study, we use advanced artificial intelligence frameworks of fully connected Artificial Neural Network (ANN) and Long Short-Term Memory (LSTM) Recurrent Neural Network to analyze the price dynamics of Bitcoin, Ethereum, and Ripple. We find that ANN tends to rely more on long-term history while LSTM tends to rely more on short-term dynamics, which indicate the efficiency of LSTM to utilize useful information hidden in historical memory is stronger than ANN. However, given enough historical information ANN can achieve a similar accuracy, compared with LSTM. This study provides a unique demonstration that Cryptocurrency market price is predictable. However, the explanation of the predictability could vary depending on the nature of the involved machine-learning model

INTRODUCTION
The "Cryptocurrency Price Analysis using A.I." project aims to provide users with a comprehensive analysis of cryptocurrency prices using artificial intelligence techniques. The project utilizes the Django framework for backend development and combines HTML, CSS, Bootstrap 5, JavaScript, and Python to create an interactive and user-friendly web application.

Cryptocurrency is the peer-to-peer digital monitory and payment system that exist online via a controlled algorithm. When a miner cracks an algorithm to record a block of transactions to public ledger named blockchain and the cryptocurrency is created when the block is added to the blockchain. It allows people to store and transfer through encryption protocol and distributed network. Mining is a necessary and competitive component of the cryptocurrency system. The miner with more computational power has a better chance of finding a new coin than that of less. Bitcoin is the first and one of the leading digital currencies (its market capitalisation had more than $ 7 billion in 2014, and then it increased significantly to $ 29 billion in 2017) which was first introduced by Satoshi Nakamoto in 2008.

Among many features of bitcoin, the most impressive one is decentralisation that it can remove the involvement of traditional financial sectors and monetary authorities effectively due to its blockchain network features. In addition, the electronic payment system of Bitcoin is based on cryptographic proof rather than the trust between each other as its transaction history cannot be changed unless redoing all proof of work of all blockchain, which play a critical role of being a trust intermediary and this can be widely used in reality such as recording charitable contribution to avoid corruption. Moreover, bitcoin has introduced the controllable anonymity scheme, and this enhances users' safety and anonymity by using this technology, for instance, we can take advantage of this property of blockchain to make identification cards, and it not only can protect our privacy but verify our identity. Nowadays, investing in cryptocurrencies, like Bitcoin, is one of the efficient ways of earning money. For example, the rate of Bitcoin significant rises in 2017, from a relatively low point 963 USD on January 1ST 2017, to its peak 19186 USD on December 17th 2017, and it closed with 9475 USD at the end of the year. Consequently, the rate of return of bitcoin investment for 2017 was over 880%, which is animpressive and surprising scenery for most investors. While an increasing

number of people are making investments in Cryptocurrency, most investors cannot get such profit for being inconsiderable to cryptocurrencies' dynamics and the critical factors that influence the trends of bitcoins.

OBJECTIVE

The main objective of this project is to leverage the power of LSTM (Long Short-Term Memory) machine learning algorithm to analyse and predict cryptocurrency prices. Additionally, the project offers a virtual trading functionality where users can simulate trading and manage a virtual portfolio. The system provides visualizations and analysis to assist users in making informed trading decisions.

Therefore, raising people's awareness of vital factors can help us to be wise investors. Although market prediction is demanding for its complex nature the dynamics are predictable and understandable to some degree. For example, when there is a shortage of the bitcoin, its price will be increased by their sellers as investors who regard bitcoin as a profitable investment opportunity will have a strong desire to pay for bitcoin. Furthermore, the price of bitcoin may be easily influenced by some influential external factors such as political factors. Although existing efforts on Cryptocurrency analysis and prediction is limited, a few studies have been aiming to understand the Cryptocurrency time series and build statistical models to reproduce and predict price dynamics.

For example, Madan et al. collected bitcoins price with the time interval of 0.5, 1and 2 hours, and combined it with the blockchain network, the underlying technology of bitcoin. Their predictive model leveraging random forests and binomial logistic regression classifiers, and the precision of the model is around 55% in predicting bitcoin's price. Shah et al. used Bayesian regression and took advantages of high frequency (10-second) prices data of Bitcoin to improve investment strategy of bitcoin. Their models had also achieved great success. In a Multi-Layer Perceptron (MLP) based prediction model was presented to forecast the next day price of bitcoin by using two sets of input: the first type of inputs: the opening, minimum, maximum and closing price and the second set of inputs: Moving Average of both short (5,10,20 days) and long (100, 200 days) windows. During validation, their model was proved to be accurate at 95% level. There have been many academic researches looking at exchange rate forecasting, for example, the monetary and portfolio balance models examined by Meese and Rogoff (1983, 1988).

The Significant efforts have been made to analyse and predict the trends of traditional financial markets especially the stock market however, predicting cryptocurrencies market prices is still at an early stage. Compared to these stock price prediction models, traditional time series methods are not very useful as cryptocurrencies are not precisely the same with stocks but can be deemed as a complementary good of existing currency system with sharp fluctuations features. Therefore, it is urgently needed to understand the dynamics of cryptocurrencies better and establish a suitable predictive modelling framework. In this study, we hypothesise that time series of cryptocurrencies exhibits a clear internal memory, which could be used to help the memory-based time series model to works more appropriately if the length of internal memory could be quantified.

We aim to use two artificial intelligence modelling frameworks to understand and predict the most popular cryptocurrencies price dynamics, including Bitcoin, Ethereum, and Ripple.

LITERATURE SURVEY

2.1. USING THE BITCOIN TRANSACTION GRAPH TO PREDICT THE PRICE OF BITCOIN

Bitcoin is the world's leading cryptocurrency, allowing users to make transactions securely and anonymously over the Internet. In recent years, The Bitcoin the ecosystem has gained the attention of consumers, businesses, investors and speculators alike. While there has been significant research done to analyse the network topology of the Bitcoin network, limited research has been performed to analyse the network's influence on overall Bitcoin price. In this paper, we investigate the predictive power of blockchain network-based features on the future price of Bitcoin. As a result of blockchain-network based feature engineering and machine learning optimization, we obtain up-down Bitcoin price movement classification accuracy of roughly 55%.

2.2. CRYPTOCURRENCY VALUE FORMATION: AN EMPIRICAL ANALYSIS LEADING TO A COST OF PRODUCTION MODEL FOR VALUING BITCOIN

This paper aims to identify the likely source(s) of value that cryptocurrencies exhibit in the marketplace using cross sectional empirical data examining 66 of the most used such 'coins'. A regression model was estimated that points to three main drivers of cryptocurrency value: the difficulty in 'mining 'for coins; the rate of unit production; and the cryptographic algorithm employed. These amount to relative differences in the cost of production of one coin over another at the margin, holding all else equal. Bitcoin-denominated relative prices were used, avoiding much of the price volatility associated with the dollar exchange rate. The resulting regression model can be used to better understand the drivers of relative value observed in the emergent area of cryptocurrencies. Using the above analysis, a cost of production model is proposed for valuing bitcoin, where the primary input is electricity. This theoretical model produces useful results for both an individual producer, by setting breakeven points to start and stop production, and for the bitcoin exchange rate on a macro level. Bitcoin production seems to resemble a competitive commodity market; in theory miners will produce until their marginal costs equal their marginal product.

ECONOMIC PREDICTION USING NEURAL NETWORKS: THE CASE OF IBM DAILY STOCK RETURNS

A report is presented of some results of an ongoing project using neural-network modelling and learning techniques to search for and decode nonlinear regularities in asset price movements. The author focuses on the case of IBM common stock daily returns. Having to deal with the salient features of economic data highlights the role to be played by statistical inference and requires modifications to standard learning techniques which may prove useful in other contexts.

DESIGNING A NEURAL NETWORK FOR FORECASTING FINANCIAL AND ECONOMIC TIME SERIES

Artificial neural networks are universal and highly flexible function approximators first used in the fields of cognitive science and engineering. In recent years, neural network applications in finance for such tasks as pattern recognition, classification, and time series forecasting have dramatically increased. However, the large number of parameters that must be selected to develop a neural network forecasting model have meant that the design process still involves much trial and error. The objective of this paper is to provide a practical introductory guide in the design of a neural network for forecasting economic time series data. An eight-step procedure to design a neural network forecasting model is explained including a discussion of trade-offs in parameter selection, some common pitfalls, and points of disagreement among practitioners.

EXISTING SYSTEM

The "Cryptocurrency Price Analysis using A.I." project is a new development aimed at providing users with an innovative platform for analysing cryptocurrency prices and simulating virtual trading. As such, there may not be an existing system directly comparable to this specific project. However, there are related systems and tools in the field of cryptocurrency analysis and trading that can provide inspiration and serve as references for certain functionalities. Here are a few examples:

1. TradingView: TradingView is a widely used web-based platform that offers a comprehensive set of tools and features for analyzing financial markets, including cryptocurrencies. It provides interactive charts, technical indicators, drawing tools, and social features for sharing and discussing trading ideas.

CoinGecko: CoinGecko is a cryptocurrency data platform that provides comprehensive market data, charts, and analytics for various cryptocurrencies. It offers historical price data, market capitalization rankings, and other metrics that can be useful for analyzing and comparing cryptocurrencies.

3. CoinMarketCap: CoinMarketCap is another popular platform for tracking cryptocurrency prices, market capitalization, and other related data. It provides real-time market data, historical charts, and information about various cryptocurrencies and exchanges.

4. TensorFlow: TensorFlow is a popular open-source machine learning framework that can be used for developing and training machine learning models, including LSTM models. It provides a wide range of tools and libraries for building and deploying machine learning algorithms.
These existing systems and tools can serve as references for certain functionalities, such as data visualization, market data retrieval, and machine learning model development. However, it's important to note that the "Cryptocurrency Price Analysis using A.I." project aims to provide a unique combination of features tailored specifically for cryptocurrency price analysis and virtual trading, making it distinct from existing systems in the market.

PROPOSED

The proposed solution for the "Cryptocurrency Price Analysis using A.I." project aims to provide users with an innovative and comprehensive platform for analyzing cryptocurrency prices and simulating virtual trading. The key features and components of the proposed solution are as follows:
1. User-Friendly Interface: Develop a user-friendly web-based interface that allows users to easily navigate and access various functionalities of the project. The interface should be intuitive, responsive, and visually appealing, providing a seamless user experience.

2. Data Visualization: Implement advanced data visualization techniques to present cryptocurrency price data in interactive and visually appealing charts, graphs, and indicators. The visualizations should allow users to analyze historical price trends, identify patterns, and make informed trading decisions.
3. LSTM Model Integration: Incorporate the LSTM (Long Short-Term Memory) machine learning algorithm to analyze historical cryptocurrency price data and generate accurate predictions. Train the LSTM model using historical price data and fine-tune its hyperparameters to optimize prediction accuracy.
4. Virtual Trading System: Develop a virtual trading system that allows users to simulate buying and selling cryptocurrencies based on real-time and historical price data. Users can create virtual portfolios, execute trades, track performance, and evaluate the effectiveness of their trading strategies.
5. Real-Time Data Updates: Integrate with external APIs or data sources to provide real-time updates of cryptocurrency prices, trading volumes, and other relevant information. Ensure that the project fetches and updates data at regular intervals to keep users informed about the latest market conditions.
6. User Authentication and Security: Implement a secure user authentication system to protect user accounts and ensure authorized access to the platform. Utilize encryption techniques and secure communication protocols to safeguard sensitive user information and transactions.
7. API Integration: Develop APIs to allow seamless integration with external systems, such as cryptocurrency exchanges or other financial data providers. These APIs can enable users to access market data, execute trades, or retrieve other relevant information programmatically.
8. Portfolio Management and Analysis: Provide tools and features for users to manage and analyze their virtual portfolios. Calculate portfolio performance metrics, track profit/loss, and generate reports to evaluate trading strategies and make informed investment decisions.
9. Scalability and Performance Optimization: Design the system to be scalable, allowing for future growth and increased user loads. Implement performance optimization techniques, such as caching, database query optimization, and asynchronous processing, to ensure efficient system performance.
The proposed solution for the "Cryptocurrency Price Analysis using A.I." project combines cutting-edge technologies, machine learning algorithms, and intuitive user interfaces to create a powerful platform for cryptocurrency price analysis and virtual trading. It empowers users to make informed trading decisions, gain insights into the cryptocurrency market, and enhance their trading strategies.

SYSTEM ARCHITECTURE

HIGH-LEVEL ARCHITECTURE

The "Cryptocurrency Price Analysis using A.I." project follows a client-server architecture, where the client is a web browser and the server hosts the Django application. The high-level architecture consists of three main components:

➢ User Interface (UI): The UI is responsible for presenting information to users and receiving user inputs. It is developed using HTML, CSS, Bootstrap 5, and JavaScript. The UI interacts with the backend through API calls.

➢ Backend: The backend is developed using the Django framework, which follows the Model-View-Controller (MVC) architectural pattern. It consists of the following components:

Models: Define the data structure and database schema

Views: Handle user requests, perform necessary computations, and return responses.

Controllers: Manage the flow of data between models and views.

Django ORM (Object-Relational Mapping): Provides an interface between the application and the database.

Database: The project utilizes a relational database to store user data, cryptocurrency prices, and other relevant information. Django supports various database backends, such as SQLite, MySQL, and PostgreSQL.

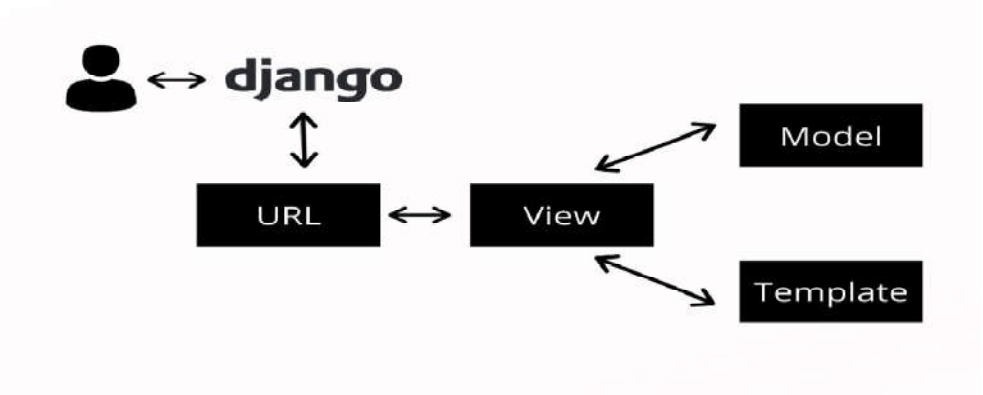

FIG. 3.1 DJANGO MVT ARCHITECTURE

COMPONENTS

The key components of the system are as follows:

➢ Data Collector: This component is responsible for collecting real-time or historical cryptocurrency price data from external sources, such as cryptocurrency exchanges or APIs. The collected data is stored in the database for further processing.

➢ Data Preprocessor: The data preprocessor component cleans and prepares the collected data for analysis. It handles tasks such as removing outliers, handling missing values, and normalizing the data.

➢ Feature Extractor: This component extracts relevant features from the pre-processed data. It identifies patterns and trends in the data that can be used for training the LSTM algorithm.

➢ LSTM Algorithm: The LSTM algorithm is a type of recurrent neural network (RNN) that is particularly effective in capturing long-term dependencies in sequential data. It is trained using historical cryptocurrency price data and can make predictions on future prices.

➢ Analysis and Visualization: This component provides various analysis techniques and visualizations to help users understand the cryptocurrency market trends. It includes features such as price trends, correlation analysis, and volatility analysis.

➢ Virtual Trading System: The virtual trading system allows users to simulate cryptocurrency trading using virtual funds. It provides functionalities such as buying/selling cryptocurrencies, managing a virtual portfolio, and evaluating trading performance.

DATA FLOW

The system's data flow can be summarized as follows:

➢ The Data Collector component retrieves real-time or historical cryptocurrency price data from external sources and stores it in the database.

➢ The Data Preprocessor component cleans and preprocesses the collected data, ensuring data quality and consistency.

The Feature Extractor component identifies relevant features from the pre-processed data, such as moving averages, relative strength index (RSI), and other technical indicators.

➢ The LSTM Algorithm component takes the extracted features as input and trains the LSTM model using historical cryptocurrency price data.

➢ The Analysis and Visualization component uses the predicted prices and other data to provide insights and visualizations to the users.

➢ The Virtual Trading System component allows users to interact with the system, simulate trading activities, and manage a virtual portfolio.

➢ The User Interface component presents the analysed data, visualizations, and trading functionalities to the users through a web interface.

➢ User inputs and interactions from the UI are sent to the Backend, where the necessary computations and database operations are performed.

➢ The Backend retrieves and processes the requested data, and sends the response back to the User Interface for display.

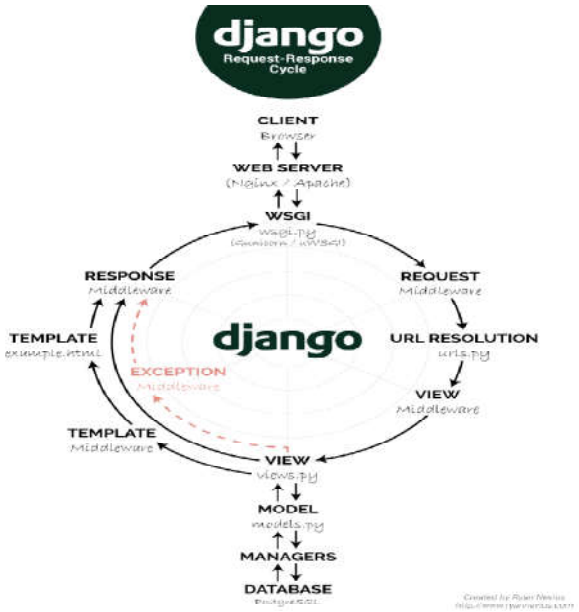

FIG. 3.2 DJANGO DATA FLOW

CRYPTOCURRENCY PRICE ANALYSIS

The "Cryptocurrency Price Analysis using A.I." project leverages the power of LSTM (Long Short-Term Memory) algorithm to analyse and predict cryptocurrency prices. This section will provide an overview of the different stages involved in the price analysis process.

DATA COLLECTION

To perform cryptocurrency price analysis, the project collects real-time or historical price data from external sources. This can be achieved by integrating with cryptocurrency exchanges or utilizing APIs that provide access to historical price data. The collected data typically includes information such as timestamp, open price, close price, high price, low price, and trading volume.

The data collection component retrieves this data at regular intervals and stores it in the project's database for further processing and analysis.

DATA PREPROCESSING

Raw cryptocurrency price data often contains anomalies, missing values, or outliers that can adversely affect the accuracy of analysis. The data preprocessing stage aims to clean and prepare the collected data for further analysis.

Data preprocessing tasks may include:

Handling Missing Values: If any price data is missing for a specific timestamp, suitable imputation techniques can be applied to fill in the gaps. Common methods include forward filling, backward filling, or interpolation.

Outlier Detection and Removal: Outliers, which are extreme values that deviate significantly from the normal price range, can distort the analysis. Outlier detection techniques, such as z-score or percentile-based methods, can be employed to identify and remove outliers.

FEATURE EXTRACTION

Feature extraction is a crucial step in cryptocurrency price analysis, as it involves identifying relevant patterns and trends in the data

Results & Analysis

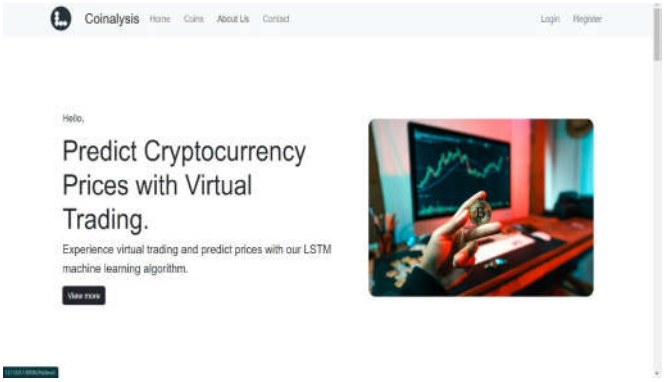

FIG. 1.1 HOME SCREEN

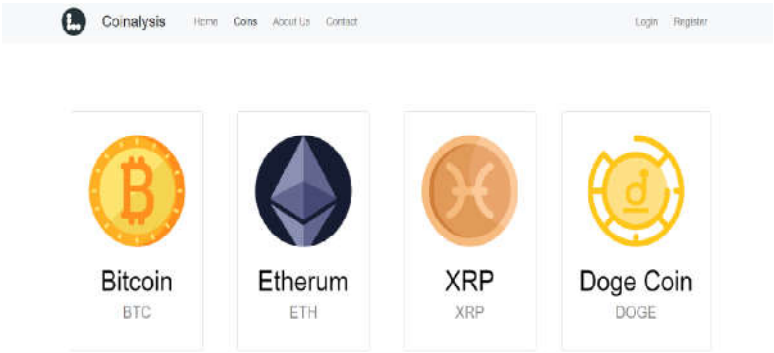

FIG. 1.2 COINS SCREEN

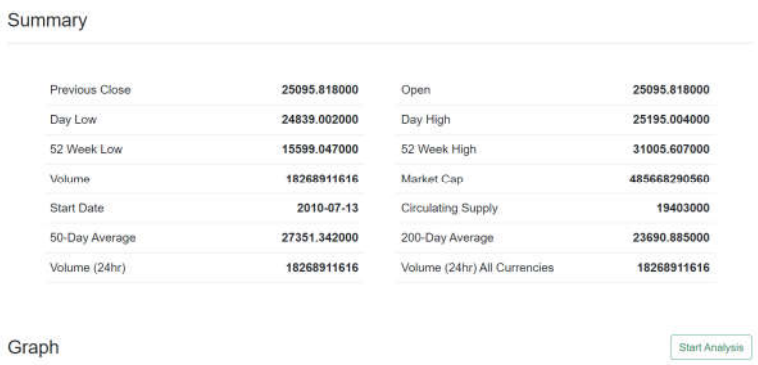

FIG. 1.6 COIN SUMMARY

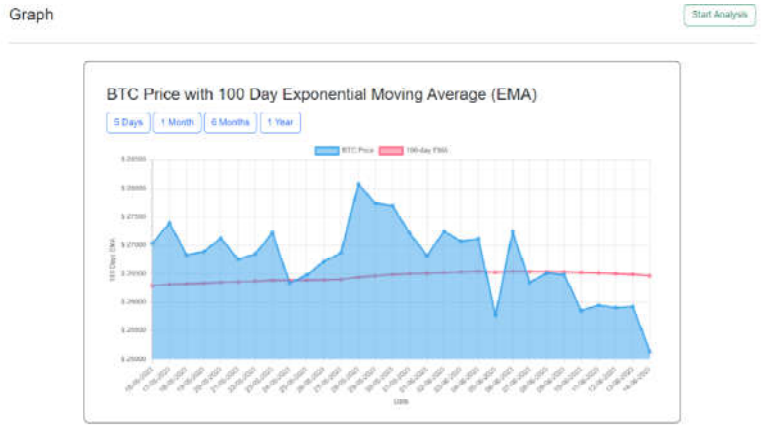

FIG. 1.7 COIN EMA GRAPH

FIG. 1.8 COIN MACD INDICATOR GRAPH

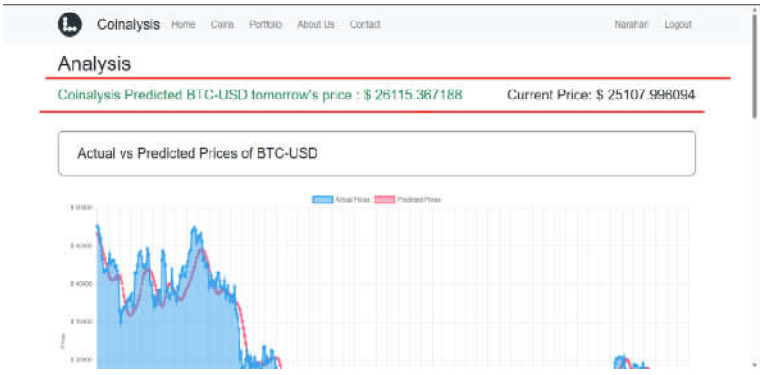

FIG. 1.12 MODEL PREDICTION SCREEN

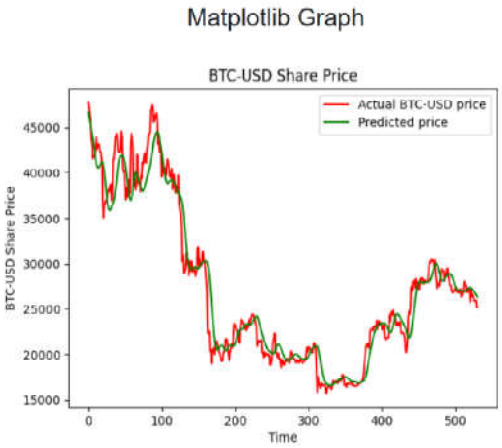

FIG. 1.13 MATPLOTLIB PREDICTED GRAPH

SECURITY MEASURES

Security is a critical aspect of the "Cryptocurrency Price Analysis using A.I." project, considering the sensitive nature of financial data and user information involved. Implementing robust security measures helps protect the system from unauthorized access, data breaches, and potential vulnerabilities. This section outlines essential security measures to consider during the development and deployment of the project.

10.1. USER AUTHENTICATION AND AUTHORIZATION

Implement secure user authentication mechanisms to ensure that only authorized users can access the system. This may involve implementing strong password policies, supporting multi-factor authentication (MFA), and utilizing secure protocols such as HTTPS for communication.

Implement authorization controls to manage user permissions and access levels within the system. Assign appropriate roles and privileges to users based on their responsibilities and restrict access to sensitive functionalities or data accordingly.

CONCLUSION

In conclusion, the "Cryptocurrency Price Analysis using A.I." project is a comprehensive web application developed using HTML, CSS, Bootstrap 5, JavaScript, and Python's Django framework. It leverages the power of LSTM (Long Short-Term Memory) machine learning algorithm to analyse cryptocurrency price data and generate predictions. The project provides users with a virtual trading system to simulate buying and selling cryptocurrencies, along with features such as data visualization, historical price analysis, and portfolio management.

Throughout this documentation, we have covered various aspects of the project, including an introduction to cryptocurrency price analysis, the role of LSTM in machine learning, data preprocessing, model training, and prediction generation. We explored the frontend development using HTML, CSS, Bootstrap, and JavaScript, along with the backend development using Django, data processing, API integration, and security measures.

The project offers valuable functionalities for cryptocurrency enthusiasts, traders, and investors. It allows users to analyse historical price data, make informed trading decisions based on LSTM predictions, and manage virtual portfolios. The integration of external APIs ensures real-time updates and access to the latest market information. User authentication and security measures protect sensitive data, while future enhancements such as advanced trading strategies, real-time price updates, sentiment analysis, and risk management tools can further enhance the project's capabilities.

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