

BLOCKCHAIN FOR IOT SECURITY AND CONFIDENTIALITY IMPROVEMENT**Neenu Kuriakose***

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ABSTRACT

Security and confidentiality are required to protect personal data and reduce data redundancy. Nowadays, the Internet of Things or IoT is used in every possible way to improve the lifestyle by simplifying technology. The improvement of the confidentiality of data that are available on the internet should be done. This process can be done using a new-age technology called *blockchain*. This is a process to record the information in a certain way so that it can not be hacked or changed easily. Different case studies have proven that this technology can be helpful for the security of data. Blockchain technology is divided into four different parts and that is private, hybrid, public, and consortium (Georgiev *et al.* 2023). There is a dataset related to finance has been considered for the analysis for the practical implementation. The overall improvement has been done using a programming language called *Python*.

KEYWORDS: IoT, Block-Chain**INTRODUCTION**

Data analysis and visualization should be needed to understand the type of data and the relationship between all the attributes. The change of data from time to time can be addressed too by this method so that maximum accuracy can be achieved. There are several libraries that can be seen in Python which are needed for the overall process. The importation of the libraries should be needed to run the code properly. The dataset has been loaded in the programming language using codes for the data analysis but before that data cleaning and processing should be done. It can be seen in the result that the data has been loaded in the first place and then the data description has been provided. The number of rows and columns is identified which can be very beneficial to reduce the data redundancy (Open 2C *et al.* 2022). The basic information of the dataset should be found using the codes to understand the types of attributes. The data cleaning was done after that, leading to data processing.

Various null values can be seen in a dataset that can create error and for that maximum accuracy can not be achieved in the outcome. It can badly affect the improvement of the security of the *Internet of Things*. Some attributes do not contain the proper values and several data are missing, on the other hand, some duplicate values can be seen in several attributes. This value should be reduced so that the proper outcome has been generated for analysis. Identification of the null and duplicate values should be done in the first place and then the creation of codes is done to reduce those null values. The data should be processed after that for the analysis process, and the type identification should be done for each attribute. The visualization of the attributes has been dependent upon this type. The unwanted columns can be dropped by using codes for the simplification of the dataset.

The index can also be changed as per the requirements of the project according to the codes. The

graphical visualization is very useful for the understanding purpose so the attributes should be converted into graphical format (Eloranta & Boman, 2022). Data cleaning should be needed for the conversion of improper data into meaningful data. The data that are used in several IoT platforms can be hacked and used by someone else with bad intentions. The data can be involved in crime and many other illegal activities. This is the reason why the security of the data should be improved. The hacking of data should be reduced to avoid the misuse of data and that has been done using blockchain technology. Security can be achieved from the first step of data recording. This is the technology that has been used to increase the security, trust, and transparency of the data that has been shared for the business or any other purposes.

METHODOLOGY

Five steps are involved in blockchain technology that is used to gain the confidentiality of the data. The first step is distribution by which all the participants are connected and represented as nodes. These participants are recording the data that should be kept in high security and for that data encryption is needed. Data encryption is a process that can convert plain data into encrypted data (Chen *et al.* 2023). It is a process that can protect important information by using some mathematical models. The data are rearranged in a certain manner so that only the participants can arrange that with the help of a key. All the payments have been done cryptographically so that a time stamp has been generated only. No real money is not involved in the transaction and for that, the theft can be reduced to a certain extent. Each transaction should be succeeded by the tokenization method by allowing the participants to access their data. The values are converted into tokens that are used for the payments instead of the real value.

The last step is decentralization which states that no single computer or system can control the overall chains. This process can easily reduce the possibilities of theft and for that improvement of the security can be achieved. Encryption is the main process that can be implemented to gain confidentiality (Magnano *et al.* 2022). Decryption is also needed to achieve the plain data from the encrypted data. There are keys that are different from all the nodes and that are used for the encryption and decryption process. The cipher code or the encrypted code is the most secure form of data that has been used in blockchain technology.

The decision tree and linear regressions are used for a better understanding of the dataset and the data that has been stored in it. A plot can be created for the decision tree and the R _values can be addressed for linear regression and decision tree. Various password options can be seen like password, pin, and some more that can be used to unlock and lock the data. Maximum security should be achieved by using more strong passwords that contain several numerical data, characters, and special symbols. These passwords should not be shared with anyone to achieve security. These can safely store all the personal information that has been used commonly for business purposes or any transaction related to that.

The interpretation of result section mentioned the discussion of the result, and using appropriate data also provides describe the using features. According to the project requirement researcher here used the HIVE dataset, based on this data frame researcher describe the specific date, open, high, low, close, adj close, and volume data of the market. Hence there every column has been related to the essential data. That are containing the appropriate information regarding the crypto market (Das *et al.*2023). Hence for the analysis process researcher used the different types of approaches, and also provide the graphs of the columns. Based on these graphs researcher shows

the peak time to downtime data of the market. Here researcher did the machine learning process, and using their process researcher has been done their analysis process. According to the data machine learning is known as the branch of artificial intelligence. It focuses on the data and different types of algorithm, and provide an outcome which has understood by human. The process of machine learning has been providing the improved accuracy of data. Hence it is also essential to grow the field of data science.

The machine learning method researcher has used statistical methods and proper algorithms that are properly trained to classify the proper data and make predictions. This prediction process has been done the insight into the data mining project and is also used for the decision-making regarding the particular business and applications. Hence these impacting in the key growth metrics, using the machine learning method researchers can easily able to sort out the spam. This process using in the banking sector, for identifying fraud or false transactions (Taloba *et al.* 2023). Machine learning is used in image recognition, fraud detection, pattern recognition, and different types of analysis processes. Here researcher used the “**Linear regression**”, “**decision tree**”, and “**R-square**”, methods, using those methods researchers have done their analysis process. The linear regression coefficient sign describes the relationship between each independent variable and each dependent variable, whether it is positive or negative. The increasing value of the independent variables is shown by the positive coefficient, which also shows a tendency for the dependent variables' values to rise. Thus, a negative coefficient indicates a rise in independent variables, and a falling trend in dependent variables is implied by a negative coefficient.

The significance of the co-efficient value indicates how much the mean of the dependent variables changes when the independent variables are shifted by one unit while the other variables are held constant in the model. Using the linear regression researcher obtain the model of linear regression, and the model has been created based on the data frame. According to the data, this graph has providing evidence of dependency of considerable dependent and independent variables (Chander, 2022). Their dependency factor provides the blockchain character in specific terms. There are holding variables of the other property have essential, and it allows the variable access. Understanding the significance of the associated findings in a practical sense is aided by the scale of the effect. studying the standardized and non-standardized size of the impacts in much more detail. In quantified statistics, the difference between the relation between the variables and the group's mean represents the size of the effect. However, analysis frequently focuses on statistical significance by evaluating effect size and p-value, which ultimately aids in assessing the significance of the practical findings.

Reflect the magnitude of the variables between the interactions, other studies and experiments frequently examine the relationship between various variables and the size of the effect. There are often two varieties of the size of the effect: one is standardized and the other. Incredibly model of regression is a much more common analysis form for both the use of beginners and professionals. It comes to be one of the relevant precise robust tools for evaluating the relationship between various allocated variables in the present data set. Additionally, the mode41 of regression also possesses the ability to forecast prediction on prior unseen data. This paper illustrates a deep drive for analysis showing every parameter to demonstrate the goal of deep evaluation snout every matric ai saying about the present designed model. The blockchain model has been done on financial data.

The interpretation needs to be done on the relationship between the different variables like the open, high, low, or close data, concerning the data, and their relevant volume. One of the major properties of blockchain in Bitcoin is the feasibility to allow additional newly added blocks that might contain new transactions in the shared and public ledger, with static integrity being kept in place. Once a mined block and newly added transactions are added to the relevant blockchain, it thus becomes much more difficult to make any further changes. The property of immutability is static in the currently designed blockchain (Rahmadika *et al.* 2022). The hash function is underpinned for the inputted data of any generated size and results in the output with a fixed size of data. Presently, the ecosystem of blockchain gets fragmented highly concerning the system of blockchain that have its protocols and mechanisms which are not been interoperable in response to other systems of the blockchain. Various systems of blockchain are designed so to solve certain problems in applications with various constraints and requirements. There possesses no such specific blockchain which could apply to every application.

The significant necessity for the use of different multiple systems of blockchain needs to be implemented which could be able to work in harmony. Multichain architecture possesses a crucial interoperability building block, that enables to cooperate and communicate with each other. This mode not only allows the values to get transferred and digital assets but there also involves certain transferable information and contract cross-chain in between systems of blockchain. One of the transactions in the structural system is Decision Tree and their roots are been calculated, this values thus stored in the header of the blockchain. The creation of the link in between various blocks should be hash computed, and these values of the hash are also been stored in the forwarded block for generating the further chain or the structure of the listed data. Graphical representation of the regression model of the decision tree illustrates the concentration near the origin, and slightly upper to the origin. This demonstrated the close reflection in the distribution of the independent and dependent variables.

The model adequately reforms the responsive variables in the current dataset, thus being used for easy understanding, interpretation, and analyzing through visually. Additionally, the R-Square value of the regression model of decision tree plays a crucial role in the precise interpretation of the results. Hereafter researcher has done the decision tree as per the model, hence decision tree is an essential part of machine learning. According to the data decision tree is the non-parametric supervised learning method, it has been used for the data frame classification and the regression process. The aim is to create a model that predicts the values of the target variables via understanding the simple decision rules. According to the data, this decision tree has been containing various types of nodes, and these can help to proceed with further actions like model optimization, evaluation, and visualization process. This training technique was used to train the model, and the testing procedure was used to test the model. Through this procedure, the dataset has been able to evaluate the accuracy of the training method and disregarded data frame. The researcher also uses the linear regression procedure, which is a statistical technique based on the data.

The modeling linkages between the dangling variable and the appropriate set of independent variables can be provided by using linear regression. The data analysis method has employed linear regression, which also can forecast unknown values or components. Based on the various roots those rae represent the entire dataset, these nodes have been helping to distribute the dataset

based on their attributes. Hence their recherche r also describes the process of the R-square method, this model has been categorized based on the sum of squares of errors from the average model (Gohar, Abdelmawgoud & Farhan, 2022). The R-Square model has followed the particular formula as per their execution process. This function is also known as the error metric, hence the model help to justify the performance of a particular model. It provides that variable's dependency level and it also describes the value of the target variable. Hence their researcher also provides the graphs which have been providing the peak and down of the per-column basis on containing variables. All graphs are similar to each other after the researcher also provides the decision tree regression model.

This decision tree graph has been obtained from the regression model, hence this help to reflect the close distribution of the independent and dependent variables of the data frame. Applying this training process and analysis process researcher has been providing data about the improvement. Thus, after that user also provides the null value checking process or method. According to this process, researchers describe whether any null value has been presented in their chosen data or not (Chen *et al.* 2022). The null value has been a process that identifies whether any attribute has been existing without value or not. Null value checking and the dropping process is essential for the dataset, this null property is used to manage the null property items. Hence there also used the EDA method, according to the data this EDA has been a process that can apply to investigate the data and properly summarize the data. This process has been delivering the basic knowledge of the chosen data distribution, and it has been also providing an analysis of the null value. During the data summarization, it can focus on the 4 main aspects of the data.

According steps first, it calculates or predicts the central tendency of the data, second it has been checking the variance and the standard deviation. The third step contains the shape distribution and the last step is the outlier existence, the EDA process has ben contain some features those are essentially describe the entire process. The first is **“Data exploration”**, according to the data this technique provides the visualization process of the data set, and it also helps to find the missing values of the data (Adere, 2022). The **“Data exploration”** process also looks for the correlation, using this method researcher can find that which column has been related to each other, this process has been done using various processes. The next process is the **“data cleaning”** method, the process has been checking the null values and errors in the data frame. Based on this researchers also try to fix their dataset issues and fix them. The next process is **“Model Building”**, in this process researcher has been critically visualizing their process and building the appropriate model and many more processes this are containing.

Hence there are the last process is the **“Present results”**, in this step researcher has provided the various types of graphs and charts, and table, and provide the visualization of the table. Hereafter completing the analysis researcher has been providing that which process they can recognize attacks in the IoT devices. Here researchers provide the blockchain process based on this blockchain process they describe blockchain-based devices and provide a critical analysis of this. Based on this analysis process and this study researcher has been providing advanced technologies which are connected to IoT devices. Hence it also provides the improvement in their basic features as well as also explained the importance of the IoT devices and their security in different sectors. Hence according to the data, this contains the different reasons to apply IoT devices in different sectors (Ugochukwu, Goyal & Arumugam, 2022).

EVIDENCE OF PRACTICAL WORK

Linear regression Coefficient Interpretation

The linear regression coefficient sign talks about the negative or positive correlation between each and every variable that is independent and the variables that are dependent. The coefficient of positive value illustrates the independent variables increasing value indicates the tendency to increase the value of variables that are dependent. Whereas the coefficient with a negative value shows that the increase in variables that are independent, there involves the decreasing trends of the variables that are dependent. The significance of the co-efficient value indicated how much the mean of variables that are dependent changes with the posing of one-unit shifting of the variables that are independent while holding other variables in a constant model (Mize, 2019).

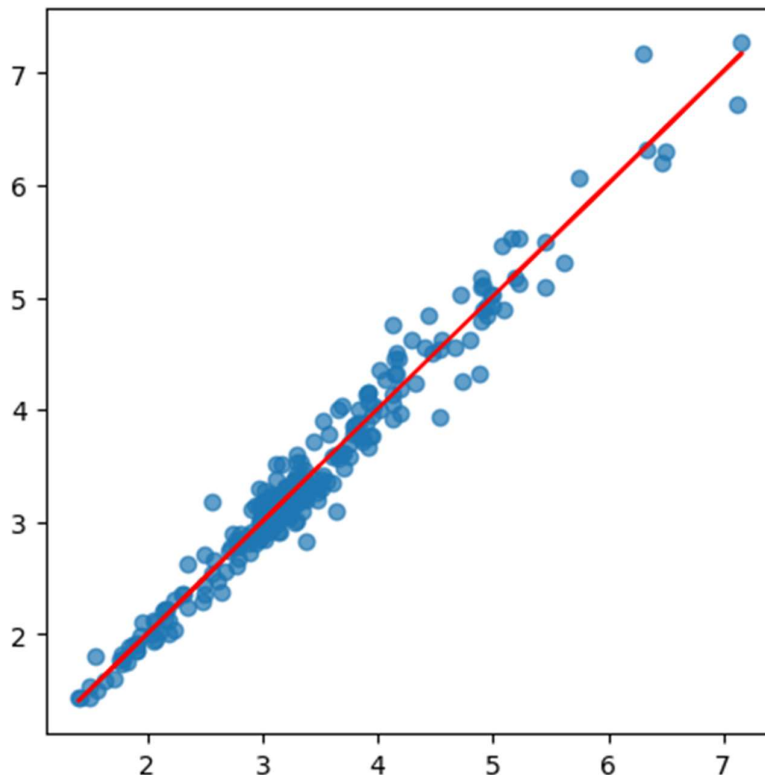


Figure 1: Plot of “*Linear Regression*” model

This graph has been obtained from the construction of a linear regression model based on the dataset. The graph is clearly reflecting the dependency of the considered dependent and independent variables. The dependency factor reflects the block chain characters in terms of security performance. A linear relationship can be observed in the graph. The holding property of the other variables in constant place becomes much more crucial as it allows the accessing of the outback effect of each and every variable in keeping isolation from each other. The coefficient of the linear regression of statistical output leads to the estimation of the actual parameter. Getting the unbiased coefficient however estimates the limited variance, and might be able to obtain the trust of p-values. The designed model is necessary to satisfy all the static seven classical assumptions of the OLS regression through linear. As per the consideration of the stratifications the coefficient of the linear regression model could be the effect of unstandardized size as they

indirectly indicated the relationship strength between the different variables through values that retain their natural units of the variable of dependence (Roback & Legler, 2021).

The size of the effect helps in understanding the importance of the related findings in a practical sense. Learning much more about the standardized and unstandardized size of the effects. The size of the effect in quantified statistics is the difference between the relation in variables and the means of the group. Analysis however often focuses on significant statistical value by interpreting the effect size, and p-value, which eventually helps in determining the importance of the practical findings. Other studies as well as experiments typically analyze access to the relationship between different variables and the size of the effect to represent the magnitude of the variables in between the relationships. The size of the effect generally comes in two flavors, one is standardized and the other one is unstandardized. Depending on the analyzing field user gets much more familiar with their flavors. Un-standardized generally illustrated the difference in regression coefficient in groups. Whereas on the other hand standardized is the static correlation coefficient, eta squared, Cohen's d, and omega square (Zhang 2023).

Unstandardized effect sizes typically use the data of natural units, the use of raw data makes the thing much more convenient while one intuitively understands these units. Often this is the case where the concept of tangible is applicable like money, weight, temperature, and many others. Sighting on the other hand standardized size of effect does not use the units of original data, instead, they are typically unitless, which eventually allows the user to make a static comparison in between the variables and studies which uses different units. Addition with these features the standardized size becomes also useful in the case of an experiment where units that are original might not be inherently potential or meaningful confusing the users. An individual might think of the effect of correlation as the standardized size effect, but actually, in reality, they are the alternate standardized regression. Correlation might not use the units of original data and all the used values falls in +1 and -1. One could use them to make the comparison of strength relationships in different variable pairs as they might use a scale of standardization.

Using the term polynomials so as to model the linear Curvature

The prior linear relationship might be very relatively straightforward to get an understanding of the effect. The relationship on linear illustrates the remaining change throughout the same line of regression. Moving towards the coefficient of relationship between curvilinear, where it occurs on the effect, that depends on the location of the related curve. The co-efficient interpretation for a relationship of curvilinearity is intuitively lesser than the relationship of linearity. However, the regression model used the term quadratic in order to model the curvature of the dataset. It can be directly shown that the significant statistical p-value is in both terms of Quadratic and linearity.

Relationship between the variables and Coefficient of Regression

Analysis through the regression model helps in determining the changing effects of the variables of independent in association with the variables that are dependent. Sighting on the other hand coefficient illustrates the variables changing effect and related p-values which will tell about the significant difference between the coefficient and zero. The effect of all these is directly in the relationship between the dependent and independent variables. However, a few times, the relationship between DV and IV might get changes on the basis of other variables. The condition in such cases generates an effect of interaction, where one variable directly depends on another

variable's value. It is a much more common effect in the regression model and designing of experiments (Oshan *et al.* 2019).

Studies show whether it is the case of a manufacturing process or a taste test, many more variables eventually affect the overall outcomes. Any change in this variable directly affects the outcome. Taking an instance, certain changes in the condiment of food result in affecting the overall enjoyment of the taste test. Similarly, analysts use different models that become necessary to access the various relationship in each dependent variable with correspondence to independent variables. Such kinds of effects are known as the main effects, while these effects are significantly straightforward, it could be a mistake to only access the main effect. Locating in much more complex studies the variable of independence might also show interaction with each other. This effect of interaction indicates the influence of the third variable in the relationship between dependent and independent variables (Capretto *et al.* 2020).

Improvements in confidentiality and security have been done using blockchain technology for the IoT device. The process of the blockchain technology should be identified first and then the implementation of that has been done. The advantage and disadvantages of the techniques have been identified for the analysis of the requirements of this. The IoT or Internet of things needed more security as personal and financial information has been involved with it (Schessner *et al.* 2022). A dataset related to financial information has been taken for the analysis and visualization of the data. The analysis has been done using Python which is a programming language. A better understanding of the dataset and requirements has been done using the analysis process and by which the relationship identification is done too.

The regression model has been created and a decision tree is also made for the dataset before that data processing and cleaning should be very important. The libraries that are required for the data analysis have been imported first and the dataset has been loaded as well. Then the data information can be achieved and the description of all the rows and columns and the data should be found. Several null values and duplicate values can be seen in the dataset that are known as the garbage value which should be identified as soon as possible. The reduction process can be done using coding. The model should be made and, in this project, a linear regression process has been done. Training and testing have been required to generate the model and before that, the visualization of each attribute can be seen for a better understanding of the data. There are several graphical plots that are available in the Python library and some of them are used for the project. The relation between the data in the dataset can also be known by using these representations (Zakaria *et al.* 2023). The linear regression has been done using the data and the codes are used for that. The decision tree should be developed for a better understanding and the split of the data has been done as well. The *r_value* of the linear regression can be seen in the figure, which is **0.97** approximately. The *r_value* has been found too for the decision tree and that value is **1.0**. There is a graphical representation of the decision tree that can be seen in the figure given above. The value has been visualized by the scattered dots that can be seen in the figure too. The two axis of the graph are low and volume as can be stated and after that, the encryption has been done to increase the security of the data.

There are seven columns that have been represented as attributes and they are volume, adj close, high, low, close date, and open. The number of rows of the dataset is 250 by which the data from **11-07-2022** to **07-07-2023** has been presented. The data type should be identified before

processing to simplify the dataset. Blockchain technology should be used to enhance the security of data. All the participants have a key password that should be very strong (Bullejos *et al.* 2023). A strong password contains numerical values, characters, and special symbols. All the participants are represented with nodes that are connected further to share the information. The data has been encrypted or scrambled in such a way that only the participants can rearrange that and the method has been called decryption. This is the key process that can protect the data from being hacked or missed. The data redundancy and missing data should have been reduced by this process as well. The data that are encrypted should be decrypted for further use otherwise the data loss can be seen.

All the transactions should be tokenized and the payments has been done cryptographically. Only the authorized participants can change or access the personal information of the data and there is no centralized system. The process in which a single system is used to maintain the operation of the network is called a centralized system. This process can be risky as the hacking of that main system can corrupt the overall system and the theft of personal information can be seen (Yu & Yuan, 2022). Maximum accuracy can not be achieved in this method so in blockchain technology this centralized system has not been used. Security and confidentiality have been improved by using this method and the password security process. No one should share their password with anyone to gain the confidentiality of the data. The data can be stolen and used for illegal purposes and even that information has been used to do several criminal activities. The modern world can not be operated without the internet of things as it can simplify the complex work for society so the maintenance of its security of it should be a huge concern.

Modification of the protocols and technologies can provide maximum accuracy and confidentiality and by using the data visualization and analysis it becomes simpler and easier to use. The regression is used to analysis the data and understand the datatype which is very helpful for further modification. The prediction of the risk factors has been done and the mitigation process should be modified as quickly as possible. There are accuracy and precisions that are also addressed by the codes that should be used. The recall values can also be identified and the data encryption and description should be done that involves some time. The processing time for the overall process is also addressed and the time for the lag of the programming can also be seen as well (Aqila & Faisal, 2023). This processing time should be reduced to enhance the efficiency of the technology and for that modification should be needed. The accuracy of the code and technology can generate the outcome with maximum effectiveness.

RESULT ANALYSIS

This section is comprised of the entire analytical results on the data of block chain-integrated security performance records. All the figures have been adequately interpreted to obtain significant outcomes. The entire process with an adequate description of all the steps has been effectively represented here. Integration of python programming language has enhanced the entire process of performing this entire analysis.

```
df = pd.read_csv(r'C:\Users\User\HIVE.csv')
print(df)
```

	Date	Open	High	Low	Close	Adj Close	Volume
0	2022-07-11	3.48	3.50	3.26	3.26	3.26	1356300
1	2022-07-12	3.21	3.30	3.12	3.15	3.15	1237600
2	2022-07-13	3.04	3.26	3.02	3.21	3.21	1323800
3	2022-07-14	3.15	3.28	3.05	3.24	3.24	1067400
4	2022-07-15	3.32	3.53	3.31	3.53	3.53	1465800
..
245	2023-06-30	4.80	4.85	4.45	4.63	4.63	2337300
246	2023-07-03	4.71	5.05	4.69	5.02	5.02	1617000
247	2023-07-05	4.89	5.24	4.74	5.17	5.17	2252500
248	2023-07-06	5.19	5.30	4.96	5.18	5.18	2772500
249	2023-07-07	5.15	5.71	5.15	5.53	5.53	2859800

[250 rows x 7 columns]

Figure 2: Data importing and reviewing

The dataset of “HIVE” block chain data has been imported within the jupyter notebook platform. The outcome of the data review shows that there are 250 rows of records under seven different columns. “Date”, “Open”, “Close”, “High”, “Low”, “Adj Close”, and “Volume” are the different columns that hold the record of block chain-imposed security data of a particular sector. It can be observed that each of the columns holds different and relevant values of the data. This data is adequate for performing the analysis over the optimization of the overall impact of block chain on security purposes.

The importing of the data to the terminal is a very essential procedure in terms of being able to carry out data analysis efficiently. It is important to understand the fact that importing the data helps to make use of the values associated with the dataset to conduct the analysis related to the overall applications associated with the use of “*Blockchain*” which helps to improve the confidentiality and the security of the “*IoT Devices*”. The importing of data is stored in the “*df*” variable which is used for the purpose of displaying the contents associated with the overall dataset efficiently (Nongthombam & Sharma, 2021). The print function is seen to be associated with the variable which helps to display the overall contents associated with the dataset efficiently. This helps to ensure that the correct dataset has been imported to conduct the data analysis which otherwise would produce inappropriate results. This process also helps to check and review the overall contents of the dataset so that the data analysis procedure can be carried out efficiently.

```
df['date'] = pd.to_datetime(df['Date'],format="%Y-%d-%m %H:%M:%S",infer_datetime_format=True)
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 250 entries, 0 to 249
Data columns (total 8 columns):
#   Column      Non-Null Count  Dtype
---  ---
0   Date         250 non-null    object
1   Open         250 non-null    float64
2   High         250 non-null    float64
3   Low          250 non-null    float64
4   Close        250 non-null    float64
5   Adj Close    250 non-null    float64
6   Volume       250 non-null    int64
7   date         250 non-null    datetime64[ns]
dtypes: datetime64[ns](1), float64(5), int64(1), object(1)
memory usage: 15.8+ KB
```

Figure 3: Null value check

The column “Date” has been structured as not null value by signifying the records to date-time-format. Thus, it reflects that there is no presence of any null values. Null value check and null value drop are significant in optimizing accurate results. Also, all of the columns have been evaluated with their counts and datatypes. Null value check and null value drop operation are important as it helps in acquiring accurate result of the determined requirements of any kind of analysis. The presence of different libraries is important in terms of offering several benefits over the entire process of analysis.

Effective completion of the above necessary steps the analysis goes through graphical visualization of all the records of each of the factors comprised within the dataset. The peak of each of the graphs states the intensity of the recorded data of each factor. Efficient visualization helps in obtaining accurate knowledge about the entire data to perform the entire analysis process prominently. Effective grip over the understanding of patterns, trends, and the nature of data flow can be achieved through the visual representation of data. Overall understanding each factor enables quick data analysis and prediction of basic knowledge. It is the most effective way of analyzing all the numeric data present in this particular dataset.

The “*Null value check*” helps to check whether there are any null values associated with the dataset. It is important to understand that to conduct a data analysis process efficiently it is important to make sure that there are no null values associated with the overall dataset. The date column associated with the overall dataset has been set to true which helps to ensure the fact no null values are associated with the data associated with the dataset. Null value helps to ensure that there are no empty fields associated with the overall dataset. The efficient conduct of data analysis generally requires values to be assigned to all the fields which are identified to be the minimum requirement to conduct data analysis efficiently (Subasi, 2020). This procedure helps to ensure that data is associated with all the fields. Therefore, conducting a “*Null value check*” is an essential procedure in terms of being able to conduct data analysis procedure efficiently.

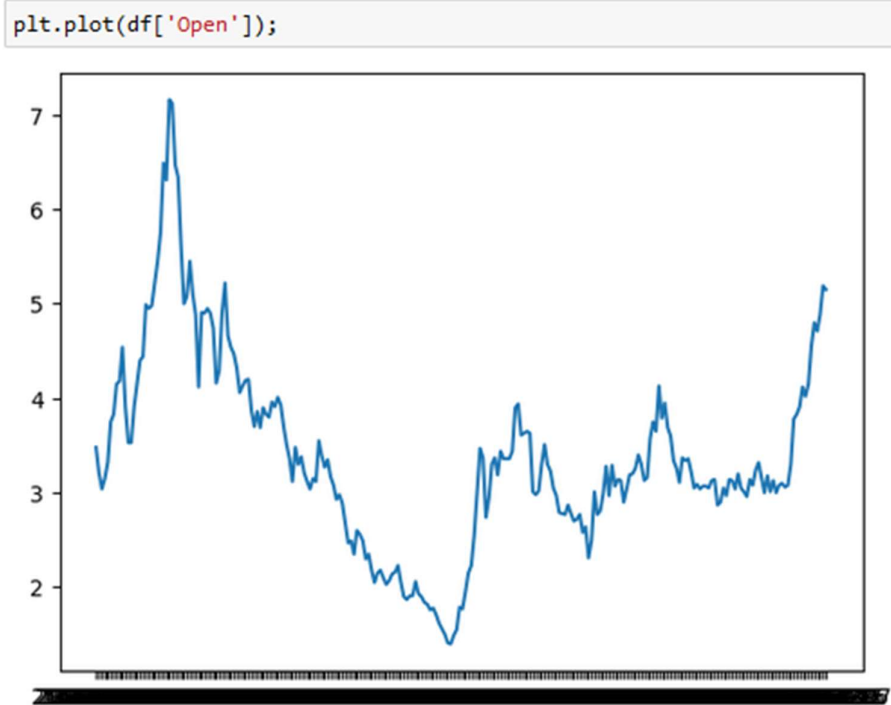


Figure 4: Plot of column “Open”

Above graphical view of data of all the recorded values in the “Open” column has been visualized here. It reflects the flow of the data of the block chain record of the variable open. The plot represents the fact that the “*Open*” applications associated with the use of “*Blockchain*” efficiently help to maintain appropriate security and confidentiality of the “*IoT devices*” very efficiently. The plot represents variable results in terms of the efficiency of “*Blockchain*” technologies to maintain appropriate security measures for different types of “*IoT devices*” efficiently. The data associated with the open records represents the fact that in most cases “*Blockchain*” technology proves to be efficient in terms of maintaining appropriate security and confidentiality for the “*IoT Devices*” (Navlani *et al.* 2021). Peak levels are reached when the “*Blockchain*” technology helps to provide high levels of security to a particular type of IoT device. This proves the overall efficiency of “*Blockchain*” technology to maintain appropriate security efficiently. Minimum levels are reached when the “*Blockchain*” technology is seen to be in-efficient to ensure appropriate security to the devices. Overall, the plot maintains optimum levels which helps to understand the fact that “*Blockchain*” technology helps to maintain appropriate security for “*IoT devices*” efficiently.

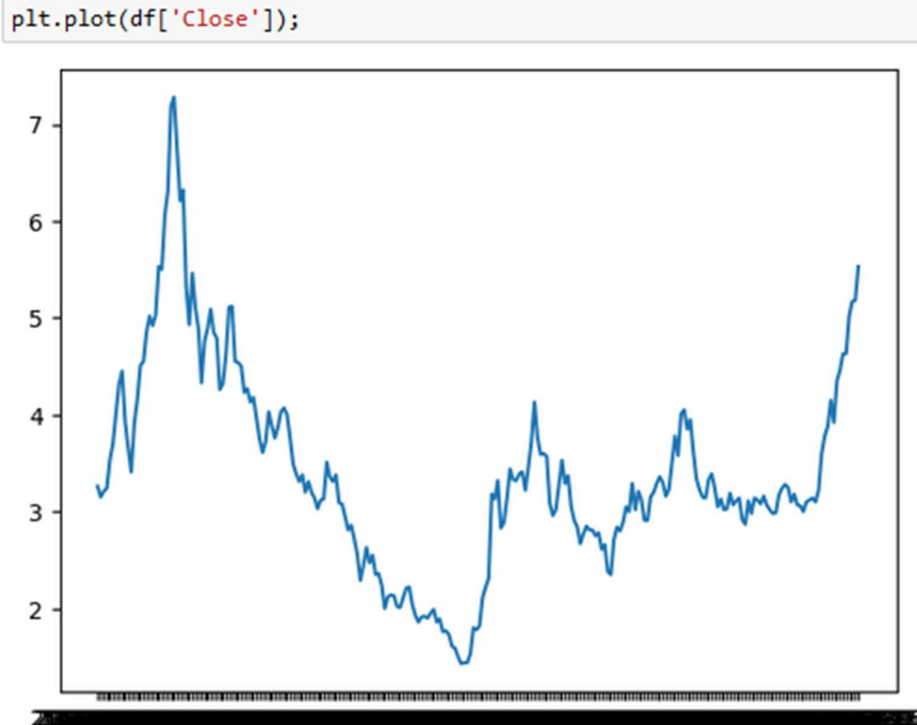


Figure 5: Plot of column “Close”

The above-represented graphical view reflects all the recorded data values in the “Close” column. It reflects the flow of the data of the block chain record of the variable close. The plot related to the close application associated with the use of “**Blockchain**” is seen to be very similar to the plot associated with the open applications. It is important to understand the fact that “**Blockchain**” technologies are generally used for the purpose of maintaining appropriate security and protecting from different threats presented by “**Cybersecurity**”. The plot helps to understand the fact that “**IoT devices**” that are associated with features related to close applications get maximum serenity from the “**Blockchain**” technologies and help to maintain effective security efficiently. “**IoT devices**” which are not associated with close applications get the minimum support from the “**Blockchain**” technologies in terms of security and confidentiality for the **IoT devices** (Bhavsar & Manglani, 2019). Similarly, like the open application the plot represents optimum levels related to the efficiency of “**Blockchain**” to maintain appropriate security and confidentiality for the “**IoT devices**”.

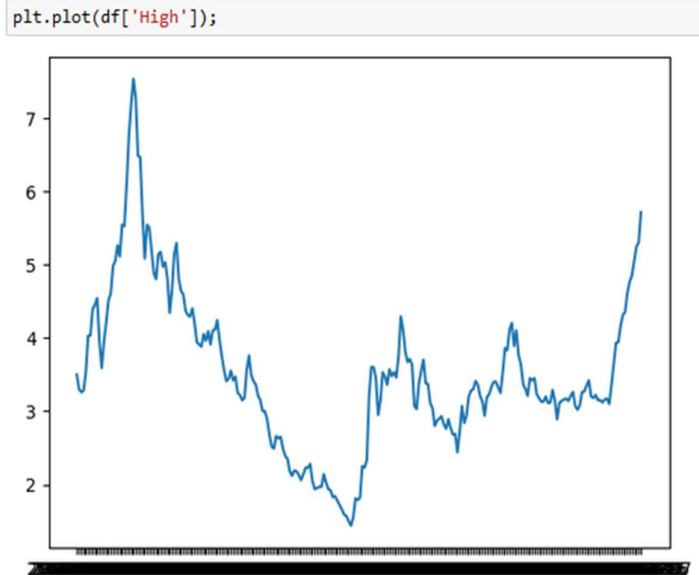


Figure 6: Plot of column “High”

This graph is adequately representing the value of all the records within column “High”, whose peak has reached over 7 as represented in the y-axis. It reflects the flow of the data of the block chain record of the variable high.

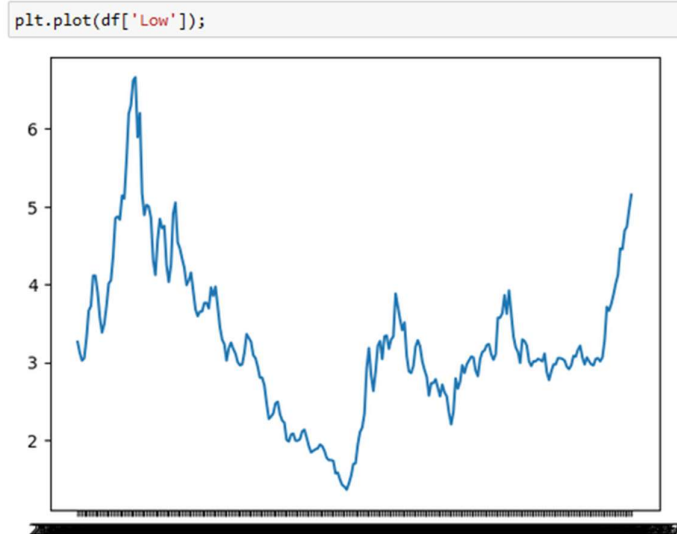


Figure 7: Plot of column “Low”

This graph is responsible for representing the recorded value of the column “High”, whose peak has reached up to 6 and above, as represented in the y-axis. It reflects the flow of the data of the variable high present within the block chain data.

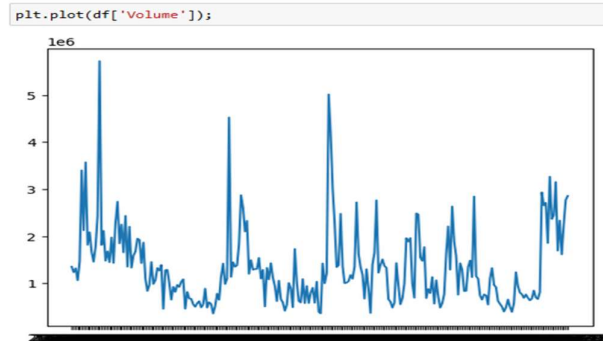


Figure 8: Plot of column “Volume”

This high-frequency graph of column volume reflects the higher value of the recorded data within this significant dataset. The flow of the data present in that column can be effectively optimized through the graph. The plot related to the “Volume” of the frequency with which “Blockchain” technologies help to improve the overall security and confidentiality of “IoT devices”. The plot represents the fact that “Blockchain” technologies are very efficient in terms of being able to efficiently improve the security of “IoT devices” and also represents the fact that there are not many flaws associated with the “Blockchain” technologies which disrupt the security of the “IoT devices”.

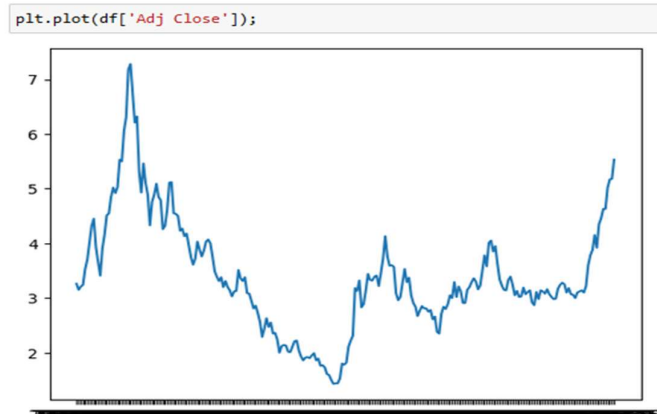


Figure 8: Plot of column “Adj Close”

The graph has been obtained from the recorded data of the Adj Close column of the dataset. This graph is also similar to the above-obtained graph of the columns open, closed, and high.

```
X = df[['Open', 'High', 'Low', 'Close', 'Adj Close']]
y = df[['Volume']]

X_train, X_test, y_train, y_test = train_test_split(X, y,
                                                    random_state=104,
                                                    test_size=0.25,
                                                    shuffle=True)
```

Figure 9: Train test split of the dataset

The train-test split of the dataset has been performed by signifying the column names in the x and y sets. The column volume has been subjected to the y set whereas the rest of the columns has integrated under the x set. The test size of this dataset has been considered as 0.25. This step

is necessary to predict the determined outcome of such analytical results. Therefore, it can be stated that the entire operation of splitting the dataset has been adequately performed to optimize the result.

```
from sklearn.metrics import r2_score
print("r_square score: ", r2_score(y, y_head))

r_square score: 0.9662814248850213
```

Figure 10: R-Square value of *linear regression* model

Justification over the constructed linear regression model can be obtained through the acquired value of the “R-Square” factor. Reflection of the independent and dependent variables can be optimized through the value of this factor. The value of this particular factor is when 1, is stated as the well-fit model to the dataset and 0 is states not fit to the dataset. The model can be stated as moderately justified as the value reflects 0.96 which is nearest to 1.

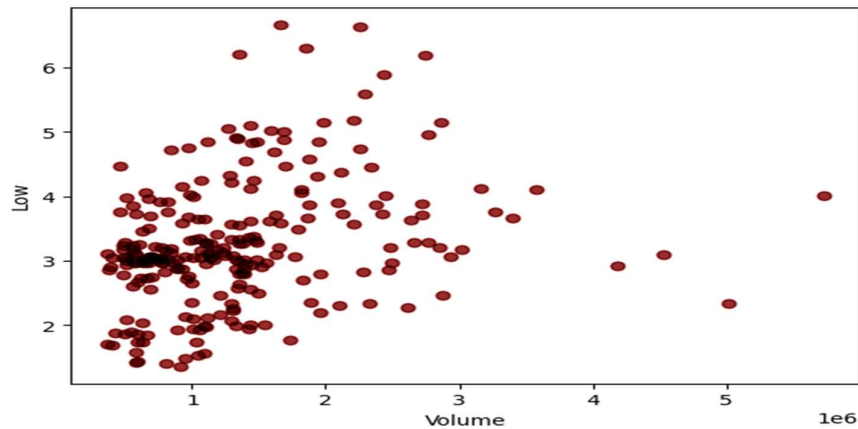


Figure 11: Plot of “*Decision Tree Regression*” model

The above graph has been obtained from the model decision tree regression. It reflects the close distribution of the dependent and independent variables of the dataset. Optimization of the response variable has been adequately obtained through the model. It has been used to obtain easy interpretation, understanding, and visualization of the analysis.

```
: from sklearn.metrics import r2_score
print("r_score: ", r2_score(y,y_head_dtr))

r_score: 1.0
```

Figure 12: R-Square value of *Decision Tree Model*

The R-square value of that particular model reflects that it fits the data well as its value is 1. Therefore, it can be stated that this particular model provides adequate optimization of all these analytical factors.

According to the data their researcher has used the dataset of the stock market, based on this there are various information has been provided which is essential for the analysis. The research has been using different types of processes, which are categorized data in a particular section. Here researcher delivers the importing process of the data and their reviewing, the dataset has been defining has as df. According to the output, the data frame is containing 250 rows and 7 columns.

Next choosing the data researcher imported it into the jupyter notebook and the outcome provides details about the data frame (Xia *et al.* 2022).

Here also researcher checking the null value of the entire data frame, for the null value checking researcher has used the null function of the dataset. Their date column has been structured as not null value via analysis of all records. Null value checking and null value dropping are essential for the analysis process (Chang *et al.* 2022). This process helps to provide the proper result and also helps to meet all criteria of the result. Hence there also using different libraries which have been providing the essential terms which provide various advantages all over the analysis process. Thus, their researcher also provides the various graphs which have been described as the proper columns of the dataset. Here researcher also performed the train test and splitting method on the data frame, the train test method has been applied when the using data frame into a testing and a training set.

This training method has been applied to the model training and testing process has been applied for the testing the model. This process has been allowing the dataset to test its accuracy on the neglected data frame and train method applied for the training of the dataset. The researcher also applies the linear regression process, according to the data linear regression is a statistical method. Using linear regression can provide the modeling relationships between the dangling variable with the proper set of the independent variable (Moulaei *et al.* 2022). The linear regression process has been used for the data analysis method and also it can able to predict unknown values or elements. This prediction process is related to the known data of the element, according to mathematical function dependent variables and independent variables are known as the linear equation. The researcher here uses the Machine learning model for their prediction method, this process has been done using linear regression and also using the Python coding language.

Following the successful completion of the aforementioned essential procedures, the analysis proceeds with the graphical depiction of all the records of each component included in the dataset. The strength of the recorded data for each component is indicated by the peak of each graph. Effective visualization aids in gaining precise knowledge of all the facts to carry out the complete analytical process effectively. The visual depiction of data allows for a more thorough understanding of patterns, trends, and the nature of data flow. Overall comprehension of each aspect permits speedy data analysis and knowledge prediction. It is the most efficient method for examining every numeric piece of information in this particular dataset (Rodríguez *et al.* 2022). Regression problems can be solved using this supervised approach, which is learned and applied to both classification and regression issues. Its structure is tree-like, and the internal code indicates that it can solve both categorical and numerical data. The node of the leaf says the final choice of the result and each node branch will declare the result of the result following the test for an attribute. The data collection, which is divided into smaller datasets, is used to create a decision tree. The division of the subsets into other subsets was done continuously in this manner. The following result section has been contains the various data which are essential for the result and there also provides various information about the using functions.

Hence their researcher provides the line plots of the columns these graphs are containing the data about peak value and down value. Here researcher provides the various methods of machine learning and also describes the various data which has been related to this. Hence also provide

the justification of the constructed function, this result section contains a particular report regarding the procedure. Hereafter researcher has been provided with the discussion which has been declared the proper data about the entire project. Here all steps has containing the appropriate steps of machine learning and are mentioned in detail. Here chosen data frame provides the details of the HIVE and it also contains various data regarding the using methods (Ullah *et al.* 2022).

The “R-value” is a vital part of this Blockchain in the decision tree model which has been described. The overall task has been displayed on the Python platform based on a specific blockchain data set. The R square value is a specific kind of measurement in Python that has a range between 0 to 1. It is primarily calculated how can similarly types of regression lines evaluated to the data and included. It has a specific condition if the overall model can be able to predict the entire data, the range will be 1. The range also can be 0 when this model cannot able to predict of this variance. The r square value has various types of values which involve in the blockchain dataset (Ilham *et al.* 2023). R2 is 1 when all types of variation are accurate for the dataset. R2 will be 0 when none of the variations are accounted for. Other than that, sometimes the value has displayed in a different way like 0.83 which means 83% variation of the data has been successfully accounted for. In the regression model, the R square value of the valuable determination is basically a measurement for the identical data point which are mentioned in the Blockchain data set.

CONCLUSION

In this result section the R square value has been evaluated in the linear regression model and also the decision tree model. The model which is based on the blockchain dataset displays the R-Square value and also reflects all the possible data when the value is 1 as mentioned in the previous section. The linear regression model is a specific kind of statistical method that is for the connection based on independent variables. In this *blockchain*, the model refers to the dependent variables which are responses, and the independent variable represents as the features for clarity. The other model is the decision tree model, which is primarily a nonparametric supervised operation. It means it is basically utilized for the regression and classification also in the Python. The main purpose of this of this model is to anticipate the specific value of the target from the data attributes. Python is executed in a *Blockchain platform* like the valuable Ethereum. It is exploited for the process of creating arrangements for Hyperledger. Hyperledger is basically a framework-based technique that helps to build the open-source process (Achmad *et al.* 2023). Data is always imported and also reviewing in the dataset and based on that sometimes the R square value can be changed. The plot section of the open column has described and displayed a graphical design. In that design, the value is always up and down, but in the end and starting position the value is in a range of 3 to 5. In the closed column, the design is similar to the open but the ending range is a little much higher than the open column end.

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